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Research Article

Association between Depression, Anxiety and Stress Symptoms and Glycemic Control in Diabetes Mellitus Patients - 8

Abdulbari Bener^{1,2,3}, Mustafa Ozturk³ and Erol Yildirim⁴

¹*Department of Biostatistics & Medical Informatics, Cerrahpasa Faculty of Medicine, Istanbul University, Istanbul, Turkey*

²*Department of Evidence for Population Health Unit, School of Epidemiology and Health Sciences, The university of Manchester, Manchester, UK*

³*Division of Endocrinology-Metabolism and Diabetes, Medipol International School of Medicine, Istanbul Medipol University, Istanbul, Turkey*

⁴*Department of Psychology, Istanbul Medipol University, Istanbul, Turkey*

***Address for Correspondence:** Abdulbari Bener, Department of Biostatistics & Medical Informatics, Cerrahpaşa Faculty of Medicine, Istanbul University, 34098 Cerrahpasa-Istanbul, Turkey, Tel:+90-535 663 9090/ +90-212-414 3041; Fax:+ 90-212-632 0033; E-mail: abdulbari.bener@istanbul.edu.tr ; abener99@yahoo.com

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ABSTRACT

Background: There are very a few studies on psychiatric symptoms in patients with Diabetes Mellitus (DM) patients and assessing glycemic controls.

Aim: To describe the level of glycemic control, complications and psychosocial functioning among DM patients using the Depression Anxiety Stress Scales (DASS-21) instrument and its predictors among diabetic Turkish population.

Subject and Methods: A cross-sectional study conducted from February 2016 to January 2017. Of the total 1,600 diabetic patients approached, 1,147 (71.6%) gave their consent. Data analysis included, sociodemographic, blood pressure and glycosylated hemoglobin (HbA1c) and the Depression Anxiety Stress Scales (DASS)-21 and Beck Depression Inventory (BDI-II) scale to assess the validity of DASS-21.

Results: Most of the studied diabetic cases were with HbA1c ≥ 8 glycemic in the age group above 40 years old. There were statistically significant differences between two groups regarding occupation ($p = 0.025$), income ($p = 0.001$), place of residence ($p = 0.014$) and consanguinity marriages ($p = 0.026$). The most significant difference were observed for parameters such as family history of Diabetes Mellitus, physical activities, high blood pressure, stroke and macro vascular complications. The depression, anxiety and stress scores were significantly higher and more frequent in diabetic HbA1c ≥ 8 cases compared to HbA1c < 8 . The multivariable logistic regression analysis revealed that high blood pressure, BDI-II depression, DASS21 stress, physical exercise, DASS21 depression, income, family history of diabetes, DASS21 anxiety and sleeping disturbance were the major significant contributors after adjusting for age, gender and other variables. The distribution depression, anxiety and stress scores in DM patients were higher in HbA1c ≥ 8 compared to HbA1c < 8 .

Conclusion: The current study suggests that there is relationship between DM and depression, anxiety and stress symptoms in Turkish population. DM is very complex disease and its management requires significant self-control and increasing access to psychological support.

Keywords: Diabetes mellitus; DASS21; Depression; Anxiety; Stress; Predictors; Turkey

INTRODUCTION

Diabetes Mellitus and psychiatric symptoms are two a major global public health problem which is increasing dramatically in developed and developing countries [1,2]. Several factors contribute in DM pathogenesis, including psychological [3], environmental and lifestyle factors [4,5], positive family history [6], ethnicity [7], and genetics [6-8]. Some author reported that the prevalence of DM rising substantially because of the epidemic of sedentary lifestyles and obesity [3,4].

There is a well recognized association between diabetes, depression, anxiety and stress and evidence showed that chronic illnesses usually have co-morbid unrecognized mental health disorders [2]. Although depression, anxiety, tension and stress are most commonly undiagnosed or underestimates among DM patients [9]. Several authors have reported that patients with diabetes are at least twice at risk to suffer from depression, anxiety and stress compared to the general population [6,8,10,11]. Furthermore, such symptoms mostly are associated with poor glycemic control, diabetes complications, worsened prognosis and quality of life [6,12]. Meanwhile, health care utilization and costs [13] increase with the coexistence of diabetes and major depression. Diabetes depression and stress has been found to be significantly associated with glycosylated haemoglobin (HbA1c) level [3].

The objective of the present study is to investigate the prevalence of anxiety, depression and stress symptoms among DM patients using the Depression Anxiety Stress Scales (DASS-21) instrument and its predictors among in Turkish population.

SUBJECTS AND METHODS

The design based on a cross-sectional study which was performed among the diabetic patients registered in diabetic clinics of the hospitals during the study period from February 2016 to January 2017. IRB ethical approval for this study was obtained from the

Cerrahpasa Faculty of Medicine and Medipol International School of Medicine, Istanbul Medipol University.

Subjects currently taking oral medications for diabetes 3 years considered to have DM and diagnosed in accordance with international standards (WHO 2006. HbA1c level-Measured using the DCA Vantage Analyser (Siemens Healthcare Diagnostics Inc, USA) from the same single finger prick.

A total number of 1,600 of DM patients males and females aged above 25 years approached and they were selected systematically 1-in-2 using a systematic sampling procedure of the PHC centres and 1,147 cases agreed to participate in the study with a response rate of 71.6%. 453 of them were excluded either because of incomplete questionnaires (163 diabetics) or did not want to respond to questionnaire (190 diabetics) due to lack of time resulting in 1,147 subjects (71.6%) for final analysis.

Depression Anxiety Stress Scales (DASS)-21 questionnaire is very well known [14-18] tool consists of 21 symptoms divided into 3 subscales (depression, anxiety, and stress) of each 7 items and has excellent reliability estimates [15-18]. DASS21 symptom based on 4-point severity scale ranging from 0 to 3 measures and scores were categorized into normal, mild-moderate and severe [6,11,15,16], with the scale depressive (0-9, 10-20, and >20), anxiety (0-7, 8-14, and >14), and stress (0-14, 15-25, and >25).

Furthermore, we have used the questionnaire based on the BDI-II Depression Scale to assess the validity of DASS-21 screening scale as reported and confirmed by the previous studies [6,19,20]. The instrument consists of 21-items/statements that are self-reported. The score ranges from 0 - 63 to determine possible degree of depression symptoms. The instrument developers established four groups of scores and classified as the following: "minimal 0-13, mild 14- 19, moderate 20-28, and severe 29-63" [18] and cut-off scores for BDII of ≥ 16 to indicate clinical depression [19,20]. The BDI-II Depression

Scale had optimal cut off ≥ 16 (sensitivity 0.84 and specificity 0.88). In the Turkish performed study, the internal consistency of the BDI-II Depression Scale showed a Cronbach's coefficient alpha of 0.86.

HbA1c values were divided into two groups ($< 8\%$ and $\geq 8\%$) to describe glycemic control level for each subject, in accordance to previous reported studies [21,22].

Student-t test was used to ascertain the significance of differences between mean values of two continuous variables groups. Chi-square and Fisher's exact tests were used for differences between two or more categorical groups. Multiple stepwise logistic regression performed

using the backward deletion method to determine the relationship between dependent metabolic control (HbA1c < 8 and ≥ 8) and independent variables. Internal consistency of the BDI-II was tested using Cronbach's coefficient alpha. 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 subjects by cut-off point's glycemic as HbA1c < 8 and HbA1c ≥ 8 . Most of the studied diabetic cases were in the age group above 40 years old. There were statistically significant differences

Table 1: Socio-demographics of the studied subjects by HbA1c among diabetic patients (N = 1,147).

Variables	HbA1c<8 N= 685 n(%)	HbA1c ≥ 8 N = 462 n(%)	P-value significance
Age in yrs (mean \pm SD)	51.0 \pm 13.4	50.7 \pm 14.0	0.808
Age Group			
<40 Years	156(22.5)	102(22.1)	0.832
40-49 Years	165(24.1)	126(26.0)	
50-59 Years	169(24.7)	105(22.7)	
≥ 60 Years	197(28.8)	135(29.2)	
Gender			
Males	234(34.20)	160(34.6)	0.869
Females	451(65.8)	302(65.4)	
Marital status			
Single	78(11.4)	62(13.4)	0.184
Married	553(80.7)	375(81.2)	
Divorced/Widow	54(7.9)	25(5.4)	
Educational level			
Primary	152(22.2)	117(25.3)	0.234
Intermediate	171(25.0)	115(24.9)	
Secondary	183(26.7)	132(28.6)	
University	179(26.1)	98(21.2)	
Occupation			
Housewife	146(21.3)	117(25.3)	0.025
Sedentary/Professional	161(23.5)	103(22.3)	
Manual	166(24.2)	82(17.7)	
Businessman	72(10.5)	68(14.7)	
Army/police/security	46(6.7)	37(8.0)	
Clark	94(13.7)	55(11.9)	
Household Income (TL)*			
< 2,500	184(26.9)	174(37.7)	0.001
2,500 – 3.999	196(28.6)	131(28.4)	
4,000 – 5,999	193(28.2)	82(17.7)	
> 6,000	112(16.4)	75(16.2)	
Place of living			
City-Urban	499(72.8)	366(79.2)	0.014
Town	186(27.2)	96(20.8)	
Smoking cigarette			
Yes	106(15.5)	73(15.8)	0.881
No	579(84.5)	389(84.2)	
Sheesha Smoking			
Yes	103(15.0)	70(15.2)	0.957
No	821(85.0)	392(84.8)	
Consanguinity			
My parents	50(7.3)	21(4.5)	0.026
Yes	56(8.2)	25(5.4)	
No	579(84.5)	416(84.8)	

*Note: 1 US \$ =3.800 Turkish Liras (TL)

Table 2: Life-style and clinical characteristics of the studied subjects by glycaemic HbA1c control among diabetic patients (N = 1,147).

Variables	HbA1c<8 N = 685 n (%)	HbA1c ≥8 N = 462 n (%)	p-value significance
BMI			
Normal (<25 Kg/m ²)	202(25.5)	141(30.5)	0.837
Overweight (25-30 Kg/m ²)	290(42.3)	198(42.9)	
Obese (30+ Kg/m ²)	193(28.2)	123(26.6)	
Duration of Diabetes(yrs)			
<5	123(18.0)	77(16.7)	0.634
5-9	399(58.2)	294(63.65)	
10+	163(23.8)	91(19.7)	
Diabetic Education			
Yes	198(28.9)	141(30.5)	0.557
No	487(71.1)	321(69.5)	
Family History of DM			
Mother	83(12.1)	27(5.9)	0.001
Father	59(8.6)	21(4.5)	0.001
Both parent	98(14.3)	52(11.3)	0.019
Sibling	152(22.2)	43(9.9)	0.011
Children	27(3.9)	16(3.5)	0.676
Uncle / Aunt	88(12.8)	65(14.1)	0.550
Grand Parents	50(7.3)	33(7.1)	0.920
Mode of Diabetes Treatment			
Physical exercise	46(6.7)	32(6.9)	0.889
Diet Modification	178(26.0)	127(27.5)	0.572
Oral anti diabetic drugs	270(39.4)	167(26.8)	0.264
Insulin	75(10.9)	58(12.6)	0.405
Insulin & oral anti diabetic drugs	108(15.8)	75(16.26)	0.832
Physical Activities			
Frequent and vigorous	180(26.3)	169(23.4)	0.023
Moderate	172(25.1)	172(23.8)	0.013
Hours of sleep (mean ± sd)	6.6 ± 1.1	6.2 ± 1.2	<0.001
Microvascular complications			
Retinopathy	85(12.4)	57(12.3)	0.971
Neuropathy	77(11.2)	63(13.6)	0.224
Nephropathy	71(12.4)	54(11.7)	0.481
Stroke	66(9.6)	27(5.8)	0.021
High Blood pressure	135(19.7)	123(26.6)	0.006
Macrovascular complications			
Yes	75(11.0)	69(15.1)	0.041
No	609(89)	389(84.9)	
Diabetic foot			
Yes	64(9.3)	51(11)	0.348
No	621(90.7)	411(89)	

between two groups regarding occupation ($p = 0.025$), income ($p = 0.001$), place of residence ($p = 0.014$) and consanguinity marriages ($p = 0.026$).

Table 2 gives the life-style and clinical characteristics of the studied subjects by HbA1c. The most significant difference were observed for parameters such as family history of Diabetes Mellitus among first degree of relatives, physical activities, high blood pressure, stroke and macro vascular complications.

Table 3 presents depression, anxiety and stress scores in DM subjects by HbA1c. The depression, anxiety and stress scores were

significantly higher and more frequent in diabetic HbA1c ≥ 8 cases compared to HbA1c < 8 .

Table 4 gives the results of stepwise logistic regression analysis revealed that high blood pressure, BBDI-II depression, DASS21 stress, physical exercise, DASS21 depression, income, family history of diabetes, DASS21 anxiety and sleeping disturbance were the major significant contributors after adjusting for age, gender and other variables.

Figure 1 shows the pattern of high depression, anxiety and stress scores in diabetes mellitus patients by HbA1c ≥ 8 compared to HbA1c

Table 3: Prevalence of depression, anxiety and stress symptoms [DASS21] by glycaemic HbA1c control among diabetic subjects (N = 1,147).

	HbA1c ≥8 N = 462 n (%)	HbA1c < 8 N = 685 n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	p ^a
Depression^b					
Normal	204(44.2)	356(52.0)	1.0		
Mild and Moderate	173(37.4)	230(33.6)	1.32	1.03 - 1.70	0.041
Severe	85(18.4)	99(14.4)	1.45	1.05 - 2.07	0.023
Anxiety^c					
Normal	176(38.1)	319(46.6)	1.0		
Mild and Moderate	230(49.8)	300(43.8)	1.38	1.09 - 1.79	0.010
Severe	56(12.1)	66(9.6)	1.54	1.03 - 2.29	0.035
Stress^d					
Normal	133(28.8)	262(38.2)	1.0		
Mild and Moderate	229(49.6)	306(44.7)	1.47	1.13 - 1.95	0.004
Severe	100(21.6)	117(17.1)	1.68	1.20 - 2.36	0.002

^aMantel Haenszel test χ^2 test.

^bDepression scored as per: normal (0-9), mild (10-13), moderate (14-20) and severe (≥ 21);

^cAnxiety scored as per: normal (0-7), mild (8-9), moderate (10-14) and (severe (≥ 15),

^dStress scored as per: normal (0-14), mild (15-18), moderate (19-25) and severe (≥ 26).

Table 4: Multivariable stepwise logistic regression with metabolic glycaemic HbA1c <8 and HbA1c ≥ 8 control as dependent variable (N = 1,147):

Independent Variables	Odds Ratio	95% Confidence Interval	significance P Value
High blood pressure	3.22	1.63-5.88	<0.001
BDI-II Depression	2.04	1.21-3.45	<0.001
DASS21 Stress	1.98	1.60-2.44	<0.001
Physical exercise	1.52	1.20-1.99	0.004
DASS21 Depression	2.55	1.68-4.23	0.005
Income	1.40	1.19-1.66	0.008
Family history of diabetes	2.79	1.75-4.51	0.013
DASS21 Anxiety	1.75	1.18-2.57	0.015
Sleeping disturbance	1.29	1.45-3.60	0.020

^{*}Multivariable stepwise logistic regression with adjustment for age, gender and other relevant confounders.

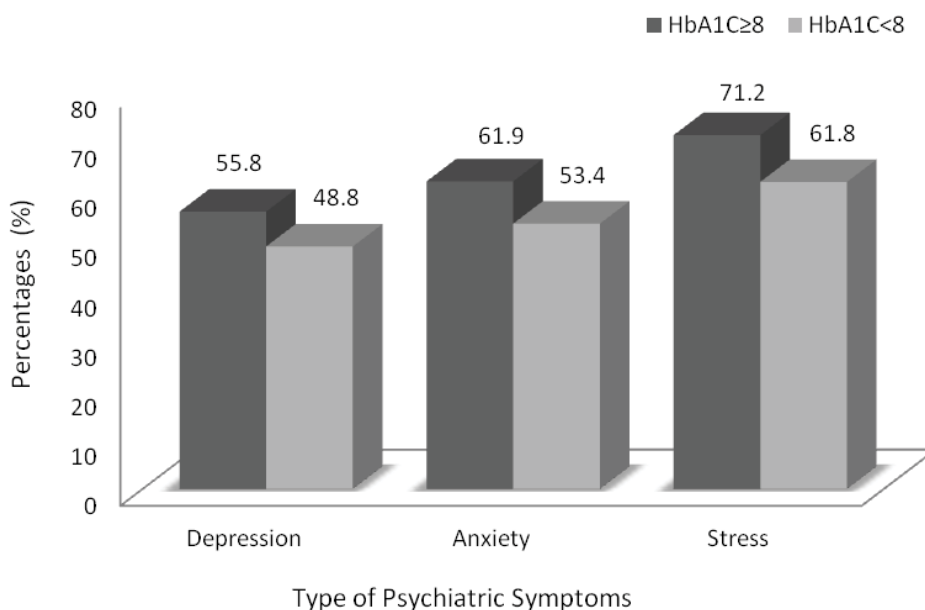


Figure 1: The pattern of Psychiatric Symptoms in Diabetes mellitus patients by glycaemic HbA1c control. Depression $p = 0.043$, Stress $p = 0.015$, Anxiety $p = 0.003$



< 8 cases. Also, depression (55.8% vs 48.8%; $p = 0.043$) anxiety (61.9% vs 53.4%; $p = 0.015$) and stress scores (71.2% vs 61.8%; $p = 0.003$) were higher and more frequent in $HbA1c \geq 8$ compared to.

DISCUSSION

This is first as an original study to investigate the prevalence of anxiety, depression and stress symptoms among DM patients using the Depression Anxiety Stress Scales (DASS-21) instrument and its predictors among in Turkish population. This study has shown that the co-existence of diabetes and depression, anxiety and stress are highly prevalent and those psychiatric symptoms were 18.4%, 12.1% and 21.6% respectively. These results are consistent with the previous reported studies [6,8,11,13,21]. Also, many studies have reported a prevalence rate of depression among adult diabetic patients ranging from 3.8% to 41.3% [6,8,13], and the current result obtained was (18.4%) which is within that range. The statistical analysis showed that depression, anxiety and stress symptoms are strongly affecting glycemic HbA1c control in Turkish DM patients. In fact, those psychiatric symptoms found to remain as an important independent risk factor for diabetes. Although, depression, anxiety and stress often remain unrecognized and untreated in DM patients [10,19,23-26]. Valenstein, et al. [27], reported that primary care physicians fail to detect depression in about 35-70% of patients. In fact, the current study suggests that the prevalence of depression, anxiety and stress among diabetes patients is underestimated. Further, the documented literature support the findings of this study that DM patients have an increased psychiatric morbidity [6, 9,11-13,25,26]. More recently clinical DM evaluation [28] reported a great amount of diabetes related psychological distress among DM patients is more than 30%. This is confirmative with the present study, depression symptoms were reported in one-fifth of the diabetic Turkish population.

The high prevalence of depression in diabetic patients has been very well established in various studies [6,9,11-13,25-28]. Multivariable logistic regression analysis based on Turkish population diabetic patients statistical analysis revealed that blood pressure, depression, anxiety, stress, physical inactivity, income, family history of diabetes and sleeping disturbance were significant risk factors for metabolic glycaemic control. This is consistent with the previous reported studies [6,8,11,13,28,29].

Maximizing diabetes care and its management represents a significant challenge to patients and understanding how best to receive treatment for complex disease [23,28]. Achieving optimal plasma glucose or metabolic glycemic control is difficult and many factors may be associated with poor control. Understanding how diabetes weaves into the complexity of an individual's personality and their life is very crucial. Also coping with the lifestyle and intellectual challenges demanded by diagnosis, patients are told living with a chronic, progressive condition [28]. It seems psychological health problems is more common among diabetic patients than the general population as reported earlier [6,11,10,19,24-27]. Norwegian population reported DM was observed higher with high levels of anxiety [25], this is confirmative with the current study.

Previously Bener, et al. [6,8] and Engum, et al. [25] reported depression, anxiety and stress symptoms has been positively linked with the diabetes patients. The prevalence of severe stress symptoms in the present conduct study sample of diabetics was 21.6% which consistent with the previous reported studies [6,8,13,25]. Furthermore, substantial depressed patients suffer from high levels of diabetes with the emotional stress [26]. In conclusion, we have observed strong

relationship between diabetes and depression, anxiety and stress symptoms in Turkish population. This is confirmative with the reported study in Qatar [6,8] and in Bahrain, [13] and in Norwegian population [25].

However, some limitations of our study need to be addressed. This study based on cross sectional study does not allow for cause and effect relationships to be studied. This type design of study has restricted the capacity of the prediction of potential risk factors related to DM and psychiatry disorders. Of the total 1,600 diabetic patients approached, 1,147 (71.6%) gave their consent, 453 of them were excluded either because of incomplete questionnaires (163 diabetics) or did not want to respond to questionnaire (190 diabetics) due to lack of time resulting this could be considered as bias. Then, it should be noted that the DASS-21 questionnaire is only a screening tool for the presence of depression, anxiety and stress symptoms, which is not diagnostic of specific psychiatric disorders. HbA1c values were divided into two groups (<8% and $\geq 8\%$) to describe glycemic control level for each subject, in accordance to previous reported studies, but, this can be considered as bias due to cut-off point. Furthermore, the strength of our study which is based on very large samples size and the sampling method.

CONCLUSION

The current study suggests that there is relationship between DM and depression, anxiety and stress symptoms in Turkish population. DM is very complex disease and its management requires significant self-control and increasing access to psychological support.

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Authors' contributions

AB, MO, EY and KUR organized study, collected data, performed statistical analysis, interpretation of the data, writing the manuscript and wrote the final draft of the article.

Ethics committee approval

Ethics committee approval was received for this study.

Informed consent

Informed consent was obtained for this study.

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