Screening for Depressive Symptoms in Patients with Diabetic Foot using (CES-D) Scale: A Cross-Sectional Study

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Abstract

Aim: The aim of this study was to assess levels of depressive symptoms present in patients with diabetic foot.
Methods: A convenience sampling method was used to recruit 108 patients with diabetic foot. After having completed the Centre for Epidemiologic Studies Depression Scale CES-D scale, the patients' demographic data and medical history were collected using pre-structured forms.
Results: Of the entire sample, 38.9% have CES-D score ≥27, which indicates risk of major depression. Logistic regression analysis showed that retinopathy was significantly associated with increased depressive symptoms among diabetic foot patients (odds ratio 3.41(p=0.017)). Taking supplement therapy and not taking a combination of oral hypoglycemic agent and insulin treatment were significantly associated with higher depressive symptoms (odds ratio 3.38 (p=0.022), 2.83 (p=0.030)), respectively. Patients with primary education level have the highest odds ratio among all factors associated with risk of major depression (OR, 4.07; p=0.003).
Conclusions: The risk of major deression among patients with diabetic foot in Jordan is high compared to general diabetic population. This was associated with low educational level, retinopathy, taking supplemt therapy, but not taking a combination of oral hypoglycemic agent and insulin. There is a need for routine screening for depressive symptoms in patients with diabetic foot to help in the prevention, early detection of depression and even referral to a psychiatrist.

Keywords: CES-D, depression , Diabetic foot

(J Med J 2018; Vol. 52 (4): 165-176)

Received	***Accepted***
July 18, 2017	*March 28, 2018*

Introduction

The prevalence of Diabetes Mellitus (DM) is increasing in Jordan (Ajlouni *et al*., 2008) and worldwide (Al-Amer *et al*., 2011). The overall prevalence of DM among adults in Jordan was 17.1% in 2008 (Ajlouni *et al*., 2008). World Health Organization (WHO) predicts that this disease will affect 300 million people by 2025 (King *et al*., 1993; King *et al*., 1998). Diabetes mellitus and depression are known as two of the most considerable public health issues in the UK and elsewhere (Chapman *et al*., 2014) and the association of the two diseases is well

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established (Lustman & Clouse, 2005; Leppävuori, 2009).

Previous studies have shown that diabetic patients may have a higher tendency to psychological disturbances. There was 2-fold risk of depression when compared to those without diabetes (Anderson *et al*., 2001; Ali *et al*., 2006). Depression could lead to the deterioration of glycemic control, an increase on the health care system's burden (Anderson *et al*., 2001) and an increase in the risk of developing the late complications of diabetes, including diabetic foot ulceration and neuropathy (Williams *et al*., 2010). Depression in type 2 diabetes patients has been shown to be associated with twice the rate of a first diabetic foot ulcer over a 4 year follow-up period (Williams *et al*., 2010). The diabetic foot along with the associated physical restrictions may negatively affect quality of life and further worsen depression (Schram *et al*., 2009). It has been shown that the necessity to offload lower limbs and physically restrictive regimens could result in an increased psychological pressure (Campayo *et al*., 2010).

It is well-known that depression reduces a persons' self-care motivation (Lin *et al*., 2004). As a result, it would be reasonable to assume that depression may affect the motivation of chronically ill patients to take optimum treatment for the compelling disorders. In this respect, levels of depression present in patients with DM may negatively influence their adherence to their medications (Ciechanowski *et al*., 2000). Diagnostically, the 'gold standard' method that can be used to identify the presence of clinical depression is an individual patient interview with a psychiatrist (Davison *et al*., 2009). Several studies used this approach to assess the prevalence of depression among diabetic patients and reported a rate of 8.2% in those with type 1 DM (Cohen *et al*., 1997) and 41.8% among those with type 2 DM (Sevincok *et al*., 2001). High levels of anxiety and depression scores were also observed in diabetic patients with Charcot foot (Chapman *et al*., 2014).

At the same time, the use of interview approach is time consuming, has a high impact on limited health resources, and ideally should be carried out by a professional psychiatrist. To reduce pressure on healthcare resources, different screening methodologies have been developed and validated to identify people who are experiencing symptoms commonly associated with depression. Examples of these scales include: the Beck Depression Inventory-II (BDI-II) (Beck *et al*., 1966), Centre for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977), and Hospital Anxiety/Depression Scale (HADS) (Zigmond & Snaith, 1983). Although not diagnostic, these self-report methodologies have been developed to enable efficient identification of depressive symptoms in various populations who may need referral for further assessment of mental health.

Many studies used the cut-off score on depression symptoms scale to assess the depression in type 1 and type 2 diabetic patients (Baily, 1996; Rubin & Peyrot, 1999; Lloyd *et al*., 2000). However, it was revealed that about 49% of diabetic patients with major depression were misrecognized by the primary care physician (Katon *et al*., 2004a; Katon *et al*., 2004b), which confirms how neglected such an issue in the health care systems of those with diabetes is.

To the best of our knowledge, this is the first study in Jordan that uses the Arabic version of CES-D scale (Kazarian, 2010) to assess levels of depressive symptoms in patients with diabetic foot disease. It is also the first one to investigate the association between depressive

symptoms and characteristics of patients with diabetic foot.

Methods

Ethical Approval

This study was approved by the Applied Science Private University in coordination with the Jordan University Hospital's Ethics committee (Reference number: 779/2015/10).

Participants

A convenience sampling method was used at an outpatient clinic in the diabetes clinic at the Jordan University Hospital over seven months. Patients who were diagnosed of diabetic foot (DF) disease, aged between 18 and 74 years, were able to read the Arabic version of CES-D, had no apparent cognitive deficit (this was judged by their physician), and had a follow-up appointment at the outpatient clinic in the study site were included in this study. All eligible patients were recruited only after written informed consent has been obtained. Recruitment was performed in accordance with the regulations of ethics at the Jordan University Hospital.

One hundred and eight diabetic patients were recruited in this cross-sectional study over 7 months (from May 2015 to November 2015). Once patients have been recruited, recording of patients' demographic data, medical and medication history, occupation, level of education, and income were collected using structured data collection forms.

Data Collection

Screening for Depression

The Arabic version of CES-D Questionnaire was used (Kazarian & Taher, 2010) to assess the risk of depression. The original short 20 item, self-report scale has been developed and validated to measure current depressive symptoms in the general population (Radloff, 1977). It aids in identifying individuals at risk of clinical depression, with good sensitivity and specificity and high internal consistency (Lewinsohn *et al*., 1997). The Arabic version was validated in a community sample of Lebanese adults (Kazarian & Taher, 2010). In the present study, the later version was obtained with permission from the authors and was used to monitor levels of depressive symptoms present in diabetic patients. There are 4 positive (reverse scored) and 16 negative questions, with each question being scored on a 4-point scale (from 0-3). Scores range from 0 to 60, with higher scores indicating more depressive symptoms.

A cut-off score of ≥16 was used to establish whether there were clinically related depressive symptoms present (Radloff, 1977). A total score between 16 and 26 indicates risk of mild depression, while a score ≥ 27 indicates risk of major depression (Zich *et al*., 1990).

Data Analysis

Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS, version 22). Frequencies were utilized for categorical variables; mean and standard deviation were obtained for continuous variables. The proportions of depressed moods in patients with diabetic foot were determined using the final score. Association of depression with gender, age, and level of blood glucose was also investigated. After conducting univariate analysis of factors for major depression, those variables with significant results (p <0.05) were subjected to multivariate analysis using backward logistic regression in order to evaluate the relative contribution of different predictors of the major depressive

symptoms. A *p*-value of <0.05 was considered significant. All tests performed were two tailed.

Results

This study included 108 patients with diabetic foot (43 females and 65 males), the majority had type 2 diabetes (98.15%) and their ages ranged between 28 and 74 years. Regarding CES-D score, 85.2% had risk of depression. The characteristics of patients who participated in the study are shown in Table 1, mean age was 58.3 years (SD = 9.59) and mean HbA1C was 8.11% (SD =2.15). About 79.6% of patients had duration of DM for 10 years or more and about 63% of patients had hypertension and 41.7% were taking more than 8 medications.

Table 1: An overview of the participant (patient) characteristics

	Average (SD)	Range
Age (years)	58.3 (9.59)	(28-74)
BMI	30.4 (6.30)	(19.90-58.77)
HbA1c	8.11 (2.15)	(5-16)
CES-D score	25.05(9.58)	(4-49)
History of DM (years)	16.90 (8.85)	(1-40)
No. of medications	7.71 (3.08)	(1-15)
No. of DM medications	1.74 (0.74)	(1-4)

	N	Frequency	Percentage
Risk of depression (score ≥16)			
- Yes	108	92	85.2%
- No	108	16	14.8%
Risk of major depression (score ≥27)			
- Yes	108	42	38.9%
- No	108	66	61.1%
Marital status			
- Single	105	7	6.67%
- Married	105	83	79.05%
- Widowed	105	15	14.28%
Normal BMI (<25)	108	17	15.7%
Smoker	100	26	24.1%
≥10 years with DM	108	86	79.6%
Gender			
- Female	108	43	39.8%
- Male	108	65	60.2%
Elderly (≥50 years)	108	92	85.2%
University education or higher	106	28	26.4%
Target HbA1C (<7%)	108	32	32.0%
Comorbidities			
- Hypertension	108	68	63.0%
- Angina	108	10	9.3%
- Heart failure	108	35	32.4%
- Renal	108	28	25.9%
- Ophthalmic	108	67	62.0%
- Hyperlipidemia	108	66	61.1%
- Numbness	108	95	88.0%
- Others	108	21	19.4%
Income (>500 JOD)	105	30	28.57%
Covered with health insurance	106	80	75.47%
Hospitalisation in the last 3 months			
- 0	108	66	61.1%
- 1	108	26	24.1%
- 2	108	7	6.5%
- 3	108	4	3.7%
- >3	108	5	4.6%

Medications			
- Respiratory	108	9	8.3%
- Neurological	108	36	33.3%
- Cardiovascular	108	88	81.5%
- Gastrointestinal	108	46	42.6%
- Antibiotics	108	67	62.0%
- Supplements	108	25	23.1%
- Corticosteroids	108	5	4.6%
- Analgesics	108	25	23.1%
Patients taking >4drugs	108	92	85.2%

Risk of major depression among patients was 38.9%. Proportion of diabetic foot patients with risk of major depression according to demographic and clinical characteristics are shown in Table 2. The results demonstrated that age, gender, BMI, income, target HbA1c, duration of DM, heart failure, and hyperlipidemia were not associated with an increased risk of major depression among patients with diabetic foot. On the other hand, ophthalmic disease, not taking a combination of insulin and oral hypoglycemic agent (OHA), low educaion level (<9th grade), and taking supplements (e.g. Multivitamins) were associated with increased risk of major depression (p <0.05).

Table 2. Proportion of diabetic foot patients with risk of major depression according to demographic and clinical characteristics

Variable	Total	N (%)‡	ρ
Gender			
Male	65	25 (38.5)	0.911
Female	43	17(39.5)	
Age (Years)			
<50	16	7(43.8)	0.666
≥50	92	35(38)	
BMI			
<25	17	5(29.4)	0.666
25-29.99	43	18(41.9)	
≥30	48	19(39.6)	
Target HbA1C			
<7	32	10(31.3)	0.276
≥7	68	29(42.7)	
Comorbidities			
- Heart failure			
Yes	35	17(48.6)	0.153
No	74	25(33.8)	
- Ophthalmic disease			
Yes	67	32(47.8)	0.016*
No	41	10(24.4)	
- Hyperlipidemia			
Yes	66	30(45.5)	0.079
No	42	12(28.8)	
Educational level >9 grade or			
<9 grade	41	24(58.5)	0.002*
≥9 grade	65	18(27.7)	
Smoking			
Yes	26	12(46.2)	0.261
No	74	25(33.8)	

Income			
<500 JD	75	30(40.0)	0.752
≥500 JD	30	11(36.7)	
Health insurance			0.979
Yes	80	31(38.8)	
No	26	10(38.5)	
>10 years with DM			
Yes	86	34(39.5)	0.785
No	22	8(36.4)	
Insulin			
Yes	93	34(36.6)	0.216
No	15	8(53.3)	
Oral Hypoglycmic agent (OHA)			
Yes	72	25(34.7)	0.209
No	36	17(47.2)	
Insulin combination with OHA			
Yes	60	18(30.0)	0.034*
No	48	24(50.0)	
Number of drugs			
≤4	92	36(39.1)	0.902
>4	16	6(37.5)	
Medications			
- Neurological			
Yes	36	17(47.2)	0.209
No	72	25(34.7)	
- Cardiovascular			
Yes	88	37(42.1)	0.158
No	20	5(25.0)	
- Supplements			
Yes	25	15(60.0)	0.014*
No	83	27(32.5)	

‡ Number and percentage of patients with CES-D score ≥27
*p-value<0.05

Table 3 shows logistic regression analysis of factors associated with risk of major depression among adult patients with diabetic foot. Retinopathy (ophthalmic disease) was significantly associated with increased depressive symptoms among diabetic foot patients (odds ratio 3.41(p=0.017). On the other hand, taking supplements and not taking a combination of oral hypoglycemic agent and insulin were significantly associated with higher depressive symptoms (odds ratio 3.38 (p=0.022), and 2.83 (p=0.030), respectively). Patients with primary education level (<9th grade) had the highest odds ratio among all factors associated with risk of major depression (OR, 4.07; p=0.003).

Table 3: Logistic regression analysis of factors associated with risk of major depression among adult patients with diabetic foot

Variable	OR (95% CI)	p-value
Education under 9th grade	4.07 (1.61-10.26)	0.003*
Ophthalmic disease (retinopathy)	3.41(1.25-9.35)	0.017*
Taking Supplements	3.38 (1.20-9.570)	0.022*
Not taking combination of insulin and OHA	2.83 (1.11-7.24)	0.030*

*p-value<0.05, OHA: oral hypoglycemic agent

Discussion

CES-D is a tool for self-reporting of depression symptoms. It is an effective and valid tool that is widely used to assess mild to moderate depression in the field of psychiatric epidemiology (Naughton & Wiklund, 1993; Snaith *et al*., 1993; Nezu *et al*., 2002; Murphy, 2002).

The association of depression and diabetes has been avowed by many studies (Baily, 1996; Cohen *et al*., 1997; Rubin & Peyrot, 1999; Lioyd *et al*., 2000; Sevincok *et al*., 2001).

One study was conducted in Jordan using the Patients' Health Questionnaire-8 (PHQ-8), which revealed that the prevalence of depression among Jordanian subjects with type 1 and 2 diabetes is high compared with some developed countries (Al-Amer *et al*., 2011).

To the best of our knowledge, data on depression in diabetic foot patients among the Middle Eastern countries including Jordan were not investigated. This study is the first study that investigates the levels of depressive symptoms in patients with diabetic foot in Jordan.

Depression was assessed using The Arabic version of CES-D questionnaire (Kazarian and Taher, 2010). The study indicated that the prevalence rate of depression risk (CES-D score ≥16) and major depression risk (CES-D score ≥27) among Jordanian patients with diabetic foot was 85.2% and 38.9%, respectively. This could be compared with a systematic random sample study that was held in Jordan and reported a prevalence rate of depression among adult diabetic patients of 19.7% (Al-Amer *et al*., 2011). Other studies reported lower prevalence rates of depression among adult diabetic patients than did our study; they reported a prevalence rate of 5.4% (Zahid *et al*., 2008), 8% (Lloyd e*t al*., 2000). The high percentage of major depression risk highlights the importance of screening diabetic foot patients with CES-D questionnaire, an easy method that can be exploited while patients are waiting to see their physicians and then referred to a psychiatrist if needed.

The presence of diabetic complications as diabetic foot and amputations is expected to increase depression rate among patients. To explain this higher prevalence of depression among diabetic foot patients, it is noteworthy that diabetic foot patients are likely to have physical limitations and a poor quality of life as manifested in the results of many studies (Rubin & Peyrot, 1999; Brown *et al*., 2000; Ciechanowsk *et al*., 2000; Finkelastin *et al*., 2003; Egede, 2004).

Another remarkable issue that is important is that depressed diabetic patients do not pay much effort to daily management activities including foot care (Lerman *et al*., 2004).

In contrast to other studies, the present study did not show an association between gender and risk of depression among diabetic foot patients (Al-Amer *et al*., 2011;Katon *et al*., 2004a; Katon *et al*., 2004b; Zahid *et al*., 2008). Among the entire sample of patients, several demographic and disease-related variables have arisen as significant independent predictors of depression among diabetic foot patients.

Results from logistic regression indicated that odds ratio of CES-D score ≥27 was 4.07 (p=0.003), which was higher for those with low educational level (primary school) than those with upper educational levels. This result is consistent with other studies (Black, 1999; Katon *et al*., 2004a; Katon et al., 2004b; Al-Amer *et al*., 2011).

Ophthalmic disease (retinopathy) showed a significant positive relationship with depression (OR, 3.41). Prior studies have shown that depressive symptoms were associated with retinopathy (Cohen *et al*., 1997; MIYAOKA *et al*., 1997). The presence of more than one complication of diabetes is expected to increase risk of depression. De Groot and colleagues in a meta-analysis of 27 studies including adults with diabetes found that diabetes complications are also higher among patients with depression (De Groot *et al*., 2001).

Higher depression symptoms among diabetic patients taking supplements may be explained by the deficiency in vitamins and minerals and their effect on mood, brain functioning, and general health. Previous studies have shown that inadequate nutrient intake has been implicated in the etiology of depression (Melanson, 2007), and that depressive patients have low folate and low vitamin B12 status.

The present study did not show an association between insulin and risk of major depression among diabetic foot patients, while other studies did (Katon *et al*., 2004a; Katon *et al*., 2004b; Al-Amer *et al*., 2011). Surprisingly, we found that the combination of insulin and oral hypoglycemic agents is associated with lower risk of depression. The lower risk of depression may be explained in the light of patients' perception about insulin. Many patients lose hope when they are prescribed insulin alone. We cannot also ignore the role of oral hypoglycemic agents in improving insulin sensitivity that may have an impact on depression risk. Further studies are needed to confirm and fully ascertain the mechanisms underlying these associations.

In contrast to other studies that found a significant relationship between glycemic control and depressive symptoms (Mazze *et al*., 1984; Anderson *et al*., 2001), our study did not show a significant relationship between the two factors. This could be explained by the fact that the CES-D scale examines the patient's psychological status within the last 1 week, while the HbA1c reflects the glycemic control during the last 3 months.

The incidence of diabetes complication increases with increased illness duration (Taylor *et al*., 20001; Ajlouni *et al*., 2008). It was expected that patients with longer duration of diabetes may have higher depression risk. However, many studies have reported that the duration of diabetes was not associated with depression among diabetic patients (MIYAOKA *et al*., 1997; Karlson & Agardh, 1997; Popkin *et al*., 1998) and our results were consistent with these studies.

This is a cross-sectional study where causal relationship between variables and risk of major depression cannot be established. Accordingly, a future longitudinal study on patients with diabetic foot is needed. Another limitation of the study is that the CES-D only measures 8 out of 9 of the commonly known depressive symptoms and excludes suicidality. Although it is a reliable and validated measure, suicidality was not assessed in this study.

Conclusion

The risk of major deression among patients with diabetic foot in Jordan is high compared to general diabetic population. This was associated with low educational level, retinopathy, taking supplements, and not taking a combination of oral hypoglycemic agents and insulin. There is a need for routine screening for depressive symptoms in patients with diabetic foot to help in the prevention of and early detection of depression and even referral to a psychiatrist when needed.

Competing Interests

This research project was funded by the Applied Science Private University, Amman, Jordan (Grant NO. DRGS-2014-2015-161).The authors declare no potential conflict of interest.

Acknowledgments

The authors would like to thank Jordan University Hospital for their help and support during the study.

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الكشف عن أعراض الاكتئاب لدى مرضى القدم السكري باستخدام استبانة مركز الدراسات الوبائية: دراسة مستعرضة

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الملخص

الهدف: كان الهدف من هذه الدراسة تقييم مخاطر الإصابة بالاكتئاب في المرضى الذين يعانون من القدم السكري باستخدام استبانة مركز الدراسات الوبائية.

الطرق: تم مشاركة ما مجموعه 108 من مرضى القدم السكري من خلال تعبئة استبانة مركز الدراسات الوبائية، و قد استخدمت النتيجة ≤27 لتقييم مخاطر الإصابة بالاكتئاب الشديد بين المرضى. كما تم جمع البيانات الديموغرافية للمرضى والتاريخ الطبي.

النتائج: تبين أن 38.9٪ من العينة كلها لديهم خطر الإصابة باكتئاب شديد، وأظهر تحليل الانحدار اللوجستي أن اعتلال الشبكية كان مرتبطا بشكل كبير بزيادة أعراض الاكتئاب بين مرضى القدم السكري (OR= 3.41, (p=0.017). بالإضافة إلى عوامل غيرها كالعلاجات التكميلية وعدم أخذ أدوية تخفيض سكر الدم الفموية والأنسولين معاً كانا مرتبطين أيضاً بشكل كبير بزيادة أعراض الاكتئاب بين مرضى القدم السكري. من بين العوامل المرتبطة بمخاطر الإصابة بالاكتئاب كان مستوى التعليم الابتدائي وهو أهم عامل عند المرضى (OR=4.07, p= 0.003).

الاستنتاجات: خطر الاكتئاب الشديد بين المرضى الذين يعانون من القدم السكري في الأردن مرتفع مقارنة مع مرضى السكري بشكل عام. وقد ترافق ذلك مع انخفاض مستوى التعليم، واعتلال الشبكية، وعدم أخذ أدوية تخفيض سكر الدم الفموية والأنسولين معاً. هناك حاجة لفحص روتيني لعلاج الاكتئاب للمرضى الذين يعانون من القدم السكرية للمساعدة في الوقاية والكشف المبكر عن الاكتئاب وحتى الإحالة إلى طبيب نفسي.

الكلمات الدالة: القدم السكري، الاكتئاب، استبانة مركز الدراسات الوبائية .