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Original Article

Diabetes Distress and Depression among Patients with Type 2 Diabetes: A Cross-Sectional Study

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Abstract

Purpose: The purpose of this study is to identify the rates of diabetes distress and depression in patients with Type 2 diabetes and to explore the relationship between glycemic control, depression, and diabetes distress. **Patients and Methods:** One hundred and fifteen adults with Type 2 diabetes were recruited for this cross-sectional study from the Dubai Diabetes Center in Dubai, United Arab Emirates. The Arabic version of the Diabetes Distress Scale was used to assess diabetes distress, and the Arabic version of the Beck Depression Inventory-II scale was used to assess depression symptoms. **Results:** Our study population consisted of 63 males (54.8%) and 52 females (45.2%). We found that, out of this study population, 54.3% had uncontrolled diabetes with glycosylated hemoglobin (HbA1c) >7% (53 mmol/mol), 54.8% exhibited diabetes distress, and 29.6% showed depression. Using a combined oral and insulin treatment was found to be significant independent predictors of poor glycemic control as defined by an HbA1c >7% (53 mmol/mol). **Conclusion:** This study has identified psychosocial issues as a significant health problem among adult patients with type 2 diabetes and offers data confirming the relevance of diabetes distress and depression among them. This finding can help clinicians have a better understanding of the extent to which psychosocial issues influence diabetes management so as to develop effective and appropriate treatment approaches.

Keywords: Depression, diabetes, diabetes distress, United Arab Emirates

Introduction

Diabetes mellitus (DM) is a major chronic illness that causes significant morbidity and mortality and has resulted in serious public health issues. According to the World Health Organization, health is defined as not only by the absence of the disease and infirmity but also by the presence of mental, physical, and social well-being.[1] As per the International Diabetes Federation World Atlas in 2019, the age-adjusted prevalence of diabetes in adults in the United Arab Emirates (UAE) was 16.3% with total cases of diabetes in adults totaling up to 1,223,400.[2] Another recent study has estimated that the total age-standardized prevalence of diabetes in the UAE was 23% among Asian males, 20% in Asian females, 21% in Emirati males, and 23% in Emirati females,[3] making UAE as one of the countries with a very high prevalence of diabetes.

One of the psychosocial problems of diabetes is depression. This is a global finding and has been associated with both poor qualities of life and poor glycemic control in patients with diabetes.[4] A systematic review and meta-analyses have shown that people with diabetes have double the risk of developing depression when compared to people without diabetes.[5,6] Other studies have shown that around 30% of people with diabetes have symptoms of depression and 10% have major depression.[7-9] Depression is directly associated with poor compliance to treatment, poor glycemic control, decreased quality of life, increased risk of diabetes-related complications as well as increased mortality.[10-13]

Diabetes distress is the combination of all the emotional responses generated in response to the demands of this chronic lifestyle-changing disease.[14] Several studies have shown

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that diabetes distress, rather than depression, is significantly correlated with glycemic control and self-management, which then directly influences the diabetes outcome.[15-17]

Few studies have examined the combined influence of depression and diabetes distress on glycemic control in the UAE and there are limited data regarding the burden of diabetes distress, depression, and quality of life with diabetes. Therefore, this study aims to determine the rate of depression and diabetes distress and their effects on glycemic control among patients with Type 2 diabetes.

Patients and Methods

Study design

A cross-sectional study was conducted between the January 15, 2018 and the April 15, 2018 among outpatients with diabetes at the Dubai Diabetes Center (DDC) (Dubai Heath Authority) in Dubai, UAE.

Setting

The DDC at Dubai Health Authority was established in 2009. It provides comprehensive diabetes care and education according to international standards. DDC has a multidisciplinary team consisting of endocrinologists, certified diabetes educators, nutritionists, exercise physiologists, podiatrist, and psychologist. Lab evaluations and retinal photography are performed in the facility. Continuous physician training and research studies are also performed in the center. During each patient visit at DDC, vital signs, anthropometric parameters, and blood glucose levels are recorded. Measurements of glycosylated hemoglobin (HbA1c), urine micro albumin, and blood ketones are carried out as indicated using point of care devices.

Study population

Patients with diabetes attending the outpatient clinic between the period of January 15, 2018 and April 15, 2018 who met the inclusion criteria were asked to be enrolled in the study. To be included in the study, patients must have been diagnosed with DM according to the American Diabetes Association (ADA) criteria, be mentally competent, above 18 years of age, able to communicate verbally, and provide informed consent. Patients with Type 1 diabetes, participants on psychiatric medications, those experiencing. Those experiencing cognitive impairment, and anyone who did not consent to participate was excluded from the study. All patients with diabetes who had an appointment at DDC and met the criteria for enrollment into the study were invited to participate. Face-to-face interviews were conducted for each patient individually in the diabetes educator's clinic. Subject's verbal agreement and written consent were obtained.

Data collection

Sociodemographic and anthropometric measurements

Sociodemographic information including age, sex, level of formal education, employment status, marital status, and monthly income, previous diabetes education, smoking status, and diabetes duration was documented. Anthropometric measurements including height measured without shoes, to the nearest 0.5 cm using a stadiometer with shoulders in a relaxed position and the arms hanging freely. The weight was measured with the patient wearing light clothing and no shoes and was measured to the nearest 0.5 kg. Body mass index (BMI) was computed by dividing the weight (kilograms) with the height squared (meters). Normal weight was defined as BMI 18.5–24.9 kg/m^2; overweight was defined as BMI 25–29.9 kg/m^2 and obesity was defined as BMI ≥30 kg/m^2.

Biochemical analysis

HbA1c was analyzed using a DCA Vantage® Analyzer (Siemens Healthcare GmbH, Erlangen, Germany), which meets the National Glycohemoglobin Standardization Program performance criteria and uses a monoclonal antibody agglutination reaction. Patients with HbA1c <7% were reported as having good DM control, whereas patients with HbA1c >7% were reported as having poor DM control.[18]

Assessment of depression and diabetes distress

A face-to-face structured questionnaire interview was performed by the authors to quantify depression symptoms and diabetes distress. The presence of depression symptoms was measured using the Arabic version of the Beck Depression Inventory-Second Version (BDI-II).[19] The Arabic version of the BDI-II was prepared by Ghareeb,[20] and the psychometric properties were assessed in 17 Arabic countries; they have reported acceptable validity for BDI-II. Alpha Cronbach ranged from 0.82 to 0.93 in these countries.[21] The BD I-II is considered the most widely used questionnaire for depression, and it provides an estimate of the severity of the depression. It is a 21-item questionnaire that takes approximately 15 min to complete. Participants entered a score on four statements (rated 0–3) Likert-Type scale, possible scores range from 0 to 63, with higher scores indicating greater depressive symptoms. The developers of the instrument classified the scores into four groups as follows: minimal depression 0–13, mild depression 14–19, moderate depression 20–28, and severe depression 29–63.[19] Cutoff scores for BDI >16 indicated clinical depression.[22] Diabetes Distress was assessed using the Diabetes Distress Scale (DDS), developed by Polonsky *et al*.[23] This scale consists of 17 items and has four subscales physician-related distress (questions 2, 4, 9, and 15), emotional burden (questions 1, 3, 8, 11, and 14), diabetes-related interpersonal distress (questions 7, 13, and 17), and regimen distress (questions 5, 6, 10, 12, and 16) and uses the 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Accordingly, a higher total score reflects greater diabetes distress, and in this study, a score lower than 2 indicated no distress, a score between 2 and 2.9 indicated moderate distress, and a score >3 was considered high distress. DDS has good internal consistency, with a Cronbach's alpha of 0.87 and validity.[23] We considered moderate and high distress score as having diabetes distress. The Arabic version scale was used with permission.[24]

Statistical analysis

Statistical Program for Social Sciences software version 16.0 (SPSS Inc. Released 2007, SPSS for Windows, Version 16.0. Chicago, IL, USA) was used to analyze the data. The means for each subscale were calculated. Descriptive statistics were used to describe the sociodemographic and clinical characteristics of the sample. Multivariate logistic regression analysis was used to estimate relationships between the subsets of sociodemographic and clinical characteristics and the questionnaire scores. Statistical significance was set at $P < 0.05$ with all tests being 2-sided.

Results

Demographic and clinical characteristics

The demographic and clinical characteristics are presented in Table 1. The sample consisted of 115 subjects; 54.8% were men and 45.2% were female. Of the total sample, 80.9% were married and 43.5% reported being employed. The average age was 53.12 ± 11.44 years and 63.5% were above the age of 60 years. Our findings showed that 54.8% of the patients had diabetes distress.

Depression

Depression was found in 29.6% of our sample population. Their level of education showed that 10.4% were illiterate, while 33.9% had a high school diploma. Around 57.4% were nonsmokers, 26.1% were ex-smokers, and 16.5% were current smokers. The average duration of diabetes was 12.64 ± 8.01 years. Out of the 115 subjects, 65 (56.5%) reported exercising, only 10.4% had a BMI in the normal range; 34.8% were overweight; and 54.8% were obese. Their current pharmacological treatment consisted of oral hypoglycemic medications in 63.5% of the patients and 36.5% using a combination of insulin and oral hypoglycemic medications. The mean value for glycemic control as measured by their HbA1c was 7.43% ±1.55%; with 45.2% having good glycemic control and 54.8% having an HbA1c level of ≥ 7%, suggesting uncontrolled glycemia. The most frequent microvascular complications were nephropathy (35.7%), retinopathy (29.6%), and neuropathy (20%). Nearly 91.3% of the study participants had dyslipidemia and 63.5% had hypertension. Bivariate correlation analysis between the continues variables was measured showed in Table 2; this analysis revealed a significant association between HbA1c and diabetes distress, HbA1c and DM durations, and depression and diabetes distress, with $P < 0.05$. On the other hand, across tab correlation test measured in Table 3, the test showed 50.8% of the employed participants have poor glycemia control with significant *P* value results. While more than 50% of those taking both oral and insulin treatment had poor glycemic control with appositive correlation. Around 30% of the participants without diabetes distress have good glycemia control, while more than 60% of the distressed participants have poor glycemic control and this correlation found to be significant [Table 4].

Table 1: Sociodemographic characteristics of the study participants

Variable	Details	*n* (%)
Sex	Male	63 (54.8)
	Female	52 (45.2)
Age (year)	≤50	42 (36.5)
	>50	73 (63.5)
Marital status	Single	12 (10.4)
	Married	93 (80.9)
	Others	10 (8.7)
Level of education	Illiterate	12 (10.4)
	Less than HS	29 (25.2)
	HS	35 (30.4)
	Greater than HS	39 (33.9)
Employment status	Not employed	41 (35.7)
	Employed	50 (43.5)
	Retired	24 (20.9)
Smoking	Nonsmoker	66 (57.4)
	Ex-smoker	30 (26.1)
	Smoker	19 (16.5)

HS: High school

Table 2: Clinical characteristics of the study participants

Variable	Details	*n* (%)
BMI (kg\m^2)	<25.0	12 (10.4)
	25.0-29.9	40 (34.8)
	≥30.0	63 (54.8)
Waist circumference (cm)	Normal	36 (31.3)
	Abnormal	79 (68.7)
Duration of diabetes (year)	≤8	42 (36.5)
	8-16	39 (33.9)
	≥16	34 (29.6)
Nephropathy	Yes	41 (35.7)
Neuropathy	Yes	23 (20.0)
Retinopathy	Yes	34 (29.6)
Diabetes treatment	OHA	73 (63.5)
	Insulin + OHA	42 (36.5)
HbAlc (%)	<7	52 (45.2)
	≥7	63 (54.8)
Hypertension	Yes	73 (63.5)
Dyslipidemia	Yes	105 (91.3)
Exercise	Yes	65 (56.5)
Depression	No (<16)	81 (70.4)
	Yes (≥ 16)	34 (29.6)
Diabetes distress	No distress	52 (45.2)
	Distress	63 (54.8)

Waist circumference was defined as normal for males <102 and for females <88 and as abnormal for males >102 cm and for females >88 cm. BMI: Body mass index, OHA: Oral hypoglycemic agents, HbAlc: Glycosylated hemoglobin

Predictors of diabetes distress are presented in Table 5. The analysis showed that there was no significant correlation between diabetes distress and the patients' sex, marital status, level of education, smoking status, BMI, waist circumference, duration of diabetes, microvascular complications, hypertension, dyslipidemia, or exercise. However, a significant

Table 3: Bivariate correlations between the continues variables

Variables	Age	BMI	Waist circumference	DM duration	HbA1c	Depression	Distress
Age							
Pearson correlation		-0.170	-0.032	0.402	-0.293	-0.015	-0.113
P		0.070	0.734	0.000	0.002	0.871	0.230
BMI							
Pearson correlation	-0.170		0.801	-0.111	-0.107	0.192	0.038
P	0.070		0.000	0.239	0.254	0.040	0.684
Waist circumference							
Pearson correlation	-0.032	0.801		-0.095	-0.065	0.159	0.070
P	0.734	0.000		0.312	0.492	0.091	0.459
Diabetes duration							
Pearson correlation	0.402	-0.111	-0.095		0.213	-0.115	0.061
P	0.000	0.239	0.312		0.022	0.223	0.518
HbA1c							
Pearson correlation	-0.293	-0.107	-0.065	0.213		0.040	0.269
P	0.002	0.254	0.492	0.022		0.670	0.004
Depression							
Pearson correlation	-0.015	0.192	0.159	-0.115	0.040		0.503
P	0.871	0.040	0.091	0.223	0.670		0.000
Distress							
Pearson correlation	-0.113	0.038	0.070	0.061	0.269	0.503	
P	0.230	0.684	0.459	0.518	0.004	0.000	

BMI: Body mass index, DM: Diabetes mellitus, HbAlc: Glycosylated hemoglobin

correlation was found between diabetes distress on depression (*P*-value 0.004) and participants aged ≤50 years old (*P*-value 0.004). Furthermore, Table 5 shows the significant predictors of depression which included diabetes distress, decreased educational level, and decreased diabetes duration, while the rest of the other variables showing no significant association.

A separate logistic regression analysis examining the relationship between each variable with HbA1c was conducted. The significant predictors of poor glycemic control from each variable were included in a logistic regression model to estimate their independent effects on HbA1c [Table 6]. We found that patients on both oral medications and insulin treatment for diabetes to be more likely to exhibit poor glycemic control (odds ratio = 7.35 and (*P*-value 0.004).

Discussion

We found that more than half of the participants (54.8%) had uncontrolled diabetes with a mean HbA1c of 7.4%. This was higher than a study done in the UAE by Alajmani *et al*.,[25] in which they reported 47% of the study participants had an HbA1c >7.0% and it may be due to the difference in both the study settings. In this study, the patients were recruited from a specialized diabetes center, while the study by Alajmani *et al*.[25] recruited the participants from the primary health-care centers and their mini diabetes clinics where they refer patients with poor glycemic control or difficult to treat patients before referring them to a specialized diabetes center. Our mean HbA1c was however close to what was reported by Tsujii *et al*. (mean HbA1c 7.5%).[26]

The rate of diabetes distress (54.8%) in this study was almost similar to that from a study conducted among South Asian Canadians[27] and slightly higher than what was reported in a study done in Bangladesh.[28]

Of all the patients with Type 2 diabetes, 29.6% were found to suffer from depressive symptoms, with a cutoff point score >16 as suggested to be accurate among patients with diabetes.[29] Once again, our study's result is higher than what was reported by Alajmani *et al*.,[25] which showed a depression prevalence of 17%. A literature review conducted for 42 studies revealed that around 20%–40% of the patients with Type 2 diabetes had comorbid depression.[30]

Our study found no association between depression and HbA1c levels, but there was a significant correlation between diabetes distress and HbA1c in the bivariate analysis, and this was consistent with the results of another study conducted by Fisher *et al*.[31] The high prevalence of diabetes related-distress suggests that patients living with diabetes may struggle emotionally and socially due to the demands of diabetes management. Further analysis is needed to establish the correlation of various factors and the level of distress.

Participants taking both oral and insulin for diabetes treatment more likely to have abnormal glycemic control than those on oral hypoglycemic agents (OHA) only. A possible explanation for this finding may be that both OHA and insulin treatment are usually prescribed as a secondary or tertiary treatment in patients with Type 2 diabetes and both are introduced into the therapy as a result of worsening glycemic control. Higher rates of abnormal glycemic control may also be due to the patient's

Table 4: Across tab correlation between the variables

Variables	Details	HbA1c <7 (%)	HbA1c ≥7 (%)	*P**
Sex	Male	29 (55.8)	34 (54.0)	0.847
	Female	23 (44.2)	29 (46.0)	
Age (years)	<50	15 (28.8)	27 (42.9)	0.120
	>50	37 (71.2)	36 (57.1)	
Marital status	Single	6 (11.5)	6 (9.5)	0.882
	Married	41 (78.8)	52 (82.5)	
	Others	5 (9.6)	5 (7.9)	
Formal education	Illiterate	7 (13.5)	5 (7.9)	0.696
	Less than high school	12 (23.1)	17 (27.0)	
	High school	17 (32.7)	18 (28.6)	
	Beyond high school	16 (30.8)	23 (36.5)	
Employment	No	18 (34.6)	23 (36.5)	0.045
	Yes	18 (34.6)	32 (50.8)	
	Retired	16 (30.8)	8 (12.7)	
Smoking	Nonsmoker	30 (57.7)	36 (57.1)	0.124
	Ex-smoker	10 (19.2)	20 (31.7)	
	Smoker	12 (23.1)	7 (11.1)	
Body mass index	<25.0	7 (13.5)	5 (7.9)	0.525
	25.0-29.9	16 (30.8)	24 (38.1)	
	≥30.0	29 (55.8)	34 (54.0)	
Waist circumference	Normal	17 (32.7)	19 (30.2)	0.771
	Abnormal	35 (67.3)	44 (69.8)	
Diabetes duration	≤8	22 (42.3)	20 (31.7)	0.087
	8-16	20 (38.5)	19 (30.2)	
	≥16	10 (19.2)	24 (38.1)	
Nephropathy	Yes	16 (30.8)	25 (39.7)	0.321
	No	36 (69.2)	38 (60.3)	
Neuropathy	Yes	10 (19.2)	13 (20.6)	0.851
	No	42 (80.8)	50 (79.4)	
Retinopathy	Yes	15 (28.8)	19 (30.2)	0.878
	No	37 (71.2)	44 (69.8)	
Diabetes therapy	OHA	43 (82.7)	30 (47.6)	<0.001
	OHA + insulin	9 (17.3)	33 (52.4)	
Hypertension	Yes	31 (59.6)	42 (66.7)	0.434
	No	21 (40.4)	21 (33.3)	
Dyslipidemia	Yes	47 (90.4)	58 (92.1)	0.750
	No	5 (9.6)	5 (7.9)	
Exercise	Yes	29 (55.8)	36 (57.1)	0.882
	No	23 (44.2)	27 (42.9)	
Depression	Yes	13 (25.0)	21 (33.3)	0.330
	No	39 (75.0)	42 (66.7)	
Distress	Yes	21 (40.4)	42 (66.7)	0.005
	No	31 (59.6)	21 (33.3)	

**P* value was derived through correlation analysis. OHA: Oral hypoglycemic agents, HbAlc: Glycosylated hemoglobin

emotional response to the introduction of a new treatment regimen. Further research is needed to analyze the patient's perception of introducing insulin to the treatment regimen and the impact of changing the treatment regimen on the patients' emotional well-being.

The impact of diabetes distress and depression highlights the importance of a multidisciplinary approach in the treatment of diabetes, which includes a mental health professional. The inclusion of a screening protocol for diabetes distress and depression in the routine treatment of diabetes can provide a more thorough understanding of the patients' needs and improve clinical outcomes. There is a significant need to further explore the relationship between diabetes distress, depression, and diabetes self-management. Further understanding of the role of mental health, social factors, and family dynamics is needed to improve psychosocial care in diabetes management. Consistent with The ADA recommendations, the importance of emotional well-being must be taken into consideration

Table 5: Predictors of diabetes distress and predictors of depression

Variable	Beta	OR (95% CI)	*P**
Predictors of diabetes distress (binary regression)			
Sex	0.889	2.433 (0.414-14.298)	0.325
Age	-1.624	0.197 (0.043-0.894)	0.035
Marital status			
Single	1.0		
Married	1.103	3.015 (0.521-17.454)	0.218
Others	0.125	1.133 (0.086-14.942)	0.924
Education			
Illiterate	1.0		
Less than HS	1.363	3.908 (0.372-41.051)	0.256
HS	-0.523	0.593 (0.069-5.107)	0.634
Greater than HS	-0.257	0.773 (0.075-7.925)	0.828
Employment			
Not employed	1		
Employed	-0.150	0.861 (0.134-5.516)	0.874
Retired	-1.162	0.313 (0.039-2.505)	0.274
Smoking			
Nonesmoker	1		
Ex-smoker	1.274	3.577 (0.842-15.193)	0.084
Smoker	0.399	1.491 (0.300-7.403)	0.625
BMI			
<25	1		
25-29.9	1.100	3.003 (0.389-23.208)	0.292
≥30	2.335	10.326 (0.591-180.381)	0.110
Waist circumference	-1.958	0.141 (0.018-1.133)	0.065
Diabetes duration			
≤8	1		
8-16	0.069	1.071 (0.297-3.860)	0.917
≥16	1.383	3.987 (0.793-20.056)	0.093
Nephropathy	0.672	1.957 (0.615-6.229)	0.256
Neuropathy	0.731	2.078 (0.496-8.707)	0.317
Retinopathy	-0.430	0.650 (0.173-2.443)	0.524
DM treatment	0.138	1.148 (0.330-3.995)	0.829
Hypertension	0.541	1.718 (0.478-6.176)	0.407
Dyslipidemia	0.831	2.296 (0.315-16.739)	0.412
Exercise	-0.281	0.755 (0.248-2.304)	0.622
Depression	2.035	7.649 (1.902-30.760)	0.004
HbA1c	0.514	1.672 (0.538-5.199)	0.374
Predictors of depression (binary regression)			
Sex	0.486	1.626 (0.208-12.720)	0.643
Age	0.624	1.866 (0.440-7.907)	0.397
Marital status			
Single	1		
Married	-1.954	0.142 (0.017-1.202)	0.073
Others	-2.129	0.119 (0.008-1.792)	0.124
Education			
Illiterate	1		
Less than HS	-0.879	0.415 (0.055-3.157)	0.396
HS	-1.267	0.282 (0.031-2.561)	0.261
Greater than HS	-3.091	0.045 (0.003-0.595)	0.019
Employment			
Not employed	1		
Employed	0.264	1.302 (0.155-10.951)	0.808
Retired	-0.780	0.458 (0.036-5.805)	0.547
Smoking			
Nonesmoker	1		
Ex-smoker	0.832	2.298 (0.476-11.101)	0.300
Smoker	1.135	3.112 (0.583-16.605)	0.184
BMI			
<25	1		
25-29.9	0.414	1.512 (0.123-18.554)	0.746
≥30	0.024	1.025 (0.053-19.801)	0.987
Waist circumference	1.172	3.229 (0.349-29.922)	0.302
DM duration			
≤8	1		
8-16	-1.337	0.263 (0.055-1.259)	0.094
≥16	-1.759	0.172 (0.030-0.985)	0.048
Nephropathy	0.115	1.122 (0.354-3.557)	0.845
Neuropathy	-0.406	0.666 (0.146-3.037)	0.600
Retinopathy	0.912	2.490 (0.616-10.069)	0.201
DM treatment	0.687	1.987 (0.566-6.979)	0.284
Hypertension	-0.341	0.711 (0.152-3.332)	0.665
Dyslipidemia	0.610	1.841 (0.163-20.773)	0.622
Exercise	0.078	1.082 (0.331-3.539)	0.897
Distress	2.163	8.694 (1.929-39.181)	0.005
HbA1c	0.308	1.361 (0.380-4.874)	0.636

**P* value was derived through logistic regression analysis, Reference group (female sex, ≥50 years of age, singles, illiterate, not employed, nonesmokers, <25 kg/m^2 BMI, abnormal waist circumference, ≤8 years DM duration, nephropathic, neuropathic, retinopathic, using both insulin and OHA DM treatment, hypertensive, dyslipidemia, active, depressed and with poor glycemic control. BMI: Body mass index, DM: Diabetes mellitus, OHA: Oral hypoglycemic agents, OR: Odds ratio, CI: Confidence interval, HbAlc: Glycosylated hemoglobin, HS: High school

when managing diabetes.[32] A multidisciplinary team approach including behavioral, family, and mental health interventions shows the most beneficial outcomes in diabetes management.[32] This study also establishes that depression is not always correlated with higher HbA1c; therefore, screening for depression is imperative regardless of HbA1c levels. Moreover, as per the ADA recommendations, it is vital that all care providers screen for the emotional well-being of patients during the initial screening and on follow-up appointments regardless of patient presentation.[32]

We found that age was a predictor of diabetes distress as younger patients were more likely to report distress than their older counterparts with Type 2 diabetes. As suggested by Wardian and Sun,[33] additional life stressors such as work, family, and finances may enhance the level of diabetes distress experienced by patients with type 2 diabetes.

Diabetes distress predicted higher rates of depression, with depression also being a predictor of distress. We hypothesized that symptoms of depression including fatigue, hopelessness, loss of interest, and diminished ability to concentrate may have contributed to symptoms of distress

Table 6: Determinants of glycosylated hemoglobin (binary regression)

Variable	Beta	OR (95% CI)	*P**
Sex	-0.098	0.907 (0.165-4.994)	0.911
Age	-0.685	0.504 (0.129-1.972)	0.325
Marital status			
Single	1		
Married	0.576	1.780 (0.333-9.518)	0.500
Others	0.375	0.760 (0.131-16.090)	0.760
Education			
Illiterate	1		
Less than HS	1.473	4.362 (0.573-33.216)	0.155
HS	0.618	1.855 (0.248-13.892)	0.547
Greater than HS	1.478	4.385 (0.481-40.006)	0.190
Employment			
Not employed	1		
Employed	0.519	1.680 (0.298-9.477)	0.556
Retired	-1.123	0.325 (0.053-1.988)	0.224
Smoking			
Nonesmoker	1		
Ex-smoker	0.670	1.955 (0.468-8.168)	0.358
Smoker	-1.159	0.314 (0.068-1.455)	0.139
Body mass index			
<25	1		
25-29.9	-0.288	0.750 (0.112-5.011)	0.767
≥30	-0.872	0.418 (0.038-4.580)	0.475
Waist circumference	1.046	2.848 (0.551-14.725)	0.212
DM duration			
≤8	1		
8-16	-0.542	0.581 (0.173-1.954)	0.380
≥16	1.121	3.067 (0.704-13.369)	0.136
Nephropathy	0.398	1.489 (0.512-4.329)	0.464
Neuropathy	-0.392	0.676 (0.166-2.756)	0.585
Retinopathy	-0.816	0.442 (0.126-1.554)	0.203
DM treatment	1.996	7.356 (2.083-25.983)	0.002
Hypertension	0.667	1.949 (0.566-6.713)	0.290
Dyslipidemia	-0.479	0.619 (0.099-3.882)	0.609
Exercise	-0.031	0.970 (0.315-2.984)	0.957
Depression	0.169	1.184 (0.336-4.168)	0.792
Distress	0.416	1.516 (0.499-4.607)	0.463

**P* value was derived through logistic regression analysis, Reference group (Female sex, ≥50 years of age, Singles, illiterate, not employed, nonesmokers, <25 kg/m^2 BMI, abnormal waist circumference, ≤8 years DM duration, nephropathic, neuropathic, retinopathic, using both insulin and OHA, DM treatment, hypertensive, dyslipidemia, active, distressed and depressed). BMI: Body mass index, DM: Diabetes mellitus, OHA: Oral hypoglycemic agents, OR: Odds ratio, CI: Confidence interval, HS: High school

due to the complexity of diabetes management in addition to other life stressors.

Finally, our study also found diabetes duration as well as educational level to be predictors of depression. The initial emotional response to the diabetes diagnosis and difficulty adjusting to lifestyle changes may contribute to mood changes, leading to increased depression symptoms. We hypothesized that newly diagnosed patients may find living with diabetes difficult in the early stages due to the importance of self-management, lifestyle changes, and behavioral changes needed to maintain a healthy HbA1c. With time, patients may adjust more appropriately to such life stages, hence decreasing the symptoms of depression. As suggested by Wardian and Sun,[33] in order to reduce diabetes-related distress, it is important to further assess specific diabetes-related distress factors such as emotional distress, regimen-related distress as well as self-management behaviors and the level of social support that they have.

There are several limitations to this study. First, the recruitment of participants was performed in only one government-specialized diabetes center located in Dubai, and the sample size was small, which can raise questions concerning the generalizability of our findings. Therefore, the results of this study should be interpreted with caution. Second, the cross-sectional nature of the study limits the definitive causal interpretations between depression, diabetes distress, and glycemic control.

To be able to show causality, future longitudinal prospective studies are needed.

Third, the possibility of recall bias cannot be ruled out in self-reports, making the findings of this study reliant upon the accuracy of the subject's self-evaluation. The social stigma of depression could have also contributed to an underreporting of depressive symptoms. Finally, a clinical psychological interview with patients was not conducted which may have highlighted other factors that contributed to diabetes distress and depression. However, despite these limitations, the findings of this study have succeeded in confirming previous findings from other studies. Finally, future research should address these questions in a larger and more representative sample for all patients with diabetes across the UAE.

Conclusion

This study has identified psychosocial issues as a significant health problem among adult patients with Type 2 diabetes and offers data confirming the relevance of diabetes distress and depression among them. The results of this study can help the policymakers and service providers to improve and modify the existing diabetes treatment criteria. The impact of diabetes distress and depression, as well as the causal factors on self-care management efforts and long-term diabetes-related health outcomes needs to be further examined in depth to create effective rehabilitation and intervention programs. This study establishes the importance of addressing diabetes distress, depression, and the importance of establishing more frequent screening early on in treatment and on regular follow-ups. Early screening and intervention will also provide practitioners with increased awareness of patients' needs and provide improved treatment outcomes. If a patient is found to be with increased emotional distress, a referral to a mental health practitioner is recommended. Only by identifying how diabetes distress and depression influence diabetes management, can we develop effective and appropriate treatment approaches.

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Authors' contribution

All named authors confirm that they fulfill the ICMLE authorship criteria and have approved the final version of the article.

Compliance with ethical principles

Approval from the Ethical Committee at the Dubai Health Authority was obtained. Informed consent was obtained, and then data were collected from the patients. Data were collected and analyzed anonymously.

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Conflicts of interest

There are no conflicts of interest.

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