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The relationship between depression and demographic risk factors, individual lifestyle factors, and health complications in patients with type 2 diabetes mellitus.

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Abstract

We aimed to determine the prevalence of depression in patients with type 2 Diabetes Mellitus (DM). We examined the relationship between depression and demographic and anthropometric characteristics, poor glycemic control, and duration of diabetes. Additionally, we analyzed the relationship between depression, lifestyle factors, and health complications. Study participants included 154 patients with type 2 diabetes mellitus between 18 to 65 years of age. Data regarding patients' demographic characteristics, medications, body mass index, blood pressure, lifestyle factors, health complications, and Hemoglobin A1c levels were documented. The SCID-I scale (the structured clinical interview for DSM IV, Axis I disorders) was administered to all the participants by a psychiatrist to evaluate the prevalence of depression. The study included a total of 154 patients with type 2 DM, of whom 82 (53.2%) were female and 72 (46.8%) were male. Patients'ages ranged from 33-65 years with a mean age of 54.8 ± 9.1 years. 18.2% (24 patients) of the patients suffered from depression. The results revealed a significant relationship between depression and gender, duration of disease, hypertension, and poor glycemic control ($p<0.05$). 64.2% of all patients had hypertension, 38.3% had nephropathy, 35% had neuropathy, 27.9% had retinopathy, 1.3% had cerebrovascular disease and 24% had cardiovascular diseases. In terms of the relationship between depression and health complications, there was a significant association between poor glycemic control and nephropathy, retinopathy, neuropathy, cerebrovascular, and cardiovascular diseases ($p<0.05$). The relationship between depression and dietary compliance, regular physical exercise, self-monitoring of blood glucose, and drug compliance was also found to be significant ($p<0.05$). The study demonstrated the relationship between depression and various factors in patients with type 2 DM. Hence, a multidisciplinary approach can help improve patients' quality of life, reduce treatment costs, and reduce delays and wastage of time for both the treatment team and patients.

Keywords: Depression, Diabetes mellitus, Risk factors, Lifestyle, Complications.

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Introduction

Diabetes Mellitus (DM) is a major cause of mortality and morbidity and its prevalence is increasing around the world. DM is the most common chronic disease in adults. It is estimated that 300 million people will have DM by the year 2025 and this figure will reach 439 million people by the year 2030, with a prevalence of 7.7% of the population. It is also estimated that 3.96 million adult diabetics will die of diabetes each year and diabetes will be responsible for 6.8% of all causes of mortality [1-3].

Depression is a common comorbidity in chronic diseases such as diabetes [4]. The prevalence rate of depression is 1.5-2 times higher in patients with type 2 DM [4,5]. Studies have shown that there is a relationship between depression and certain socio-demographic, clinical, and behavioral characteristics in patients with type 2 DM. In general, higher rates of depression were reported in women, patients who have poor glycemic control, take insulin therapy, or have had diabetes for a longer duration. Different results have been obtained from studies that investigated the relationship between depression and age, Body Mass Index (BMI), education, socio-economic status, smoking, and alcohol consumption [6,7]. Hence, evidence of the relationship between depression and various demographic and lifestyle factors among patients with type 2 DM has been mixed.

The purpose of this study is to determine the prevalence of depression in patients with type 2 DM in the Turkish population and seek answers to three different questions. The first question aims at investigating the relationship between depression and demographic and anthropometric characteristics, poor glycemic control, and duration of diabetes in patients with type 2 DM. The second question deals with the relationship between depression and individual lifestyle factors, and the third question investigates the relationship between depression and health complications.

Materials and Methods

The study included 154 patients who were undergoing treatment and follow-up by Sisli Etfal Education, Research Hospital Internal Medicine Department and Bezmialem Vakıf University Internal Medicine Department, with diagnosis of type 2 DM were aged 18-65 years. Our study was designed as a sectional observational study. We included patients were admitted to our hospital with the diagnosis of type 2 DM between August 2013 and September 2015. Patients who had any additional chronic disease that might also cause depression (e.g., multiple sclerosis, epilepsy, rheumatic diseases, cancer), patients who were going through pregnancy or puerperium, patients currently receiving therapy for any psychiatric disease, those using antidepressants (e.g., for migraines, fibromyalgia), antipsychotics (e.g., for insomnia, epilepsy), and antiepileptics for non-psychiatric reasons, and patients with dementia, mental retardation and the diabetic patients who were diagnosed as type 1 diabetes mellitus were excluded from the study sample.

Clinical measurements

Demographic information (i.e., age, gender, duration of disease, marital status, family history, employment status, socio-economic status, and educational status) was documented for all patients. Height (m) and weight (kg) measurements were obtained to calculate the body mass index. BMI was calculated by dividing weight in kilograms by the square of height in meters. Systolic and diastolic blood pressures were measured using an automatic sphygmomanometer with an appropriate cut size on the right arm after a resting period of 10 min. Patients were diagnosed as DM according to the criteria of American Diabetes Association (ADA). Duration of the illness and DM disease onset age were documented. Patients whose systolic/diastolic blood pressure is ≥ 140/90 mmHg or who is on an antihypertensive treatment were accepted as hypertensive patients [8]. Patients whose BMI is <25 kg/m^2 were considered as normal, 25-29 kg/m^2 as overweight and ≥ 30 kg/m^2 as obese [9].

Life style measurements

Furthermore, dietary compliance accompanied by dietician, physical exercises, blood glucose monitoring at home and medicine compliance have been questionized. Patients were considered as complianced to diet who are on diet ≥ 3 days in a week in company with a dietician; as complianced to exercise who do exercises at least half an hour and ≥ 3 days a week; as complianced to blood glucose monitoring at home who do measurements at home ≥ 5 days a week; as noncomplianced to drug treatment who miss taking drugs ≥ 1 times a week; and as compliance to treatment who do not miss any drugs and take the drugs regularly.

Laboratory measurements

Patients fasted after midnight and blood samples were drawn in the morning of the next day from an antecubital vein into vacuum tubes for laboratory tests, which were sent to the central laboratory. The levels of Hemoglobin A1c (HbA1c) and fasting glucose levels were measured for each patient. Blood glucose was measured by enzymatic methods. HbA1c were measured by immunoturbidimetric method and high performance chromatography. Patients were considered to have good glycemic control if they had an HbA1c level <7% and poor glycemic control if they had an HbA1c level ≥ 7% [9].

Psychiatric evaluation

The SCID-I scale (the structured clinical interview for DSM IV, Axis I disorders) was administered to all patients by a psychiatrist to detect the presence of depression [10].

Complications measurements

All patients were examined for the presence of retinopathy by an ophthalmologist. Presence of nephropathy was evaluated in terms of urinalysis, 24 h urine protein test and creatinine clearance. Glomerular filtration rate was calculated. Presence of neuropathy was assessed by orally questioning the patients for any complaints about burning, tingling, pain, jerks, etc. in the extremities. The patients were examined and their electrocardiograms were evaluated by a cardiologist and a cardiovascular surgeon for the presence of any cardiovascular disease. If necessary, the patients were further evaluated by using vascular ultrasound and coronary angiography. The patients were questioned for the presence of cerebrovascular disease by clinic and neurological examinations.

Ethics statement

All participants provided written consent for participation in the study. Ethics approval for conducting this study was received from the Ethical Committee of the Sisli Etfal Education and Research Hospital (Istanbul, Turkey). All procedures were in accordance with the ethical standards of the committee on human experimentation of our institution and with the Declaration of Helsinki.

Data analysis

The IBM SPSS 22 (IBM SPSS, Turkey) programme was used for the statistical analyses of data from this study. The relationship of depression with demographic parameters, laboratory parameters, life style and complications was analyzed using chi-square, Mann-Whitney U test, and independent samples t-tests. Quantitative data were reported as

percentages and mean ± standard deviation; normally distributed parameters were compared using Student's t-tests and nonnormally distributed parameters were compared using Mann Whitney U tests. Qualitative data were compared using the chi-square test. Binary logistic regression analysis was used to analyze the joint effect of the independent variable on the dependent variable for two outcome. A P value <0.05 was considered statistically significant.

Results

The study included a total of 154 patients with type 2 DM, of whom 82 (53.2%) were female and 72 (46.8%) were male. Patients' ages ranged from 33-65 years with a mean age of 54.8 ± 9.1 years. 18.2% (24 patients) of the patients suffered from depression. When the relationship between depression and demographic, clinical, and anthropometric factors was examined, a significant relationship was found between depression and gender, duration of the disease, hypertension, and poor glycemic control, whereas no significant relationship was found between depression and age, age at the onset of diabetes, family history, marital status, employment status, educational status and BMI (Table 1).

Table 1. *Relationship between demographic variables and depression.*

Variables	Total	Without Depression	With Depression	P value
Gender				
Female	82	62 (49.2%)	20 (71.4%)	0,033
Male	72	64 (50.8%)	8 (28.6%)	
Age (year)	54.8 ± 9.1 (33-65)	54.8 ± 9.2	55.1 ± 8.9	
Age at onset (year)	48.5 ± 8.7 (25-64)	48.9 ± 8.8	46.6 ± 8.2	
HbA1c (%)				
<7%	51	47 (37.3%)	4 (14.2%)	0.019
≥ 7%	103	79 (66.7%)	24 (85.8%)	
Duration of diabetes (year)	6.3 ± 6.1	5.8 ± 5.5	8.5 ± 7.9	
Marital Status				
Married	138	115 (91.2%)	23 (82.1%)	0.15
Single	16	11 (8.8%)	5 (17.9%)	
Family history				
Positive	118	98 (77.7%)	20 (71.4%)	0.47
Negative	36	28 (32.3%)	8 (28.6%)	
Job status				
Working	44	38 (30.1%)	6 (21.4%)	0.35
Not working	110	88 (69.9%)	22 (78.6%)	
Educational Status				
Lower than high school	121	98 (77.7%)	23 (82.1%)	0.61
Higher than high school	33	28 (32.3%)	5 (17.9%)	
Body mass index (kg/m^2)	30.5 ± 4.8	30.3 ± 4.8	31.1 ± 4.3	
Hypertension				
Yes	99	75 (59.5%)	24 (85.7%)	0.009
None	55	51 (40.5%)	4 (14.3%)	

44.8% of all patients had no diabetes-related health complications, whereas 18.2% of the sample experienced one health complication and 37% had multiple health complications. 64.2% of all patients had hypertension, 38.3% had nephropathy, 35% had neuropathy, 27.9% had retinopathy, 1.3% had cerebrovascular disease and 24% had cardiovascular diseases. When the relationship between health complications and depression was examined, a significant relationship was found between depression and nephropathy, retinopathy, neuropathy, cerebrovascular, and cardiovascular diseases ($p<0.05$). Depression was detected in a rate of 24.2%, 27.1%, 31.4%, 32.5%, 100% and 32.4% in patients with hypertension, nephropathy, neuropathy, retinopathy, cerebrovascular disease and cardiovascular disease; respectively. There was also a significant relationship found between depression and the number of health complications experienced ($p<0.05$), (Table 2). Depression was detected in a rate of 24.7% in patients with one or more complications.

Table 2. *Relationship between depression and health complications in diabetes patients.*

Variables	Total	Without Depression	With Depression	P value
Nephropathy				
Yes	59	43 (34.1%)	16 (57.1%)	0.023
None	95	83 (65.9%)	12 (42.9%)	
Neuropathy				
Yes	54	37 (29.3%)	17 (60.7%)	0.002
None	100	89 (70.7%)	11 (39.3%)	
Retinopathy				
Yes	43	29 (23%)	14 (50%)	0.004
None	111	97 (77%)	14 (50%)	
Cerebrovascular				
Yes	2	0 (0%)	2 (7.1%)	0.003
None	152	126 (100%)	26 (92.9%)	

Cardiovascular				
Yes	37	25 (19.8%)	12 (42.8%)	0.01
None	117	101 (80.2%)	16 (57.2%)	
Number of complications				
None	69	62 (49.2%)	7 (25%)	0.001
One	28	26 (20.6%)	2 (7.1%)	
Two or more	57	38 (30.2%)	19 (67.9%)	

Of all the patients, 39% of them were considered to have dietary compliance and 61% had no dietary compliance. Similarly, 40.3% exercised regularly and 59.7% did no physical exercise. 63.6% of the patients complied with taking diabetes drugs, while only 43.5% of the sample self-monitored their blood glucose at home. When the relationship between depression and individual lifestyle factors was examined, a significant relationship was found between depression and dietary compliance, regular physical exercise, self-monitoring of blood glucose, and diabetes drug compliance (Table 3). Also parameters that are significant in univariate analysis performed was assessed by multivariate analysis. A significant relationship was found between depression and self-monitoring of blood glucose. The rate of depression was significantly lower in the group which make self-monitoring of blood glucose (Odds ratio:8,564; %95 CI: 0.207-3.972, P value: 0.017). Multivariate analysis results shown in Table 4.

Table 3. *Relationship between individual lifestyle factors and depression in diabetes patients.*

Variables	Total	Without Depression	With Depression	P value
Dietary compliance				
Yes	60	55 (43.6%)	5 (17.8%)	0.011
No	94	71 (56.4%)	23 (82.2%)	
Physical exercise				
Yes	62	57 (45.2%)	5 (17.8%)	0.008
No	92	69 (54.8%)	23 (82.2%)	
Self-monitoring of blood glucose				
Yes	67	64 (50.7%)	3 (10.7%)	<0.001
No	87	62 (49.3%)	25 (89.3%)	
Diabetes drug compliance				
Yes	98	88 (69.8%)	10 (35.7%)	0.001
No	56	38 (30.2%)	18 (64.3%)	

Table 4. *A multivariate analysis about relationship between risk factors and depression in diabetes patients.*

Parameters	Odds Ratio	95% CI		P value
		Lower	Upper	
Gender	0.394	0.141	1102	0.076
Age	0.966	0.91	1026	0.258
Duration of diabetes	1083	0.987	1189	0.094
HbA1c (%)	0.84	0.22	3204	0.798
Hypertension	0.384	0.101	1450	0.158
Nephropathy	1235	0.398	3840	0.715
Retinopathy	0.697	0.175	2778	0.609
Cerebrovascular	0	0	-	0.999
Cardiovascular	0.913	0.248	3362	0.891
Neuropathy	1015	0.28	3684	0.982
Dietary compliance	0.779	0.172	3525	0.745
Physical exercise	0.907	0.207	3972	0.897
Self-monitoring of blood glucose	8564	1474	49761	0.017
Drug compliance	1076	0.308	3757	0.909

Discussion

With the increasing prevalence of diabetes worldwide and the established higher incidence of depression among diabetes patients, it becomes important for us to manage and control depression when treating diabetes. In this study, the prevalence of depression among patients with type 2 DM as well as several associated risk factors were investigated. The prevalence of depression in patients with type 2 DM was found to be 18.2% in this study. In a meta-analysis carried out by Anderson et al. in 2001, the prevalence of depression was found to be in the range of 3.8%-27.3% [11]. A study conducted in Jordan reported the prevalence of depression as 19.7% of the population, which was very close to the results obtained in this present study [6].

In this study, a significant positive relationship was found between depression and being female, a longer duration of diabetes, poor glycemic control, dietary non-compliance, non-compliance with regular physical exercise, lack of self-monitoring of blood glucose, non-compliance with diabetes drugs, and the presence of health complications. Although the relationship that was found between age and depression in this study is contradictory to previous research, some studies have shown a significant relationship between depression and age at the onset of diabetes [12-15]. In this study, although no relationship was observed between age, patients who were younger at the onset of diabetes and depression. Moreover, women were found to have a significantly higher rate of depression, which is a finding that is in line with previous studies [6,15]. Although the relationship between BMI, low level of education, receiving insulin therapy, and depression is contradictory in previous studies [12,13,16,17], our study showed no significant relationship between depression and BMI, and educational status. Many studies have shown a significant relationship between depression, poor glycemic control and a longer duration of diabetes [14,18]. In a meta-

analysis carried out by Lustman et al., a significant relationship was observed between depression and HbA1c [17]. Furthermore, other studies have shown that having diabetes for a longer duration led to an increased rate of depression [14,19]. This study also demonstrated that the rate of depression increased with poor glycemic control and a longer duration of diabetes.

Individual lifestyle factors and habits are not only important considerations for management of type 2 DM but are also closely associated with depression. Non-compliance with lifestyle changes worsens glycemic control, which leads to susceptibility to depression. Depression consequently, compromises the individual's compliance with the necessary lifestyle changes and makes diabetes management difficult. Studies have shown a close relationship between lifestyle-related factors and depression. Al-Amer et al. and Niraula et al. showed that the rate of depression was significantly lower in patients with good dietary, exercise, and drug compliance [6,18]. In this study, the rate of depression significantly declined with compliance with necessary lifestyle changes.

Since depression is associated with hyperglycemia and in turn, hyperglycemia is associated with health complications in diabetes, we can conclude that depression is indirectly associated with health complications in diabetes. In a meta-analysis of 27 studies, a significant relationship was demonstrated between depression and microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular (cerebrovascular and cardiovascular diseases) complications [20]. A prospective study showed that over a follow-up period of 5 years, depressed patients had a 36% higher risk of developing microvascular complications and a 25% higher risk of developing macrovascular complications compared to non-depressed patients [7]. In patients with type 2 DM, the activation of the hypothalamic-pituitary-adrenal axis (increased cortisol production), sympathetic nervous system (elevated catecholamine), and proinflammatory and procoagulant factors (increase in cytokines and platelets) has been found to be associated with depression [7]. The same mechanisms are considered to lead to the development of microvascular and macrovascular complications. It can also be argued that since depression adversely affects drug compliance this leads to poor glycemic control which then in turn results in an increase in health complications among patients.

In this study, there was a significant relationship between presence of depression and both diabetic complications and comorbid diseases. The frequency of depression was detected as 24.2% in patients with hypertension, 27.1% in patients with nephropathy, 31.4% in patients with neuropathy, 32.5% in patients with retinopathy, 100% in patients with cerebrovascular disease and 32.4% in patients with cardiovascular disease. In a study that was conducted with 424 patients with chronic diseases in Turkey by Bilge et al., the frequency of mood disorders was reported as 32.3% while the most of them was major depression with a frequency of 20.5% [21]. Keskin et al. reported similar results in hypertensive patients, a frequency of 37.1% for mood disorders and 5.2% for major depression [22].

The ideal care for management of chronic conditions like diabetes, heart failure, cardiovascular disease is very important [23]. The Chronic Care Model developed by Wagner et al, and the Innovative Care for Chronic Conditions, edited by the World Health Organization, propose that ideal care for chronic conditions is achieved when health care providers interact with informed patients [24,25]. The essential ingredient of effective chronic care treatment is the partnership between the patient and health professionals because it offers the opportunity to empower patients to become more active in managing their health. When patients are more informed, involved, and empowered, they interact more effectively with health care providers and strive to take actions that will promote healthier outcomes [24,25]. Evidence suggests that when programs teaching self-management consider the patient's assessment of their condition, there is greater patient satisfaction with care, better patient compliance with treatment, and higher likelihood of maintenance of continuous relationships in health care [26].

Conclusion

The prevalence of depression in patients with type 2 DM, associated risk factors, and the relationship between depression and health complications have been investigated in the Turkish population. It has been found that the rate of depression is significantly higher in women, those who had diabetes for a longer duration, poor glycemic control, and patients who did not comply with diabetes drugs or with the necessary lifestyle changes. The relationship between depression and microvascular and macrovascular complications has also been demonstrated. This study highlights the importance of consultation and liaison between clinics. It is important for cases to be analyzed from a psychosocial perspective and patients need to be supported if they require psychiatric help. A multidisciplinary approach can help improve patients' quality of life, reduce treatment costs, and reduce the delay and wastage of time for both the treatment team and patients.

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