

High Prevalence of Depression, Anxiety and Stress Symptoms Among Diabetes Mellitus Patients

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Abstract: *Background:* Few studies have documented the rates of psychiatric symptoms in patients with Diabetes Mellitus (DM) patients and compared them with healthy controls.

Aim: To determine whether there is a relationship between high depression, anxiety, and stress symptoms in Diabetes Mellitus (DM) patients in comparison to a group of controls.

Design: This was a matched case-control study.

Setting: Primary Health Care (PHC) Centres of the Supreme Council of Health, State of Qatar.

Subjects: 889 DM patients and 889 healthy subjects matched for age, gender and ethnicity, from September 2009 to August 2010 were included in this study.

Methods: Face to face interviews were conducted with DM patients and controls using a questionnaire which captured the socio-demographic characteristics of subjects and the short version of the Depression Anxiety Stress Scales (DASS)-21 questionnaire. Furthermore, we used the questionnaire based on the Hospital Anxiety and Depression Scale (HADS) to assess the validity of DASS-21.

Results: The study findings revealed that most of the studied diabetic cases (33.6%) and healthy controls (30.9%) were in the 40-49 years age group. Significantly larger proportion of DM subjects had severe depression scores (13.6% vs 5.9%; $p < 0.001$); severe anxiety scores (35.3% vs 16.3%; $p < 0.001$); and severe stress scores (23.4% vs 10%; $p < 0.001$) compared to healthy controls. The major predictors for high depression scores among diabetic cases were systolic blood pressure (OR 3.91; $p = 0.001$), duration of diabetes (OR 2.68; $p = 0.011$) and obesity (OR 2.50; $p = 0.001$). The major predictors for high anxiety scores among diabetic cases were systolic blood pressure (OR 2.8; $p = 0.001$), obesity (OR 2.27; $p = 0.001$), and smoking (OR 1.78; $p = 0.04$). The leading predictors for high stress scores were systolic blood pressure (OR 3.57; $P = 0.001$), diastolic blood pressure (OR 2.80; $P = 0.001$) and physical activity (OR 2.11, $P = 0.025$). Diabetic women had higher depression (63.3% vs 50.4%), anxiety (70.1% vs 61.6%) and stress (73.3% vs 61.4%) scores than men. No significant association was observed between the diabetic complications and depression, anxiety or stress scores.

Conclusion: The present findings revealed that diabetic cases had significantly higher depression, anxiety and stress scores compared to healthy controls. In particular anxiety scores were higher more frequently among diabetic patients in comparison to depression and stress scores.

Keywords: Diabetes mellitus, depression, anxiety, stress, prevalence, Qatar.

INTRODUCTION

DM is a major global public health problem which is increasing dramatically in developing countries [1]. The prevalence of DM worldwide is estimated to be around 200

million people, more than 5% of the adult population globally [2]. Several factors contribute in T2DM pathogenesis, including environmental and lifestyle factors [3-5], positive family history [6], ethnicity [7], and genetics [3, 4, 8]. Previous studies conducted in the State of Qatar on the prevalence of DM indicate that DM is becoming increasingly common because of the epidemic of obesity and sedentary lifestyles [3, 4].

Among the many additional complications which coincide with DM, depression, anxiety, tension and stress are most commonly under-detected [9]. This is despite the fact

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that a growing body of literature has reported that patients with diabetes are almost twice as likely to suffer from anxiety and depression as the general population [10, 11]. Also, such symptoms were associated with poor glycemic control, diabetes complications, worsened prognosis and quality of life [12]. To date, the overwhelming majority of these studies have used small sample sizes and very few were using a control group [13]. The aim of the current study is to determine the prevalence of anxiety, depression and stress symptoms among a large representative sample of DM patients using the short-form of the Depression Anxiety Stress Scales (DASS-21) instrument as compared with the general population.

SUBJECTS AND METHODS

This matched case-control study using surveys was performed at the primary health care (PHC) centers of the State of Qatar from September 2009 to August 2010. It was based on 889 DM cases and 889 control subjects, matched for age, gender and ethnicity. PHC centers are frequented by all levels of the general population as a gateway to specialist care. The study was approved by the Hamad General Hospital, Hamad Medical Corporation. All human studies have been approved by the Research Ethics Committee and have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Of the 22 PHC centres available, we selected 12 PHC centres at random. Of these, 9 were located in urban and three in semi-urban areas of Qatar. Finally, subjects were selected systematically 1-in-2 using a systematic sampling procedure. Each participant was provided with brief information about the study and was assured of strict confidentiality. The study excluded patients who were below 25 years and above 65 years, patients with any cognitive or physical impairment and who refused to give consent to take part in the study.

Selection of Type 2 Diabetic (DM) Subjects

Subjects reporting a history of DM, or currently taking oral medications or insulin for diabetes were considered as having DM. DM was defined according to the WHO Expert Committee group (2003) [14], i.e. fasting venous blood glucose concentration ≥ 7.0 mmol/l and/or 2h post-OGTT venous blood glucose concentration ≥ 11.1 mmol/l. In all subjects, fasting blood glucose was determined by glucose meter and an oral glucose tolerance test (OGTT) was conducted only if blood sugar was <7 mmol/l. For the OGTT, subjects were requested to drink, within the space of 5 min, 75 g anhydrous glucose dissolved in 250 ml water. Samples were processed within 30 minutes of collection and the above laboratory tests were measured. Pre-diabetes status was based on the presence of impaired fasting glucose (venous blood glucose concentration for 5.6-6.9 mmol/l) or impaired glucose tolerance (2 Hrs post-OGTT venous blood glucose level of 7.8-11.0 mmol/l) [3, 4]. A total number of 1088 eligible of DM patients aged above 25 years of age were selected systematically 1-in-2 using a systematic sampling procedure of the PHC centres and 889 cases agreed to participate in the study with a response rate of 81.7%.

43% of DM subjects had dietary modification or no medication for treatment, while the remaining 57% of DM subjects were taking oral medications and/or insulin. The period of treatment for patients was on average 12 years.

Selection of Controls

Control subjects aged above 25 years were identified from community as healthy and if their venous blood glucose values were < 6.1 mmol / L and if they had never taken any diabetic medication. This group involved a random sample of 1126 healthy subjects who visited the PHC Centers for any reason other than acute or chronic disease. Of the 1126 healthy subjects approached, 889 healthy subjects were eligible and responded to our questionnaire, with a response rate of (78.9%). The healthy subjects were selected in a way matching to the age and the gender of cases to give a good representative sample of the studied population.

Face-to-face interviews conducted by physicians and qualified trained nurses with subjects were used to complete the questionnaire that comprised personal data/demographic details. Furthermore, we used the short form of the DASS-21; which participants took an average of 8 minutes to complete. DASS-21 is a short version of the original 42-item DASS-42 self report inventory [15], and consists of 21 symptoms divided into 3 subscales (depression, anxiety, and stress) of 7 items taken from DASS-42. DASS-21 measures the 3 dimensions specified in the tripartite model [16], and is associated with very good reliability estimates [17-19]. A 4-point severity scale ranging from 0 (does not apply to me), to 3 (applies to me most or all of the time) measures the extent to which each state was experienced over the past week. Depressive (0-9, 10-20, and >20), anxiety (0-7, 8-14, and >14), and stress (0-14, 15-25, and >25) symptom scores were categorized into normal, mild-moderate and severe, based on data obtained from previous testing of the scale [20]. It is important to note that while these scores are not diagnostic, they indicate the possible presence of depression, anxiety and stress in the subjects.

Data Collection Tool

We used the questionnaire based on the Hospital Anxiety and Depression Scale (HADS). To assess the validity of DASS-21, a group of patients (n= 50) and controls (n=50) completed the 14-item Hospital Anxiety and Depression Scale (HADS) screening scale. The HADS consists of seven items for anxiety (HADS-A) and seven for depression (HADS-D). The items are scored on a four-point scale from zero (not present) to three [0-3] (considerable) [12, 21]. The depression scale (7 items, score range 0-21) measures mostly anhedonia, a phenomenon considered to be the central characteristic of major depressive disorder [21]. The anxiety scale (7 items, score range 0-21) measures mostly symptoms of generalized anxiety disorder [12]. For both HADS scales higher scores represent higher symptom levels. The depression and anxiety scales are intended to detect depressive and anxiety disorders in general medical settings. In this study valid HADS subscale scores were defined as having answered at least five of seven items on both the

HADS-A and the HADS-D. The depression items were based on anhedonia, which is considered to be one of the essential criteria of depression [22]. The HADS-A had optimal cut off ≥ 8 (sensitivity 0.87, specificity 0.78), and the HADS-D had by optimal cut off ≥ 8 (sensitivity 0.82 and specificity 0.86). The HADS scales generally used cut-off score of (cut off score ≥ 8) and above was used to identify respondents with the possible presence of anxiety or depression [12, 21-24], but who scored below the cut-off score of 8 on either the anxiety or the depression subscale of the HADS were not considered as a case. In the Arabian performed study, the internal consistency of the HADS showed a Cronbach's coefficient alpha of 0.86. Excellent correlation concordance was observed between DASS-21 and HADS in assessing depression among DM patients and healthy subjects ($\rho=0.732$; $p<0.0001$), anxiety among DM and healthy subjects ($\rho=0.715$; $p<0.0001$) and stress among DM patients and healthy subjects ($\rho=0.786$; $p<0.0001$). Content validity, face validity and reliability of the questionnaire were tested using 50 DM patients and 50 controls. These tests demonstrated a high level of validity and high degree of repeatability ($\kappa = 0.86$).

Statistical Analysis

Student-t test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by non-parametric Mann-Whitney test. Chi-square and Fisher's exact test were performed to test for differences in proportions of categorical variables between two or more groups. Odds ratio (OR) and their 95% confidence intervals (CI) was calculated by using Mantel-Haenszel test. The multivariate stepwise logistic regression analysis was performed to find out the best predictors for diagnosis. The Pearson's and Spearman rank correlation coefficient was used to evaluate the strength association between two variables. Internal consistency of the HADS-A and the HADS-D was tested using Cronbach's coefficient alpha. Pearson's correlation coefficient was used for estimation of the overlap between the subscales. Sensitivity and specificity were calculated for different cut-off values for the HADS-A, the HADS-D. The level $p<0.05$ was considered as the cut-off value for significance.

RESULTS

Table 1 shows the socio-demographic characteristics of the studied diabetic cases and healthy controls. Most of the studied diabetic cases (33.6%) and healthy controls (30.9%) were in the (40-49) years age group.

Table 2 reveals the depression, anxiety and stress scores in DM cases and healthy controls. While these scores are not diagnostic, they indicate the possible presence of depression, anxiety and stress in the subjects. Compared with the healthy controls, the depression scores were significantly higher and more frequent in diabetic cases; this was the case for both mild (38.9% vs 26.5%; $p<0.001$) and severe depression (13.6% vs 5.9%; $P<0.001$) respectively. The scores for mild (37.7% vs 26.8%; $P<0.001$) and severe anxiety (35.3%

vs 16.3%; $P<0.001$) were higher and more frequent in diabetic cases compared to healthy controls. Similarly, higher stress scores were significantly more frequent in DM cases where mild stress was present in (46.6% vs 21.7%; $P<0.001$) and severe stress symptoms were present in (23.4% vs 10.0%; $P<0.001$).

Table 3 gives the results of stepwise logistic regression analysis as predictors of high depression, anxiety and stress scores among DM subjects. The most significant predictors for high depression scores were systolic BP (OR=3.91; CI 1.73-6.10 and $p=0.001$), duration of diabetes (OR=2.68; CI 1.65-4.84 and $p=0.011$), and obesity (OR=2.50; CI 1.33-4.70 and $p=0.001$). Systolic BP (OR=2.80; CI 1.30-5.72 and $p=0.001$), Obesity (OR=2.27; CI 1.42-3.65 and $p=0.011$) and smoking (OR=1.78; CI 1.17-2.73 and $p=0.04$) were the most significant contributors for high anxiety scores among DM subjects. For high stress scores (OR=3.57; CI 2.06-6.22 and $p=0.001$) systolic BP (OR=3.57; CI 2.06-6.22 and $p=0.001$), diastolic BP (OR=2.80; CI 1.69-4.66 and $p=0.001$), and Physical inactivity (OR=2.11; CI 1.13-3.94 and $p=0.025$) were the major contributors.

Fig. (1) shows the distribution of high depression, anxiety and stress scores in DM subjects. High depression scores were more frequent among females (63.3%) compared to males (50.4%) with a ratio of 1:1.2. Also, anxiety (70.1% vs 61.6%; $P=0.009$) and stress scores (73.3 vs 61.4; $P<0.001$) were higher and more frequent in women compared to men.

Fig. (2) presents the distribution of diabetic complications in patients with co-morbid depression, anxiety or stress symptoms. There was no significant association between the diabetic complications and psychiatric symptoms.

DISCUSSION

The present study addresses the question of possible relationship between depression, anxiety and stress in DM patients. The study findings suggest that depression, anxiety and stress symptoms are highly prevalent in DM patients. Despite the increasing confirmative evidence of this finding, psychiatry disorders such as depression, anxiety and stress often remain unrecognized and untreated in DM patients [10, 19, 25, 26]. For instance, one study indicated that primary care physicians fail to detect depression in about 35-70% of cases [27]. Another study noted that only one-third of diabetes patients are treated with anti-depressant therapy by their diabetologist [28].

A growing number of studies in the international literature support the findings of this study that DM patients have an increased psychiatric morbidity [8, 10, 19, 25, 26]. Anderson *et al.* [10] documented in their study that approximately 30-40% of diabetic patients reported elevated depressive symptoms and 10-15% of diabetic patients suffer from a depressive disorder, according to clinical criteria. A similar pattern was observed in the present study that more than half of the DM patients were sufferers of depression symptoms (52.5%), while (13.6%) had severe depression

Table 1. Socio-Demographics Characteristics of the Studied DM Cases and Healthy Controls (N=1778)

Variables	Total n=1778 n (%)	DM Patients n= 889 n (%)	Healthy Subjects n= 889 n (%)	p-Value
Age Group in years				
<30	273 (15.4)	133 (15.0)	140(15.7)	
30-39	434 (24.4)	201 (22.6)	233(26.2)	
40-49	574 (32.2)	299 (33.6)	275(30.9)	0.349
50-59	286 (16.1)	151 (17.0)	135(15.3)	
>60	211 (11.9)	105 (11.8)	106(11.9)	
Sex				
Male	938(52.8)	458(51.5)	480(53.9)	
Female	840(47.2)	431(48.5)	409(46.1)	0.318
Nationality				
Qatari	859(48.3)	422(47.5)	437(49.2)	
Non-Qatari	919(51.7)	467(52.5)	452(50.8)	0.253
Marital status				
Single	152(8.5)	69(7.8)	83(9.3)	
Married	1481(83.3)	778(87.5)	703(82.5)	0.001
Widow/Divorcee	145(8.2)	42(4.7)	103(11.6)	
Educational level				
Illiterate	324(18.2)	131(14.7)	193(22.1)	
Primary	321(18.1)	144(16.2)	177(19.9)	
Intermediate	351(19.7)	187(21.0)	164(18.4)	<0.001
Secondary	435(24.5)	238(26.8)	197(22.2)	
University	347(19.5)	189(21.3)	158(17.8)	
Occupation				
Not working/housewife	483(27.2)	215(24.2)	268(30.1)	
Sedentary/professional	527(29.6)	271(30.5)	256(28.8)	
Clark/manual	364(20.5)	160(18.0)	204(22.9)	0.564
Businessman	194(10.9)	92(10.3)	102(11.5)	
Army/Police/Security	137(7.7)	90(10.1)	47(5.3)	
Household Monthly Income* (QRs)				
< 5000	133(7.5)	61(6.9)	72(8.1)	
5000 – 9999	593(33.4)	290(32.6)	303(34.1)	
10,000 – 15,000	604 (34.0)	286(32.2)	318(35.8)	0.019
> 15,000	448(25.1)	252(28.3)	196(22)	
No. of bedrooms (Mean ± SD)	5.4±1.9	5.7±1.7	5.5±1.8	0.565
No. people in house(Mean±SD)	6.6±2.4	6.8±2.2	6.4±2.4	0.675
Consanguinity				
Yes	690(38.8)	325(36.6)	365(41.1)	
No	1088(61.2)	564(63.4)	524(58.9)	0.029

*§ 1 US Dollars = 3.65 Qatari Riyals.

symptoms. The prevalence of severe depression symptoms in DM cases (13.6%) was two fold higher than from the healthy controls (5.9%). A study by Hermans *et al.* [26] indicated a

great amount of diabetes related psychological distress in one-third of the sample with a significant association between depression status and diabetes, whereas in our

Table 2. Prevalence of Depression, Anxiety and Stress Symptoms in DM Patients and Healthy Subjects

	DM Patients N = 889 n(%)	Healthy Subjects N = 889 n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	p ^a
Depression^b					
Normal	422(47.5)	600(67.6)	1.0		
Mild	346(38.9)	236(26.5)	2.08	1.69-2.58	<0.001
Severe	121(13.6)	52(5.9)	3.31	2.30-4.76	<0.001
Anxiety^c					
Normal	240(27.0)	506(56.9)	1.0		
Mild	335(37.7)	238(26.8)	2.97	2.35-3.75	<0.001
Severe	314(35.3)	145(16.3)	4.57	3.53-5.91	<0.001
Stress^d					
Normal	267(30.0)	607(68.3)	1.0		
Mild	414(46.6)	193(21.7)	4.88	3.88-6.14	<0.001
Severe	208(23.4)	89(10.0)	5.31	3.95-7.16	<0.001

^aMantel Haenszel test χ^2 test.

^bDepression was scored as per: normal (0-9), mild (10-20), and severe (≥ 21).

^cAnxiety scored as per: normal (0-7), mild (8-14), and severe (≥ 15).

^dStress scored as per: normal (0-14), mild (15-25), and severe (≥ 26).

study, depression symptoms were reported in half of the diabetic patients. Another study indicated that the prevalence of depression in diabetic patients was reported to vary between 8.5% and 27% [29] which is consistent with our prevalence rate of severe depression symptoms (13.6%). A possible explanation for the differences in prevalence could be attributed to the different measurement scales used to determine the presence of depression.

Although our prevalence rate was slightly lower than the findings of two studies (25% and 17.6%) [30], the prevalence of depression symptoms in our sample is very close to that of other studies of depression and diabetes [10, 31]. These study findings confirm that there is an association between depression symptoms and DM. While our findings, do not determine the direction of whether diabetes causes the onset of depression or vice versa, other studies have noted a direction. For example, a recent meta-analysis study concluded that depression increases the risk for DM by 37% [32]. Two years later, in the meta-analysis review, the risk for incident diabetes was 60% higher in depressed patients compared to non-depressed controls [33]. Two possible pathways have been proposed for this causation. The first pathway is *via* behavioral mechanisms, whereby emotional stress results in people adopting unhealthy lifestyle habits, which in turn lead to DM. The second pathway is physiological mechanisms, emotional stress causes biochemical changes in the body to occur which results in increased abdominal obesity and in turn DM [34].

In the present study, depression symptoms were significantly associated with the sex of the subjects studied with a male to female ratio of 1:1.2. This finding is in line with the other studies who reported depression to be significantly higher in diabetic women than in diabetic men [35, 36]. A cross sectional study in Nigeria reported a male to female ratio of 1:3 [37]. It also concurs with another study [10] that reported depression to be significantly higher in diabetic women (28%) than in diabetic men (18%). These findings are similar to the general trend of gender distribution in the general population [35, 36, 38]. This could be attributable to gender-specific issues like pregnancy, menstrual cycle changes, post partum and additional stresses such as responsibilities at work and at home, single parenthood, caring for children and aging parents which could all lead to depression [39, 40].

In the study sample of diabetic patients, blood pressure, duration of diabetes, obesity and physical inactivity were significant risk factors for depression. The study did not find any association between depression and age groups of the diabetic patients, a finding which contrasts with that of another study who reported majority of the patients diagnosed with depression to be of younger age group [41]. A possible explanation for this discrepancy could be the different methodology used to document depressed patients and the fact that most of our cases and controls were in the 40-49 years age group.

It is found that anxiety is closely related to depression in diabetic patients. This relation is similar to previous reports

Table 3. Results of Stepwise Logistic Regression Analysis as Predictors of Depression, Anxiety and Stress Symptoms Among DM Patients

Depression			
Independent Variables	Odds Ratio (OR)	95% Confidence Interval	Significance (p Value)
Systolic blood pressure	3.91	1.73–6.10	0.001
Duration of Diabetes	2.68	1.65-4.84	0.011
Obesity ^a	2.50	1.33-4.70	0.001
Diastolic blood pressure	1.95	1.11-3.57	0.003
Physical activity ^b	1.85	1.39–2.45	0.018
Anxiety			
Independent Variables	Odds Ratio (OR)	95% Confidence Interval	Significance (p value)
Systolic blood pressure	2.80	1.30-5.72	0.001
Obesity	2.27	1.42-3.65	0.001
Smoking ^c	1.78	1.17–2.73	0.040
Diastolic blood pressure	1.76	1.15-2.57	0.002
Duration of Diabetes	1.54	1.06-2.35	0.020
Stress			
Independent Variables	Odds Ratio (OR)	95% Confidence Interval	Significance (p Value)
Systolic blood pressure	3.57	2.06-6.22	0.001
Diastolic blood pressure	2.80	1.69-4.66	0.001
Physical activity	2.11	1.13-3.94	0.025
Sleeping hours	2.04	1.13-3.69	0.001
Duration of Diabetes	1.86	1.19-2.88	0.037
Income	1.49	1.17-1.86	0.029

Adjusted for age and gender.

Note:

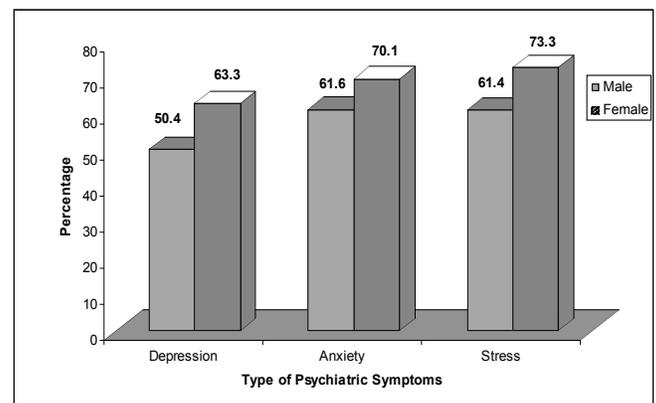
Obesity, physical activity and smoking considered as “Yes” or “No”.

^aObesity (Yes) is: >30 BMI group (kg/m²).

^bPhysical activity (Yes) is: walking > 30 minutes/day.

^cSmoking (Yes) is: “Previous and currently smoker”.

showing that prevalence of anxiety and depression was common in diabetic patients [20]. But in the present study, anxiety was severe in diabetics (35.3%) which are two fold higher than in non-diabetics (16.3%). Also, the prevalence of anxiety (35.3%) was nearly three times more than the depression rate (13.6%). Compared with depressive symptoms, anxiety symptoms seem to be more specifically linked to diabetes in the current study. It is however, higher than the 25.2% prevalence of anxiety among diabetics reported in a study to assess the psychiatry morbidity among diabetics [26], but lower than the rate found in a study of (40%) [42]. Also, Engum *et al.* [43] has tested anxiety as a risk factor for the development of diabetes in a large Norwegian population and found that the risk of DM was higher with high levels of anxiety. It was found that systolic blood pressure, obesity and smoking were significant predictors for anxiety in the diabetic study sample.



Note: Depression $P < 0.001$, stress $P < 0.001$ and Anxiety $P = 0.009$.

Fig. (1). Distribution of Psychiatric Symptoms in DM patients by Gender.

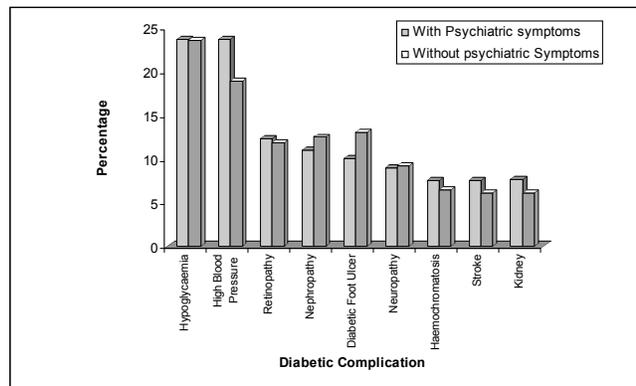


Fig. (2). Distribution of diabetic complications in diabetic patients with or without psychiatric symptoms.

Similar to depression and anxiety disorders, stress also has been positively linked to DM. Work stress has been reported to be associated with four fold higher risk of DM in Japanese men [44]. The prevalence of severe stress symptoms in the study sample of diabetics was 23.4% which is two fold higher than healthy controls (10%). Moreover, a considerable number of depressed patients suffer from high levels of diabetes-specific emotional stress [45]. For stress symptoms, blood pressure, less physical activity and less sleeping hours were the significant predictors in DM patients.

In summary, there is evidence of high co-morbidity of diabetes and depression, anxiety and stress symptoms in Qatar. This is similar to a study done in this region, Bahrain [46], that examined the association of depression, anxiety and stress with DM; it found a positive contribution of T2DM to increased depression, anxiety and stress disorders among diabetic patients. The reasons for high morbidity of psychiatric disorders and DM are not fully understood. The authors of the current study concluded that the occurrence of psychiatric symptoms appeared to be independent of diabetes complications because both the depressed and reference groups had a similar rate of complications like hypoglycemia, neuropathy, retinopathy and nephropathy except for high blood pressure. This is in line with another study that psychiatry morbidity was not associated with the presence of complications of diabetes [47].

A potential limitation to the current study was use of the DASS-21 instrument which only determines the presence of depression, anxiety and stress symptoms, rather than conducting a diagnostic interview which would have conclusively determined the prevalence of depression, anxiety and stress in the population. Moreover, the cross-sectional design of this study inevitably limits the capacity of the data to project a direction of causation in relation to DM and psychiatry disorders. Nonetheless, this study has some strengths which make it a worthy contribution to the growing body of literature on DM and psychiatric co-morbidity. It is one of the few matched case control studies, with a large population based sample size, to be conducted on the subject [13].

CONCLUSION

The present study revealed that there is evidence of high co-morbidity of DM and depression, anxiety and stress

symptoms in Qatar. Anxiety symptoms were more prevalent than depression and stress symptoms in DM patients. Depression and anxiety symptoms were severe in DM cases, which is two fold higher than in healthy controls. Depression, anxiety and stress symptoms were significantly associated with sex of the diabetic patients, with a higher prevalence in women. Diabetes appears to increase the risk of developing psychiatry disorders; therefore early detection and treatment intervention are required for diabetic patients.

ACKNOWLEDGMENTS

This study was generously supported and funded by the Qatar Diabetic Association and Qatar National Research Fund- QNRF NPRP 30-6-7-38. The authors would like to thank the Hamad Medical Corporation for their support and ethical approval (HMC # RP 7100/07).

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Received: August 24, 2011

Revised: September 23, 2011

Accepted: September 26, 2011

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