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Prevalence, Gender Differences and Associated Factors of Depression among Adults with Type 2 Diabetes, Jordan

Hyassat D[1], Al-Doseri S[1], Hashem J[2], Bani-Mustafa R[3], Mohammed El-Khateeb[1], Dalila B[1] and Kamel A[1]*

[1]Department of Endocrinology, The National Center (Institute) for Diabetes, Endocrinology, and Genetics, The University of Jordan, Amman, Jordan
[2]Department of Epidemiology and Public Health, Jordan University of Science and Technology (JUST), Irbid, Jordan
[3]Department of Psychiatry, The National Center (Institute) for Diabetes, Endocrinology, and Genetics, The University of Jordan, Amman, Jordan

Abstract

Our objectives were to estimate the prevalence of depression and its associated factors among type 2 diabetes mellitus patients. A cross-sectional study was conducted among type 2 diabetics aged ≥ 18 years during the period from 1st of November 2013 to 1st of March 2014. A total of 1591 patients were studied. Depression was assessed using the Arabic version of Patient Health Questionnaire-9 (PHQ-9), a cut-off point of 10 was used to categorize depression. Prevalence rates of overall, major and minor depression were 40%, 8.7% and 25.5%, respectively. Multiple logistic regression analysis indicated that age, sex, educational level, smoking status, DM complications especially neuropathy, vitamin D3 level and family support were significant. Whereas, marital status, monthly income, BMI, glycemic control and support of friends and significant others were not significant. Old age, maleness, higher education, non-smoking, adequate vitamin D3 level, absence of DM complications and presence of family support were significantly less likely to have depression. Depression is highly prevalent among diabetic patients. Factors associated with depression differ by gender and perceived family support is a protective factor against depression.

Keywords: Diabetes; Depression; Prevalence; Risk factors; Type 2 diabetes mellitus; Social support; Jordan

Introduction

The association of depression with diabetes was first noted in the literature more than 300 years ago when Willis made the surprising remark that diabetes was the result of sadness or prolonged sorrow [1]. Depression is at least twice as common among diabetic patients compared with the general population and has been estimated to affect 11% to 72% of subjects with Diabetes [2,3]. The causal relationships underlying the association of depression with diabetes are complex and probably bi-directional. A meta-analysis conducted by Mezuk and coauthors found that depression was associated with a 60% increased risk of type 2 diabetes while type 2 diabetes was associated with only modest increased risk of depression [4]. In addition, others found a higher incidence of diabetes in depressed versus non-depressed subjects (0.72% vs. 0.47% yearly), with unadjusted and adjusted risk (95% CI) of 1.56 (1.37-1.77) and 1.38 (1.23-1.55), respectively (both P values <0.001) [5,6]. Depression could facilitate the onset of diabetes through multiple mechanisms, including depression- related factors known to increase insulin resistance such as disturbances in eating behaviors and physical inactivity, antidepressant medication use and weight gain, or stimulation of stress-related hormonal pathways and pro-inflammatory cytokines which interfere with glucose metabolism [7-12].

On the other hand, diabetes may increase the risk of depression because of the sense of threat and loss associated with receiving diabetes diagnosis and the substantial lifestyle changes (limitations on diet, physical and social activities) necessary to avoid developing debilitating complications, together with some diabetes-related symptoms (e.g. fatigue), which could induce depressed mood [13]. A systematic review and meta-analysis conducted by Nouwen concluded that in comparison with non-diabetic controls, people with type 2 diabetes have a 24% increased risk of developing depression [14]. Additionally, another meta-analysis conducted by Rotella and his co-author found that diabetes is associated with a significantly increased risk for depressive symptoms [5,6].

Depression in patients with diabetes is associated with multiple adverse outcomes including poor glycemic control, higher rates of mortality, poor adherence to dietary recommendation, reduced quality of life and increased health care expenditures [15-20]. A quantitative meta-analysis Gao also showed that depression is a major risk factor for incidence of dementia (including Alzheimer's disease, vascular dementia and any dementia) and mild cognitive impairment [21].

Previous studies had correlated depression with a variety of diabetes complications. In a meta-analysis including patients with type 1 and type 2 diabetes, De Grot found that depression was significantly associated with a variety of diabetes related complications (Retinopathy, nephropathy, neuropathy, macrovascular complications and sexual dysfunction).

It is important in Jordan to realize the high prevalence of depression among diabetics because of its unique socioeconomic situation as much as its presence as a role model for health cares in the region. According to a World Bank report, the economy of Jordan (~ 7 million people) is one of the smallest in the Middle East, with shortage of oil, water and other natural resources. Additionally, Jordan's economy suffers from other serious economic problems like, increasing poverty rates, unemployment, dependency on grants and remittances, budget deficit and inflation. The slowdown of international economy and regional conflicts, however, have impacted negatively on the growth of GDP in Jordan (GDP per capita is around US 6,000 $ - power purchasing parity).

***Corresponding author:** Kamel A, Department of Endocrinology, The National Center (Institute) for Diabetes, Endocrinology, and Genetics, The University of Jordan, Amman, Jordan, Tel: +9626 5347810; Fax: +962 6 5356670; E-mail: ajlouni@ju.edu.jo

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The energy problem of lacking natural gas and oil has worsened the budget deficit and economic situation. According to the latest official information released in 2014, the public debt has exceeded 85% of the total GDP, inflation rate 5.9%, unemployment rate 1%, unemployment youth ages (15-24) 29.3%, and below poverty-line population 14.2%. On the other hand, and according to a recent United Nations Development Program (UNDP) report regarding Socio-economic Inequality in Jordan in 2015, Jordan's levels of inequality are low as compared with other countries with similar GDP. The level of education of the household explains the inequality of opportunity. Education up to the high-school is available free to everybody in Jordan. Nevertheless, Jordan shows a very low rate of women participation in labor force. Moreover, in the same report, it was concluded that income inequality is higher when compared with consumption inequality.

The health care system in Jordan is divided between public (80%) and private sectors (20%), the 80% have either governmental or military insurance coverage, the 20% have either private or no insurance. Health indicators in Jordan are considered among the best in the region and to a greater extent matches some developed countries.

The objectives of this study were to determine the prevalence of depression among adults with type 2 diabetes (type 2 DM) and to study the variables associated with depression.

Materials and Methods

A cross sectional study was carried out from the first of November 2013 to the first of March 2014 at the National Center for Diabetes, Endocrinology and Genetics (NCDEG) in Amman-Jordan. All type 2 DM adults (≥ 18 years of age) attending the center during the study period were eligible to be included in the study. Type 1 DM, and pregnant diabetics were excluded from the study. All eligible patients were invited to participate in the study after explaining the purpose of the study. Those who consented to participate were included in all the study procedures. The data sources used were the patient medical file and a structured self-administered questionnaire. The medical file was used to gather information on latest weight, height, DM complications, HbA1c level and vitamin D3 values. The questionnaire is composed of three parts. The first part gathered information on socio-demographic and lifestyle data including age, gender, marital and smoking status, educational level and family monthly income. The second part measured Perceived social support using the Arabic-translated version of the Multidimensional Scale of Perceived Social Support (MSPSS) The scale is a 12-item self-reported scale to assess the perception of social support adequacy from the family, friends, and significant others such as health care team. Items 3, 4, 8, and 11 are a subscale assessing family support.

Typical example is "My family really tries to help me". Items 6, 7, 9 and 12 are a subscale assessing support of friends. Typical example is "I can count on my friends when things go wrong". Items 1, 2, 5 and 10 subscale assesses support of significant others. Typical example is "There is a special person who is around when I am in need". The response on each item is through a 7-point Likert scale ranging from 1 (very strongly disagree) to 7 (very strongly agree). Friends (items 6, 7, 9 and 12); and significant others (items, 1, 2, 5 and 10); The total score ranges from 7 to 84. The higher the score the higher is the perceived social support. The response on any of the last three Likert points is considered positive support on that items and responding positive on 3 out of the 4 items for each of the family, friends, and significant others (SO) subscales were considered receiving social support on that subscale. MSPSS scale had a good internal consistency with Cronbach's alpha of 0.88 and robust construct validity [22].

The third part assessed the depressive status using the Arabic version of the Patients' Health Questionnaire-9 (PHQ-9). The PHQ-9is a self-administered version of the depression part of the PRIME_MD which used the actual 9 symptoms criteria of DSM-IV that assess depressive disorders in primary care. The instrument has been validated for use in clinical practice, and found to have adequate convergent and discriminant validity [23]. The internal consistency reliability of the PHQ-9 was excellent, with a Cronbach's α of 0.89 in the primary care setting [24].

The Arabic version of the PHQ-9 was validated in previous research the Internal Consistency Reliability (Cronbach's α) in this study was 0.78 [25]. A typical example: "over the past 2 weeks how often have you been bothered by any of the followings (little interest or pleasure in doing things). Participants were asked to use a 4-point frequency scale (0= not at all, 1=some of the days, 2=more than one-half the days, 3=nearly every day) to indicate how much the statement applied to them over the past two weeks. The PHQ-9 score ranges from 0 to 27. The highest levels of sensitivity and specificity of the instrument were achieved at a cut-off point of 10 (88% and 88%) [24]. This cut-off point was used to categorize patients into depressed (≥ 10) and not depressed. The criteria for major depression syndrome are met if the patient checks items 2 and 3 and five or more of the PHQ-9 at least "more than half the days", or checked item 9 (suicidal ideation). The criteria for Other Depression Syndrome are met if the patient checks items 2 and 3 and 2-4 of the other items of the PHQ-9 at least "more than half the days. Serum vitamin D3 concentrations were determined using radioimmunoassay (Biosource Europe S.A., Nivelles, Belgium). Glycosylated hemoglobin (HbA1c) was analyzed using the high-performance liquid chromatography method (Bio-Rad). Diabetes was considered controlled if the patient had HbA1C value <7.0% according to the American Diabetes Association (ADA) 2011 guidelines [26]. Vitamin D values of 30 ng/mL or less was considered insufficient/deficient [27].

Ethical considerations

The study protocol was approved by the ethics committee at the National Centre for Diabetes, Endocrinology and Genetics (NCDG). Patients were assured of confidentiality of data and to be used only for scientific research. Consents of patients to participate in the study were secured after granting them the freedom to withdraw from the study at any time if they wanted to.

Statistical analysis

Data were analyzed using the Statistical Program for Social Sciences (SPSS) version 20.0. Frequency distribution was used for categorical variables. Chi-square distribution was used to examine the relationship between two categorical variables. Multiple logistic regression analysis was used to examine the net effect of each of the independent variables on the dependent variable (depression) after controlling for the effect of other variables included in the model. AP- value ≤ 0.05 was considered significant.

Results

A total of 1591 type 2 diabetic patients were included in the study with a response rate of 99.1%. Of all participants, 637 (40%) scored positive (≥ 10) for depressive symptoms on PHQ9, 138 (8.7%) had major depression, and 406 (25.5%) had minor depression.

As shown in Table 1, 49.1% of the participants were females, 23% aged <50 years, 47% were between 50-60 years and 31% were >60 years of age, 40% and 19% had a family monthly income of <750 US$ and

>1500 US$, respectively. The majority of the sample were obese (50%), married (85%), hold college diploma or higher (59%), non-smokers (76%), had uncontrolled diabetes (62%), had vitamin D3 level of <30 ng/mL (53%), had diabetes complications (64%), receive family support (72%), receive support of SO (74%); only 31% receive support from friends. The vast majority of males (80%) suffer erectile dysfunction.

Prevalence of depression

A total of 637 scored positive (≥ 10) for depression on PHQ9 with an overall prevalence rate of 40%; 250 (30.9%) males and 387 (49.6%) females. Moreover, 139 (8.7%) patients reached DSM-IV criteria for major depression on the PHQ9; 56 (6.9%) males and 83 (10.6%) females. Furthermore, 405 (25.5%) patients reported having other depressive disorder; 169 (20.9%) males and 236 (30.2%) females. Among all categories of depression, females have significantly higher rates than males.

Variables	Total N	PHQ score of ≥ 10%	P*
	1591	636 (40.0)	
Age (years)			
20 ≤ 50	362	161 (44.5)	0.01
50 ≤ 60	742	309 (41.6)	
60+	487	178 (34.4)	
Sex			
Men	810	250 (30.9)	0.01
Women	781	387 (49.6)	
Marital status			
Single	55	20 (36.5)	0.05
Married	1358	531 (39.1)	
Widow/divorced	178	86 (48.3)	
Education			
<High school diploma	276	140 (50.7)	0.01
High School diploma	374	174 (46.5)	
> High school diploma	930	318 (34.2)	
Family monthly income			
< 750 US$	623	303 (48.6)	0.01
750-1500 US$	654	236 (36.1)	
>1500 US$	297	89 (30.0)	
BMI (kg/m²)			
<25.0	170	58 (34.1)	0.00
25.0 ≤ 30.0	582	196 (33.7)	
30.0+	762	353 (46.3)	
Glycaemic control (HbA1c)			
<7.0%	613	214 (34.9)	0.00
≥ 7.0%	978	423 (43.3)	
Smoking status			
No	1203	460 (38.2)	0.00
Yes	388	178 (45.9)	
Vitamin D3 (ng/mL)			
≥ 30	691	253 (36.6)	0.00
<30	765	338 (44.2)	
DM complications			
Absent	580	205 (35.3)	0.00
Present	1009	431 (42.7)	
Family support			
Present	1127	411 (36.5)	0.00
Absent	438	217 (49.5)	
Friends' support			
Present	488	183 (37.5)	0.15
Absent	1077	445 (41.3)	
Significant others' support			
Present	1163	445 (38.3)	0.01
Absent	402	183 (45.5)	
Certain variables did not add to 1591 because of missing values.			

Table 1: Frequency distribution of the study population who reported having moderate to severe depression (scored ≥ 10 on PHQ-9) by certain Socio-demographic and health variables (N=1591)[1].

Variables	OR	P-value
Age (years)		
< 50	1.8	0.00
50-60	1.6	0.00
>60	1	
Sex		
Men	0.43	0.00
Women	1	
Education level		
<High school diploma	1.5	0.03
High school diploma	1.3	0.12
>High school diploma	1	
Marital status		
Single	1	
Married	1.6	0.18
Widow/divorced	1.8	0.13
Family monthly income (US$)		
<750	1.4	0.07
750 ≤ 1500	1.1	0.57
≥ 1500	1	
BMI (kg/m²)		
<25.0	0.8	0.25
25.0 ≤ 30.0	0.9	0.21
30.0+	1	
Smoking status		
Current smoker	1.5	0.01
Nonsmoker	1	
DM complications		
Present	1.4	0.01
Absent	1	
Glycemic control (HbA1c)		
≥ 7%	1.1	0.42
<7%	1	
Vitamin D3 (ng/mL)		
<30	1.4	0.01
≥ 30	1	
Family support		
Present	0.6	0.00
Absent	1	
Friends' support		
Present	0.9	0.35
Absent	1	
Significant others' support		
Present	1	0.89
Absent	1	
[2]Using multiple logistic regression analysis		

Table 2: Adjusted[2] odds ratios and their level of significance of prevalence of depression by certain socio-demographic and health variables (N=1591).

Bivariate analysis indicated in Table 1 that depression (PHQ9 ≥ 10) is significantly associated with age, sex, marital status, educational level, family monthly income, BMI, smoking status, vitamin D3 level, HbA1c level, diabetes complications, family support, and support of SO; but no significant association with friends' support.

Multiple logistic regression analysis was performed to examine the net effect of socio-demographic variables, BMI, smoking status, vitamin D3 level, HbA1c level, diabetes complications, and perceived social support from family, friends, and significant others on depression. As shown in Table 2, age, sex, educational level, smoking status, DM complications, vitamin D3 level and family support were significant to the model. Whereas, marital status, family monthly income, BMI, glycemic control and support of friends and significant others were not significant to the model. The eldest age group, males, participants holding high school diploma or higher, nonsmokers, those with vitamin D3 level of 30 ng/mL or higher, those with no DM complications, and those who perceive having family support were significantly less likely to have depression than their counterparts.

Variables	Males OR	P-value	Females OR	P-value
Age (years)				
< 50	2.2	0.00	1.7	0.04
50-60	1.8	0.02	1.5	0.03
>60	1		1	
Education level				
<High school diploma	1.3	0.43	1.7	0.02
High school diploma	1.1	0.66	1.4	0.12
>High school diploma	1		1	
Marital status				
Single			0.6	0.21
Married			0.8	0.34
Widow/divorced			1	
Family monthly income (US$)				
<750	2	0.01	1	0.98
750 ≤ 1500	1.1	0.49	1	0.86
≥ 1500	1		1	
BMI (kg/m²)				
<25.0	0.8	0.37	0.8	0.54
25.0 ≤ 30.0	0.9	0.53	0.8	0.24
30.0+	1		1	
Smoking status				
Current smoker	1.3	0.19	1.8	0.01
Non-smokers	1		1	
DM complications				
Present	1.7	0.01	1.2	0.23
Absent	1		1	
Glycaemic control (HbA1c)				
≥ 7%	1.1	0.51	1.5	0.6
<7%	1		1	
Vitamin D3 (ng/mL)				
<30	1.3	0.13	1.5	0.02
≥ 30	1		1	
Family support				
Present	0.6	0.04	0.6	0.00
Absent	1		1	
Friends' support				
Present	0.8	0.27	0.9	0.76
Absent	1		1	
Significant others' support				
Present	0.9	0.63	1.1	0.57
Absent	1			

[3]Using multiple logistic regression analysis
[4]Marital status was not included in the regression model for males because only 6 males were single and 41 were widow/divorced.

Table 3: Adjusted[3] odds ratios and their level of significance of prevalence of depression by associated factors among males (n=810) and females (n=781)[4].

To examine for gender differences in the factors associated with depression, multiple logistic regression analyses was performed separately for both males and females.

As shown in Table 3, females who are in the younger age groups, having the lowest level of education, current smokers, have <30 ng/mL of vitamin D3 level, and perceived no family social support were significantly more likely to have depression than their counterparts. On the other hand, marital status, family income, BMI, DM complications, level of glycemic control, and perceived support from friends and SO were not significant to the regression model.

Table 3 also shows that males who are in the younger age groups, in the lowest level of family income, suffer DM complications, and who perceive no family support were significantly more likely to have depression than their counterparts. On the other hand, marital status, level of education, BMI, smoking status, glycemic control, vitamin D3 level, and perceived support from friends and SO were not significant to the regression model.

Discussion

In the present study, depression is widely prevalent (40%) among T2DM patients attending the NCDEG. This finding is higher than the 11%, 14%, 17% and 33.4% prevalence rates in, comparable to the 39% and 40.5% prevalence among Hispanic people in South Texas and Northeastern Mexico, but lower than the 46%-72% prevalence rates reported in some other countries[28-34]. In Jordan, Al Amer et al., 2011 found that the prevalence of depression among Jordanian subjects with type 1 and type-2 diabetes was 20% and was associated with gender, educational level, insulin treatment, low self-management behaviors and increased barriers to adherence. These variations in the prevalence rates of depression are related to differences in the definition of depression, differences in study designs, ethnic variations, and/or to differences in the attributes of the study populations.

Our data indicated that females are at higher risk of developing depression than males. This finding is in line with the results reported in other studies and this could be due to the fact that women had multiple roles in society, heavier social burden and more household responsibilities [35-40].

The study findings indicated that indices of poverty (low level of education and low family income) were positively associated with depression. The significant association between depression and indices of poverty such as; low level of education and financial difficulties seems to be a well-known and universal finding occurring in all societies regardless of their level of development [41-43].

An important finding of our study was the significant negative association between vitamin D3 deficiency/insufficiency and depression. This finding is in agreement with the findings reported in other studies [36,44-46].

This finding is supported by the identification of vitamin D receptors in areas of the brain implicated in depression, and the detection of vitamin response elements in the promoter regions of serotonin genes [47].

The study data indicated a positive association between smoking and depression. This finding is in agreement with others but not all studies [38,39,48,49].

Smoking in this study is significantly associated with depression

among women but not men. In Jordan, smoking is still a socially acceptable behavior for males and to lesser extent for females. Unpublished data from a national survey indicate that the prevalence rates of cigarette smoking are 27% among males vs. 6.9% among females. The majority of male smokers have started to smoke during adolescence and continued to smoke all through their adulthood. Therefore, it is unlikely to trace the association between adolescent smoking and adulthood depression. On the other hand, the majority of females start smoking during adulthood which denotes a relatively close temporal proximity to adulthood depression.

The presence of diabetic complications (particularly neuropathy) in this study was positively associated with depression. Aiash had also found a highly significant association between neuropathy and depression in adults with diabetes. Additionally, results from a case control study conducted by Stanković found a statistically significant higher rate of neuropathy in depressed adults with type 2 DM compared to non- depressed ones. A significant negative association was found between depressions and perceived family support in both female and male patients. Similarly, Kamen found that higher family support was associated with less depression and predicted a steeper trajectory of recovery from depression over 23 years [50-52].

The present study indicates that the factors associated with depression vary by gender. For males, depression is negatively associated with age, family income, and family support and positively associated with the presence of DM complications. For females, depression is negatively associated with age, educational level, vitamin D3 level, and family support and positively associated with smoking. We found no association of depression and each of BMI, and friends' support and support of SO by gender.

It appears that there is a discrepancy in the association between indices of poverty (level of education and family income) and depression by gender. For a while males are psychologically more concerned about the financial difficulties of the family than their educational attainment, females are more concerned about their educational attainment than the family income. This finding is perhaps related to the social norm that males are the breadwinners for the family, thus are more concerned about the family income than females. The impact of DM complications on the mental status of men but not women could be explained on the same line of thought as men need to stay healthy to support their families. Women's concern about educational attainment is not surprising in face of the fact that 25.2% of women and 10% of men in this study hold less than high school diploma and 46.1% of women vs. 71.2% of men hold college diploma or higher. These figures are comparable to the national figures in Jordan.

Our data could not find a significant association between depression and level of glycemic control. This finding is in agreement with several [20,53].

Conclusion

In conclusion, this study showed a high prevalence of depression (40.0%) among adults with T2DM and that the factors associated with depression vary by gender [54-59]. Therefore, it is recommended that prevention and management of depression has to focus on the amelioration of the factors for each gender category. The discrepancy in the association between depression and vitamin D3 by gender suggests a need for further research of vitamin D3 receptors in the brain for males and females separately [60-65].

Limitations and Strengths

As with any cross-sectional study, we could not pinpoint the temporal association between the purported risk factors and depression. Using a self-reported questionnaire for assessment of depression was also considered as a limitation. However, this questionnaire is a valid and reliable instrument to screen depression, thus it has been suggested to be widely used by primary health care physicians. Additionally, this study was conducted in one center and non-random sampling was used which may limit the generalization of the results. To answer these questions raised from the limitations, a prospective nationwide study should be done.

On the other hand, this study had a number of strengths such as the large sample size, the high response rate and the validated measures used for (depression, medication adherence and self- reported diabetes, self-management behaviors).

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