Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2019, 8(3): 43-52

Prevalence of Depression and its Associated Factors among Jordanian Diabetic Foot Patients

Abeer M. Al-Smadi[1,2]* and Besher Gharaibeh[1]

[1] *Department of Adults Health Nursing, Faculty of Nursing, Jordan University of Science and Technology, Irbid, Jordan*

[2] *Department of Clinical Medical Science, College of Medicine, Dar Al Uloom University, Riyadh, Saudi Arabia*

**Corresponding e-mail: abeer.smady@yahoo.com*

ABSTRACT

Background: *Diabetes mellitus is widespread metabolic disorders with long-term complications, which include significant psychosocial dysfunctions such as depression and physiological dysfunctions such as diabetic foot (DF). Related to diabetic studies in general, the prevalence of depression is high and causes deterioration in health related outcomes and quality of life, whereas the studies about depression and diabetic foot in specific are meager and insufficient.* ***Purposes:*** *The purposes of this study were to assess the prevalence of depression, to identify factors associated with depression, and to identify the rate of unscreened depression among diabetic foot patients.* ***Methods:*** *The design of this study is cross-sectional. A convenience sampling of 216 diabetic foot patients was recruited from diabetic clinics of government hospitals in Jordan during the period from January 2016 to March 2016. Data was collected using a structured self-report questionnaire which consisted of 2 sections including socio-demographic questions with one self-reported question, and Patient Health Questionnaire-9 (PHQ-9) scale to assess depression.* ***Results:*** *The current study showed that 179 diabetic foot patients (82.9%) had depression according to PHQ-9 scale with different levels of depression, namely, mild, moderate, moderately severe, and severe that consist 25%, 25.5%, 18.5%, and 13.9% of the total sample respectively. Multiple linear regression showed that the availability of social support by the family and being a nurse as main healthcare provider were associated with low depression scores among DF patients, also high glycated hemoglobin was associated with high depression scores (F=8.923, p=0.001).* ***Conclusion:*** *Prevalence of depression among Jordanian diabetic foot patients and the rate of unscreened depression were high, which indicates an urgent need for thorough assessment of depression level that may help in early detection, treatment, and prevention of depression among diabetic foot patients. Several factors viewed to be associated with depression level that should take into consideration in the diabetic foot care plans.*

Keywords: Diabetes, Depression, Diabetic foot (DF), Patient health questionnaire-9 (PHQ-9)

INTRODUCTION

Diabetes is a worldwide metabolic disease, which is rapidly increasing. In Jordan, the prevalence of diabetes significantly increased by 31.5% over 10 years survey from 1994 to 2004, which is a high percentage [1]. Diabetes has common physiological complications such as diabetic foot and serious psychological complications like depression that elevate the burden of health care in diabetic patients [2,3].

Diabetic foot (DF) is a neuropathy complication among diabetic patients that may involve skin, muscles, or bones of the foot; it can lead to amputation, death, or both in non-healing foot ulceration [4]. Furthermore, DF disturbs the patient's quality of life such as limited mobility, sleep disturbances, and feelings of loneliness, powerlessness, and depression [5]. Approximately 15% to 25% of diabetic patients develop foot ulcer because of neuropathy and vascular disorder [6]. A study conducted in Jordan showed that the prevalence of DF was 5.3% and the risky foot was 17.2% among diabetic patients [7].

Diabetic patients are at two-fold risk or more to develop depression compared to the general population [8]. A meta-

analysis study indicated that 20% to 40% of diabetic patients have comorbid depression [9]. According to Jordan research, the prevalence of depression was 19.7% among diabetic patients, which was higher than some developed countries [10]. On the other hand, DF is one of the most commonplace complications of diabetes, which increases the severity of depression among diabetic patients [11], so the negative impact of depression among DF patients is higher than diabetic patients without DF [12]. DF patients with depression have more severe negative impacts on physical, psychological, quality of life, health status, and mortality compared to non DF with diabetes [11-13]. In Jordan, one study found that the prevalence of depression among DF patients was 39.6%, which is of high rate and need further care [14].

Many previous studies in the literature focused on depression and its associated factors among diabetic patients, which may vary based on different countries and cultures with a few studies among diabetic foot patients in specific. In Jordan, there were few diabetic studies that assessed the prevalence of depression and its associated factors and up to researcher knowledge, there is only one DF study conducted by Ahmad and his colleagues about depression and its associated factors, which is not enough and needs further investigation [10,14].

Furthermore, many diabetic patients may have unscreened depression and thus untreated, a published date reported that 45% of diabetic patients had undiagnosed depression and 28.3% of DF patients had unscreened depression [15,16], whereas this data is not investigated in Jordan until now. Considering the scarcity of literature on depression among Jordanian DF patients, we conducted this study to assess the prevalence of depression and its associated factors among DF patients and to identify the rate of unscreened depression among DF patients.

MATERIALS AND METHODS

A cross-sectional study was conducted in diabetic clinics of government hospitals in Jordan. The target population included all diabetic patients diagnosed with a diabetic foot or had an amputation surgery in their lower extremities in diabetic clinics. The accessible sample included all diabetic patients with type 1 or type 2 who visited the diabetic clinics to follow up their health status during the period from January 2016 to March 2016. Convenience sampling technique was used in this study.

Inclusion Criteria

- Age: 18 years or more
- Patients diagnosed with diabetic foot in medical records

Exclusion Criteria

- Patients diagnosed with a neurological disorder

Only one patient did not meet the eligibility criteria (patient with epilepsy) and the total sample size was 216 diabetic foot patients.

Ethical Considerations

This study was approved by the research ethics committee of the Jordanian Ministry of Health before conducting the study in government hospitals.

Instrument

A structured self-report questionnaire was used to collect study data. Data collection procedure was in diabetic clinics of the government hospitals through the waiting area of clinics before or after visiting. Informed consent was obtained from each participant after explaining the nature, purpose, and data collection procedures of the study. The questionnaire consists of 2 sections. The first section is general information questions about socio-demographic factors such as gender, marital status, educational level, weight and height, duration of diabetes and DF, amputation, and current smoking. All socio-demographic data was obtained from patients themselves, whereas the last reading during the past 3 months of HbA1c, type of diabetes, and age was obtained from the medical records of diabetic clinics. In addition, the first section contains one self-reported depression question to assess patients' recognition of having depression.

The second section includes the Arabic version of the Patients' Health Questionnaire-9 (PHQ-9) scale. The PHQ-9

scale is a self-reported scale, which is used to assess depression and its severity among DF patients in this study. This questionnaire consists of 9 Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria which can establish provisional depressive disorder diagnosis and grade depressive symptom severity. Each criterion contains a negatively worded statement which has response options of 0 (not at all), 1 (several days), 2 (more than half days), and 3 (nearly every day) during the past 2-weeks. The total score of all statements was from 0 to 27, the scores of 5, 10, 15, and 20 represent cutoff points for depression severity including mild, moderate, moderately severe and severe depression, respectively. There are abundant translations of PHQ-9 scale available in numerous languages like Arabic, which have been developed by the MAPI Research Institute using an internationally accepted translation methodology [17-19].

The PHQ-9 scale had high sensitivity (73%) and specificity (98%) when compared with sensitivity and specificity for a structured psychiatric interview for depression diagnosis, which is a reliable and valid measurement for depression diagnosis [18-20]. A study for validity/reliability of PHQ-9 psychometrics properties showed that test-retest reliability was acceptable, coefficient alpha was acceptable (0.78), and construct validity was supported by the powerful association between PHQ-9 and general health rating [21]. Also in another study, cronbach's alpha of PHQ-9 was high; it was 0.83 which supported the internal consistency reliability of the PHQ-9 [22]. Related to the Arabic version of the PHQ-9 scale, a study was conducted in Lebanon which showed that Arabic translated version of the PHQ-9 scale had high internal consistency reliability (Cronbach's alpha=0.88) [23]. In this study, the internal consistency reliability of the PHQ-9 scale was calculated, the result showed a high reliability coefficient for the PHQ-9 scale (Cronbach's alpha=0.87).

Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) software program version 22. Descriptive statistics were used to describe the sample, which includes frequencies, mean and standard deviation. Correlation analysis was used to assess the relationship between depression scores and all socio-demographic factors in this study. Multiple linear regression analysis was used to identify the most significant predictors or associated factors of depression. Chi-square test was used to assess the significant difference between depression diagnosed by PHQ-9 scale and self-reported depression answers. Analysis of variance (ANOVA) using post-hoc test according to Bonferroni's method was used to compare depression scores of DF patients across the 3 groups of their healthcare provider. A significance level of less than 0.05 was considered as statistically significant.

RESULTS

Participant's Characteristics (Socio-Demographic Factors)

A total of 216 participants were enrolled in this study. The mean age of participants was 60.2 years, with a range of 18 to 86 years. Most of the participants had type 2 DM (78.7%), and 21.3% of them had type 1 DM. In addition, most of the participants were married (74.5%) with no current work (79.2%). About 56% of the participants had less than high school education, and the mean income of participants was JD 466.6 per month. Approximately 77% of the participants had social support by their family and 75% of the participants had a healthcare giver by their family, while the specialist doctor was the main healthcare provider for 46.8% of all participants. The mean of family members for participants was 8.2, and the mean of members who are living with the participant in the same house was 4.2. Most of the participants did not drink alcohol (99.5%), whereas 71.3% of the total sample was a non-smoker.

About 75.5% of participants had another disease in addition to diabetes such as hypertension (64.4% of total sample), heart disease (25.5% of total sample), and renal disorders (13% of total sample). The mean duration of diabetes mellitus among participants was 18.3 years while the mean duration of the diabetic foot was 2.3 years and 47.2% of the total sample had foot amputation. About 74.1% of the total sample used a rehabilitation assistant device. The mean body mass index (BMI) was 29.2 kg/m^2. Related to current diabetic medications, 26.9% of the total sample were using oral hypoglycemic agents, 35.6% of the total sample were using insulin injection, and 37.5% of the total sample were using both. The mean of glycated hemoglobin (HbA1c) for the participants was 9.2. Tables 1 and 2 show more detailed information about the participant's characteristics. Related to participants' socio-demographic factors in Table 1, all continuous data had been normally distributed (skewness ≤ 2).

Table 1 Descriptive statistics of participants' socio-demographic factors with skewness values

Socio-demographic Factors	Minimum	Maximum	Mean	Standard Deviation (SD)	Skewness
Age	18.00	86.0	60.2	13.5	-0.41
Income per month (JD)	20.00	2500.0	466.6	480.8	2.00
Number of family members	1.00	17.0	8.2	3.2	0.21
Number of members who are living with the patient in the same house	0.00	13.0	4.2	2.3	0.85
Duration of diabetes (years)	1.00	40.0	18.3	8.1	0.20
Duration of diabetic foot (years)	0.25	15.0	2.3	2.6	1.90
Glycated hemoglobin (HbA1c)	5.00	16.0	9.2	2.2	0.82
Body mass index (BMI)	17.50	51.8	29.2	5.9	0.95

Table 2 Frequency distribution of participants' socio-demographic factors

Socio-demographic Factors	Groups	Frequency (N)	Percentage (%)
Gender	Male	137	63.4%
	Female	79	36.6%
Marital Status	Single	14	6.5%
	Married	161	74.5%
	Divorced	4	1.9%
	Widowed	37	17.1%
Employment Status	Employed	45	20.8%
	Not employed	171	79.2%
Educational level	Illiterate	48	22.2%
	Primary school	73	33.8%
	High school	39	18.1%
	Diploma	18	8.3%
	University	28	13.0%
	Higher education	10	4.6%
The availability of social support by the family	Yes	167	77.3%
	No	49	22.7%
The availability of healthcare giver by family	Yes	162	75.0%
	No	54	25.0%
The type of main healthcare provider	Specialist doctors	101	46.8%
	General doctors	35	16.2%
	Nurses	80	37.0%
Amputation	Yes	102	47.2%
	No	114	52.8%
Currently smoking	Yes	62	28.7%
	No	154	71.3%
Drinking alcohol	Yes	1	0.5%
	No	215	99.5%
Other disease	Yes	163	75.5%
	No	53	24.5%
Current diabetic medications	Oral hypoglycemic agents	58	26.9%
	Insulin injection	77	35.6%
	Both	81	37.5%
Rehabilitation	Yes	56	25.9%
	No	160	74.1%
Type of diabetes	Type 1 DM	46	21.3%
	Type 2 DM	170	78.7%
Total		216	100.0%

Depression among Diabetic Foot Patients

Prevalence of depression among DF patients in the study sample was 82.9% (179 participants) according to PHQ-9 scale. Based on PHQ-9 scale there were different levels of depression, about 30 patients had severe depression, 40 patients had moderately severe depression, 55 patients had moderate depression, and 54 patients had mild depression (Table 3).

Table 3 Frequency distribution of participants' level of depression

Level of Depression	Frequency (N)	Percentage (%)
No depression	37	17.1%
Mild	54	25.0%
Moderate	55	25.5%
Moderately severe	40	18.5%
Severe	30	13.9%
Total	216	100.0%

A question of self-reported depression was asked to participants to assess participant answer about having depression, about 104 participants answered that they are not depressed, 85 participants answered that they are depressed, and 27 participants answered that they don't know if they are depressed or not (Table 4).

Table 4 Frequency distribution of participants' self-reported depression question

Self-reported depression answers	Frequency (N)	Percentage (%)
Not depressed	104	48.1%
Depressed	85	39.4%
Don't know	27	12.5%
Total	216	100.0%

A comparison between PHQ-9 scores and self-reported depression question was done. Among participants who answered that they are "depressed" in self-reported depression question, 100% of them had depression according to PHQ-9 scores. Also among participants who answered that they "don't know" in self-reported depression question, 92.6% of them had depression according to PHQ-9 scores. In addition, among participants who answered that they are "not depressed" in self-reported depression question, 66.3% of them had depression according to PHQ-9 scores (Table 5). So 43.5% of the total sample had depression based on PHQ-9 scale and didn't answer that they had depression in self-reported depression question, thus 43.5% of the total sample had unscreened depression. Chi-square test was used to assess the significant difference between depression diagnosed by PHQ-9 scale and self-reported depression answers, the difference was statistically significant, (χ^2=39.4, p=0.001).

Table 5 Comparison of PHQ-9 depression and self-reported depression answers

Variables		PHQ-9 Depression	
		Depressed	**Not Depressed**
Self-reported depression answers	Not depressed	69	35
	Depressed	85	0
	Don't know	25	2
Total		216	

Factors Associated with Depression among Diabetic Foot Patients

The relationship between total depression scores based on PHQ-9 scores and socio-demographic factors were investigated by using correlation analysis, as shown in Table 6. There were significant negative correlations between total depression scores and employment (rpb=-0.19, p=0.006), income (r=-0.26, p=0.001), educational level (r=-0.24, p=0.001), the availability of social support by the family (rpb=-0.33, p=0.001), the availability of healthcare giver by family (rpb=-0.22, p=0.001), the type of main healthcare provider (r=-0.21, p=0.002), and rehabilitation (rpb=-0.18, p=0.007). In contrast, glycated hemoglobin (HbA1c) was correlated positively with total depression scores (r=0.29, p=0.001).

Table 6 Correlation analysis between total depression scores and socio-demographic factors

Socio-demographic factors	Correlation coefficients
Gender	0.11
Marital Status	0.13
Employment Status	-0.19**
Income per month (JD)	-0.26**
Educational level	-0.24**
Number of family members	0.04
Number of members who are living with the patient in the same house	-0.13
The availability of social support by the family	-0.33**
The availability of healthcare giver by family	-0.22**
The type of main healthcare provider	-0.21**
Duration of diabetes (years)	0.02
Duration of diabetic foot (years)	0.05
Amputation	0.08
Currently smoking	0.10
Other disease	0.03
Current diabetic medications	0.08
Rehabilitation	-0.18**
Type of diabetes	0.05
Age	0.07
Glycated hemoglobin (HbA1c)	0.29**
Body mass index (BMI)	-0.02
**Correlation is significant at the 0.01 level (2-tailed)	

Correlation analysis showed that 8 socio-demographic factors were correlated with total depression scores among DF patients. Multiple linear regression analysis was used to identify which of these factors were the most significant predictors of depression among DF patients. Multiple linear regression analysis showed that there were 3 predictors of depression ($F(8,207)=8.923$, $p=0.001$), as shown in Table 7. The results showed that the availability of social support by the family was associated with low depression scores (B=-0.392), also the type of main healthcare provider was associated with low depression scores (B=-0.148). Furthermore, high glycated hemoglobin was associated with high depression scores (B=0.203). The value of R^2 was 0.256, but after adjustments were made for sample size and number of predictors, the value was reduced to 0.228. Thus, around 23% of the variance in depression scores among diabetic foot patients in this sample is explained by the combined effect of the 3 predictors. The remaining 77% of variation is explained by other factors that were not measured in this study.

Table 7 Socio-demographic factors that associated with total depression scores

Socio-demographic factors	b	SE	Beta (B)	t	Sig.	Partial	Part
Employment Status	-1.43	1.06	-0.088	-1.353	0.178	-0.09	-0.08
Income per month (JD)	-0.001	0.001	-0.068	-0.982	0.327	-0.07	-0.06
Educational level	-0.478	0.316	-0.106	-1.511	0.132	-0.1	-0.09
The availability of social support by the family	-6.2	2.15	-0.392	-2.883	0.004	-0.2	-0.17
The availability of healthcare giver by family	2.25	2.08	0.147	1.083	0.28	0.08	0.07
The type of main healthcare provider	-1.08	0.458	-0.148	-2.361	0.019	-0.16	-0.14
Rehabilitation	-0.894	0.954	-0.059	-0.937	0.35	-0.07	-0.06
Glycated hemoglobin (HbA1c)	0.605	0.185	0.203	3.279	0.001	0.22	0.2
$F(8,207)= 8.923$; $p<0.05$; $R^2=0.256$; Adjusted $R^2=0.228$							

Multiple linear regression analysis showed that the type of main healthcare provider was associated with low depression scores of DF patients, but the main healthcare providers had three groups including specialist doctors, general doctors, and nurses. So, further analysis of variance (ANOVA) using post-hoc test according to Bonferroni's method was needed to compare depression scores of patients across their healthcare provider. First, one-way analysis of variance (ANOVA) was performed to describe the differences of depression scores between DF patients as measured using the PHQ-9 scale according to their main healthcare provider. The F-value for the means of depression scores of DF

patients between the 3 groups reached (F (2,213)=6.464, p=0.002) and it was statistically significant at the level of ($p<0.05$), this denotes that there was a statistically significant difference in the means of depression score of DF patients between the 3 healthcare provider groups.

Second, post-hoc comparison using the Bonferroni test was used to find out the significant difference of depression mean scores of DF patients between the groups of the main healthcare provider. The test showed that the mean of total depression scores of DF patients among nurses group was significantly different from other groups ($p<0.05$), the DF patients in the nurse's group had the lowest depression scores compared to other healthcare provider groups (Table 8 and Figure 1).

Table 8 The mean difference of total depression scores of diabetic foot patients according to the main healthcare provider

The type of main healthcare provider	Specialist doctors	General doctors	Nurses
Specialist doctors	-	-0.59	3.10*
General doctors	0.59	-	3.69*
Nurses	- 3.10*	- 3.69*	-
*The mean difference is significant at significance level ($p<0.05$)			

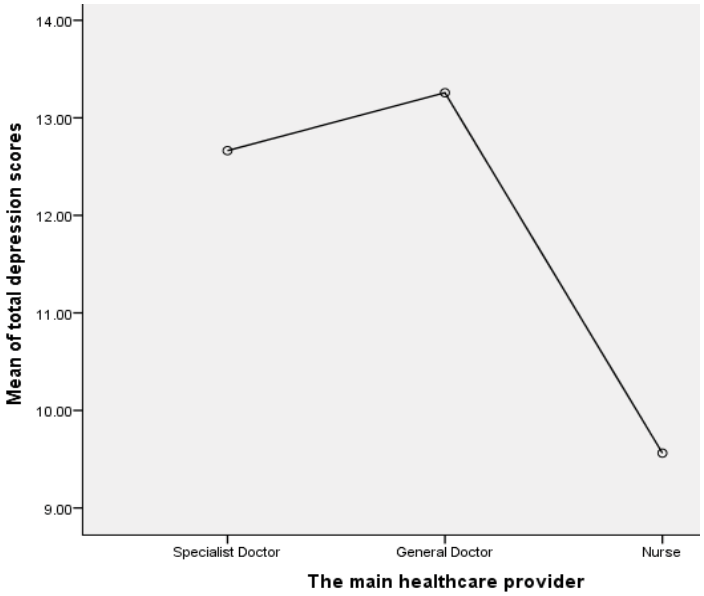

Figure 1 The means plots of total depression score of diabetic foot patients according to the type of main healthcare provider

DISCUSSION

Based on PHQ-9 scores, the study data indicates that prevalence of depression among Jordanian diabetic foot participants was high (82.9%), which is considered as a double result compared to another Jordanian study [14]. In addition, this prevalence is relatively higher than other diabetic foot studies, i.e. a study was conducted in Australia using PHQ-9 scale reported 51.7% of participants had depression [16], and another study was conducted in southeast London, U.K found that 32.2% of patients had depression [13]. The possible explanation is that diabetic foot patients in Jordan are not receiving psychological assessment and psychological care well enough, in addition to the presence of different associated factors with depression among Jordanian patients.

There were few studies about the prevalence of depression among diabetic foot patients, whereas most of the previous studies focused on depression among patients with diabetes alone. These diabetic studies reported that prevalence of depression was ranged from 14.7%, 19.7%, 20.5%, 46.2%, and 55.6% of the total sample, which are totally lower than our study [10,24-27]. Therefore, our study supported that diabetic foot increases the level of depression among diabetic patients [11]. A possible explanation for this finding may be interpreted as diabetic patients who develop that foot ulcer are suffering from more physical burden and mortality rate, so they have more depression level.

Our study showed that the availability of social support by the family, the type of main healthcare provider, and

glycated hemoglobin (HbA1c) were associated with depression level. Comparing to other diabetic foot studies, up to researcher knowledge the relationship between depression and its associated factors did not discuss sufficiently, which prevented comparing the results of our study with other diabetic foot studies. The possible explanation is that studies about depression and its associated factors focused on diabetic patients in general and neglected diabetic foot patients in specific.

Some of the factors associated with depression among DF patients in this study were also supported by diabetic studies. One of the factors was the availability of social support by the family that was associated with lower depression level, compared to diabetic studies; Eren, et al., supported this relationship among diabetic patients [27]. A possible explanation for this association may be interpreted as the presence of psychological support from the family could provide physical comfort and emotional support, which enhance the psychological status of diabetic foot patients. Specifically, the family member may help the patients with diabetic foot care, following healthcare visit, and giving hope to their life.

The other factor was the type of main healthcare provider, which indicated that nurses as healthcare provider had patients with lower depression level compared to a specialist and general doctors. A possible explanation for this association may be interpreted as the nurses provide the psychological support for DF patients more than doctors do. Additionally, nurses may give patients enough time to ask questions and express their feelings while the doctors may have limited time or neglect the psychological aspect of these patients. This result indicates the importance of the nursing role in decreasing depression level among diabetic foot patients. Up to researcher knowledge, there were no previous studies that support this relationship among diabetic patients or even diabetic foot patients.

The last factor was high glycated hemoglobin (HbA1c), which was associated with higher depression level. Compared to diabetic studies, many diabetic studies supported this relationship among diabetic patients [25-28]. A possible explanation for this association may be interpreted as the high blood sugar is a risk factor for stroke, coronary heart disease, and death that increases physical and psychological burdens, so increases depression levels among diabetic foot patients [29]. Moreover, as a neurological explanation, the elevated glycated hemoglobin (HbA1c) indicates poor glycemic control, it leads to poor glucose metabolism in the brain which causes more brain tissue loss, and the poor glucose metabolism was described as a risk factor for the development of depression among diabetic patients [29].

According to self-reported depression question, a large number of patients who answered “don’t know” and patients who answered “not depressed” had depression based on PHQ-9 scale, which they were considered as unscreened depression patients. Our study showed that 43.5% of diabetic foot patients had unscreened depression, which was high compared to other studies, i.e. Pearson, et al., reported that 28.3% of DF patients had undiagnosed depression [16]. A possible explanation for this study finding may be interpreted as Jordanian diabetic foot patients do not know the nature of depression symptoms, in addition to the lack of psychological assessment that makes the patients unfamiliar with their depression. Unscreened depression patients usually do not seek depression treatment and keep suffering from depression complications because they do not recognize their depression.

CONCLUSION

Prevalence of depression among Jordanian diabetic foot patients was high (82.9%) with different levels of depression, which indicates an urgent need for depression assessment that may help in early detection, treatment, and prevention of depression among diabetic foot patients. Several factors viewed to be associated with depression level; the availability of social support by the family was associated factor with low depression level, which indicates the importance of family’s psychological support that needs thorough assessment and encouragement by healthcare providers. In addition, the diabetic foot patients among nurses group had the lowest depression level than other healthcare provider groups (specialist doctors and general doctors), which indicates the importance of the nursing role that needs to focus on the incorporation of the psychological aspects in the nursing care plan. Moreover high glycated hemoglobin was associated factor with high depression level, which indicates for a thorough assessment and follow-up for HbA1c and depression levels. Furthermore, the study showed a high rate of unscreened depression among DF patients, which emphasizes the needs for comprehensive depression assessment to provide the proper management for DF patients.

Limitations

There are some limitations to this study. The design of this study is a cross-sectional design where a causal relationship

between depression and independent variables cannot be established. In addition, the study sample was limited in Jordanian government hospitals and was collected by using convenience sampling, which limits the generalization of the study results. Moreover, there was a scarcity of diabetic foot and depression studies, which limits the comparison between the results of this study and other studies. Furthermore, the study did not assess the stages of the diabetic foot as an associated factor with depression level.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Ajlouni, Kamel, et al. "An increase in prevalence of diabetes mellitus in Jordan over 10 years." *Journal of Diabetes and its Complications,* Vol. 22, No. 5, 2008, pp. 317-24.

[2] Hasan, Syed Shahzad, et al. "Incidence and risk of depression associated with diabetes in adults: evidence from longitudinal studies." *Community Mental Health Journal,* Vol. 51, No. 2, 2015, pp. 204-10.

[3] Klandorf HP, and Stark SWRNAD. "Diabetes mellitus." Salem Press, 2014.

[4] Martin, Elizabeth A., ed. *Concise medical dictionary*. Oxford Quick Reference, 2015.

[5] Herber, Oliver R., Wilfried Schnepp, and Monika A. Rieger. "A systematic review on the impact of leg ulceration on patients' quality of life." *Health and Quality of Life Outcomes,* Vol. 5, No. 1, 2007, p. 44.

[6] Singh, Nalini, David G. Armstrong, and Benjamin A. Lipsky. "Preventing foot ulcers in patients with diabetes." *JAMA,* Vol. 293, No. 2, 2005, pp. 217-28.

[7] Yousef AlAyed, Musab, et al. "Prevalence of foot ulcers, foot at risk and associated risk factors among Jordanian diabetics." *Current Diabetes Reviews,* Vol. 13, No. 2, 2017, pp. 182-91.

[8] Roy, Tapash, and Cathy E. Lloyd. "Epidemiology of depression and diabetes: a systematic review." *Journal of Affective Disorders,* Vol. 142, 2012, pp. 8-21.

[9] Anderson, Ryan J., et al. "The prevalence of comorbid depression in adults with diabetes: A meta-analysis." *Diabetes Care,* Vol. 24, No. 6, 2001, pp. 1069-78.

[10] Al-Amer, Rasmieh M., et al. "Depression among adults with diabetes in Jordan: risk factors and relationship to blood sugar control." *Journal of Diabetes and its Complications,* Vol. 25, No. 4, 2011, pp. 247-52.

[11] Ikem, R. T., I. C. Ikem, and B. A. Ola. "Relationship between depression, cognitive function and quality of life of Nigerians with diabetic foot ulcers, a preliminary controlled study." *Acta Endocrinologica*, 2009, pp. 75-83.

[12] Winkley, K., et al. "Five-year follow-up of a cohort of people with their first diabetic foot ulcer: The persistent effect of depression on mortality." *Diabetologia,* Vol. 55, No. 2, 2012, pp. 303-10.

[13] Ismail, Khalida, et al. "A cohort study of people with diabetes and their first foot ulcer: The role of depression on mortality." *Diabetes Care,* Vol. 30, No. 6, 2007, pp. 1473-79.

[14] Ahmad, Ali, et al. "Anxiety and depression among adult patients with diabetic foot: Prevalence and associated factors." *Journal of Clinical Medicine Research,* Vol. 10, No. 5, 2018, p. 411.

[15] Li, Chaoyang, et al. "Prevalence of depression among US adults with diabetes: findings from the 2006 behavioral risk factor surveillance system." *Diabetes Care,* Vol. 31, No. 1, 2008, pp. 105-07.

[16] Pearson, Sue, Toni Nash, and Vanessa Ireland. "Depression symptoms in people with diabetes attending outpatient podiatry clinics for the treatment of foot ulcers." *Journal of Foot and Ankle Research,* Vol. 7, No. 1, 2014, p. 47.

[17] Kroenke K, Spitzer RL. "The PHQ-9: A new depression diagnostic and severity measure The nine-item patient health questionnaire depression scale is a dual-purpose instrument that can establish provisional depressive disorder diagnoses as well as grade depression severity." *Psychiatric Annals,* Vol. 32, 2002, pp. 509-21.

[18] Spitzer, Robert L., Kurt Kroenke, and J. B. Williams. "Patient health questionnaire primary care study group. Validation and utility of a self-report version of PRIME-MD: The PHQ primary care study." *JAMA,* Vol. 282, No. 18, 1999, pp. 1737-44.

[19] Spitzer, Robert L., et al. "Validity and utility of the PRIME-MD patient health questionnaire in assessment of 3000 obstetric-gynecologic patients: The PRIME-MD patient health questionnaire obstetrics-gynecology study." *American Journal of Obstetrics and Gynecology,* Vol. 183, No. 3, 2000, pp. 759-69.

[20] Kroenke, Kurt, Robert L. Spitzer, and Janet BW Williams. "The PHQ-9: validity of a brief depression severity measure." *Journal of General Internal Medicine,* Vol. 16, No. 9, 2001, pp. 606-13.

[21] Monahan, Patrick O., et al. "Validity/reliability of PHQ-9 and PHQ-2 depression scales among adults living with HIV/AIDS in western Kenya." *Journal of General Internal Medicine,* Vol. 24, No. 2, 2009, p. 189.

[22] Hammash, Muna H., et al. "Psychometrics of the PHQ-9 as a measure of depressive symptoms in patients with heart failure." *European Journal of Cardiovascular Nursing,* Vol. 12, No. 5, 2013, pp. 446-53.

[23] Sawaya, Helen, et al. "Adaptation and initial validation of the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder-7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample." *Psychiatry Research,* Vol. 239, 2016, pp. 245-52.

[24] Zahid, Naeem, et al. "Depression and diabetes in a rural community in Pakistan." *Diabetes Research and Clinical Practice,* Vol. 79, No. 1, 2008, pp. 124-27.

[25] Katon, Wayne, et al. "Behavioral and clinical factors associated with depression among individuals with diabetes." *Diabetes Care,* Vol. 27, No. 4, 2004, pp. 914-20.

[26] Das, Ranjan, et al. "Prevalence of depression in patients with type II diabetes mellitus and its impact on quality of life." *Indian Journal of Psychological Medicine,* Vol. 35, No. 3, 2013, p. 284.

[27] Eren, Ibrahim, Özlem Erdi, and Mehmet Şahin. "The effect of depression on quality of life of patients with type II diabetes mellitus." *Depression and Anxiety,* Vol. 25, No. 2, 2008, pp. 98-106.

[28] Atasoy, Volkon, et al. "Depression, anxiety and quality of life among adult turkish patients with Type 1 Diabetes Mellitus/Erskin Tip 1 Diyabetli Hastalarda Depresyon, Anksiyete ve Yasam Kalitesi." *Turkish Journal of Endocrinology and Metabolism,* Vol. 17, No. 2, 2013, pp. 28-33.

[29] Perlmutter, David. Grain brain: the surprising truth about wheat, carbs, and sugar-your brain's silent killers. Hachette UK, 2018.