

Depression Among Patients With Type 2 Diabetes Mellitus at King Abdulaziz University Hospital (KAUH): A Cross-Sectional Study

Review began 04/26/2022

Review ended 04/30/2022

Published 06/16/2022

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Abstract

Background: Depression can increase the risk of diabetes-related complications, healthcare expenditures, and morbidity in patients with type 2 diabetes mellitus (T2DM). There have been increasing cases of diabetes in Saudi Arabia; however, research correlating depression with diabetes is lacking. The aim of this study was to find out how common depression is among T2DM patients at King Abdulaziz University Hospital (KAUH), Jeddah, and assess any additional risk factors for depression in these patients.

Methodology: A cross-sectional study using computer-assisted telephone interviews was conducted among patients with T2DM from June to August 2021. A total of 215 participants completed the survey. Symptoms and signs of depression were assessed using the Patient Health Questionnaire (PHQ-9). Univariate, bivariate, and multivariate statistical analyses were used to determine the prevalence and risk factors associated with depression.

Results: Depression was shown to be prevalent in 54% of type 2 diabetes patients, with the most common associated risk factors being not exercising ($p=0.00$) and having at least one diabetes-related complication ($p=0.001$). There was no evidence of a significant relationship between depression and gender or age, although females were, in general, more depressed than males.

Conclusion: Diabetic patients have a significantly high prevalence of depression; therefore, it is vital to conduct regular screening for depression in patients diagnosed with T2DM.

Categories: Endocrinology/Diabetes/Metabolism, Internal Medicine, Psychiatry

Keywords: saudi, depression, exercise, diabetes-related complications, diabetic

Introduction

Diabetes mellitus (DM) is a prevalent chronic metabolic disorder characterized by elevated plasma glucose levels due to inadequate insulin synthesis and/or enhanced insulin resistance. According to the International Diabetes Federation (IDF), 463 million individuals aged 20–79 years had diabetes in 2019, accounting for 9.3% of the global population; this figure is anticipated to rise to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045. Despite the fact that type 2 diabetes is becoming more common worldwide, 79% of diabetic individuals reside in low- and middle-income countries [1]. Over the last 20 years, rapid economic progress and changing lifestyles in Saudi Arabia have resulted in a dramatic increase in the prevalence of diabetes mellitus [2]. The prevalence of type 2 diabetes mellitus (T2DM) in Saudi Arabia is estimated to be 18.5% [1].

Diabetes is usually treated with medication and lifestyle changes. However, the persistent demands of diabetes care, such as following a strict diet and exercising regularly to maintain good health, monitoring blood glucose levels, regular follow-up, managing symptoms, and constantly having to watch out for complications, can cause additional stress to diabetic patients. As a result, individuals suffer from depression, anxiety, and stress, all of which have a severe negative impact on their health and general quality of life [3].

During psychological stress, counter-regulatory hormones such as dopamine, a neurotransmitter; glucocorticoids, growth hormones; and glucagon are activated [4]. The activation of counter-regulatory hormones hinders insulin from functioning normally, causing blood glucose levels to increase. Maintaining metabolic regulation becomes more difficult when the glucose level rises. In patients with diabetes, poor glycemic control and functional impairment owing to developing diabetes complications may induce or exacerbate depression and anxiety [5–7].

According to several studies, anxiety and depression are prevalent among individuals with diabetes [7–10].

How to cite this article

Al Qusaibi B, Mosli H, Kattan W, et al. (June 16, 2022) Depression Among Patients With Type 2 Diabetes Mellitus at King Abdulaziz University Hospital (KAUH): A Cross-Sectional Study. *Cureus* 14(6): e25990. DOI 10.7759/cureus.25990

Anxiety and depression are more widespread among diabetic patients than in the general population [11,12]. Diabetes and depression co-existence leads to poor management of glycemic control, which increases the risk of diabetes complications and lowers the overall quality of life and life expectancy [8,13-15]. The exact biomedical processes responsible for the association between depression and T2DM are unknown [8].

The information on the prevalence of depression and its related risk factors among patients with diabetes in Saudi Arabia, particularly in Jeddah, is scarce. The current study at King Abdulaziz University Hospital (KAUH) in Jeddah aimed to determine the prevalence of depression and potential risk factors in patients with type 2 diabetes.

Materials And Methods

Study design and setting

This cross-sectional study was conducted at King Abdulaziz University Hospital (KAUH) in Jeddah, Saudi Arabia, from June to August 2021 and approved by the ethics committee (Ref: 223-21). All participants were notified about the study objectives and response confidentiality, and consent was obtained from all participants.

Medical records of 215 adult patients with T2DM were reviewed, and the patients were contacted via telephone calls. The sample size was calculated using the Roasoft website with a margin of error of 5% and a 95% confidence interval. Our study comprised patients over 18 years of age who had been diagnosed with T2DM at KAUH. Patients with a history of psychiatric illnesses previous to diagnosis, those with language barriers, and those who refused to participate in the study were all excluded from the study.

Data collection instruments

The questionnaire was divided into two sections. The first section was aimed at collecting demographic data such as gender, age, nationality, education, and occupation, as well as participants' detailed history of type 2 DM (complications, medications used, and adherence). The second section assessed depression using an Arabic version of the PHQ-9 test, a valid and reliable screening tool for detecting depression. The PHQ-9 has nine questions (numbered 1-9) which were graded on a four-point Likert scale from 0 to 3 as follows: 0=not at all, 1=a few days, 2=more than half of the days, and 3=nearly every day. Symptom severity was graded from 5 to 9 for mild, 10 to 14 for moderate, 15 to 19 for moderately severe, and 20 to 27 for severe.

Analysis

Microsoft Excel was used for data entry and SPSS version 21 was used for data analysis and coding. Frequencies were used to describe categorical variables, including primary variables, while mean and standard deviations were used to describe continuous variables for normally distributed values. Bivariate analysis was conducted for categorical variables using the chi-square test to identify all possible risk factors. Odds ratios, confidence intervals of odds ratios, and p-values were generated for the side effects using binary logistic regression. Statistical significance was set at $p < 0.05$.

Results

A total of 215 patients out of a sample size of 552 agreed to participate, resulting in a response rate of 39%. Majority of the study participants were male ($N=122$, 56.7%) and the remaining were female ($N=93$, 43.3%). Most of the participants in the study were over 40 years old ($N=201$, 93.5%) with an average age of 60.34 ± 12.167 years. Several of them were Saudi nationals (58.6%). Table 1 illustrates the sociodemographic characteristics of the participants.

Variable		Frequency	Percentage
Age	18-40 years	14	6.5
	>40 years	201	93.5
Gender	Male	122	56.7
	Female	93	43.3
Marital status	Married	171	79.5
	Widow	27	12.6
	Divorced	11	5.1
	Single	6	2.8
Employment status	Employed	49	22.8
	Non-employed	94	43.7
	Retired	72	33.5
Education level	University	60	27.9
	Secondary	60	27.9
	Primary	41	19.1
	Illiterate	54	25.1
Nationality	Saudi	126	58.6
	Non-Saudi	89	41.4
Type of medication	Insulin	72	33.5
	Oral drugs	89	41.4
Diabetes-related complication	Both	42	19.5
	Yes	114	53
Workout	No	101	47
	Yes	73	34
	No	142	66

TABLE 1: Sociodemographic data of the participants

The PHQ-9 aimed to screen for depression and revealed depressive symptoms in 116 participants, accounting for 54% of the total sample size. Moderate to moderately severe depression was found in 22.8% of the patients (N=49). Furthermore, the most common problem reported by patients in the PHQ-9 was "feeling tired or having little energy," which was reported by 71.7% of the patients (N=154) (Table 2, Figure J).

Problems	Not at all, 0		Several days, 1		More than half the days, 2		Nearly everyday, 3	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Little interest or pleasure in doing things	108	50.2	69	32.1	22	10.2	16	7.4
Feeling down, depressed, or hopeless	98	45.6	59	27.4	32	14.9	26	12.1
Trouble falling or staying asleep, or sleeping too much	101	47	47	21.9	30	14	37	17.2
Feeling tired or having little energy	61	28.4	66	30.7	47	21.9	41	19.1
Poor appetite or overeating	134	62.3	40	18.6	21	9.8	20	9.3
Feeling bad about yourself or that you are a failure or have let yourself or your family down.	146	67.9	54	25.1	6	2.8	9	4.2
Trouble concentrating on things, such as reading the newspaper or watching television.	136	63.3	40	18.6	22	10.2	17	7.9
Moving or speaking so slowly that other people could have noticed or the opposite being so fidgety or restless that you have been moving around a lot more than usual.	128	59.5	45	20.9	24	11.2	18	8.4
Thoughts that you would be better off dead or hurting yourself in some way.	183	85.1	15	7	10	4.7	7	3.3

TABLE 2: The results of the PHQ-9 depression screening (N=215)

PHQ-9: Patient Health Questionnaire

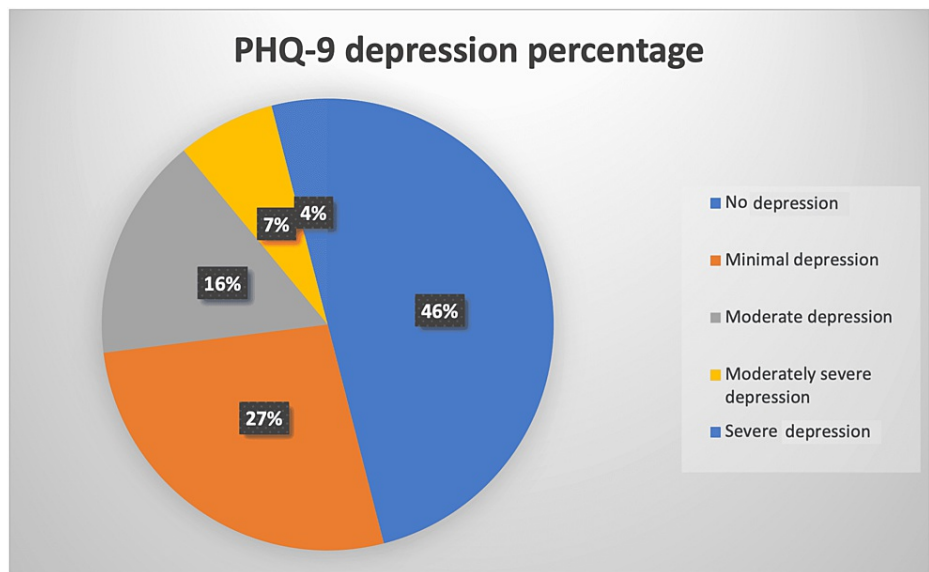


FIGURE 1: PHQ-9 depression percentage

PHQ-9: Patient Health Questionnaire

In terms of depression and its relationship to various sociodemographic characteristics of the participants, 60 males (49.2%) were found to be depressed, while 56 females (60.2%) were found to be depressed. Our findings revealed that there was no statistically significant relationship between age and depression ($p=0.746$). Moreover, non-employed and at least one diabetes-related complication were found to have a significant association with depression (64.9%, $p=0.016$ and 64.9%, $p=0.001$, respectively). Table 3 illustrates the association between sociodemographic factors and depression.

Variables		No depression, N (%)	Depression, N (%)	Odds ratio	p-Value
Age	18-40 years	5 (35.7%)	9 (64.3%)	1	-
	>40 years	94 (46.8%)	107 (53.2%)	0.351	0.147
Gender	Male	62 (49.2%)	62 (50.8%)	0.978	0.6
	Female	37 (39.8%)	56 (60.2%)	1	-
Nationality	Saudi	65 (51.3%)	61 (48.4%)	0.653	0.072
	Non-Saudi	34 (38.7%)	55 (61.8%)	1	-
Marital status	Married	84 (49.1%)	87 (50.9%)	0.814	0.375
	Widow	9 (33.3%)	18 (66.7%)	1.881	0.622
	Divorce	4 (36.4%)	7 (63.6%)	2.365	0.534
	Single	2 (33.3%)	4 (66.7%)	1	-
Employment	Employed	28 (57.1%)	21 (42.9%)	1	-
	Non-employed	33 (35.1%)	61 (64.9%)	0.866	0.016
	Retired	38 (52.8%)	34 (47.2%)	0.649	0.422
Education	University	35 (58.3%)	25 (41.7%)	0.523	0.066
	Secondary	27 (45%)	33 (55%)	1.229	0.699
	Primary	19 (46.3%)	22 (53.7%)	0.833	0.755
	Illiterate	18 (33.3%)	36 (66.7%)	1	-
Insulin	Yes	43 (43.3%)	71 (62.3%)	0.979	0.009
	No	56 (55.4%)	45 (44.6%)	1	-
Oral hypoglycemic	Yes	68 (51.9%)	63 (48.1%)	1.289	0.044
	No	31 (36.9%)	53 (63.1%)	1	-
Take the medications regularly	Yes	90 (46.4%)	104 (53.6%)	0.724	0.988
	No	9 (42.9%)	12 (57.1%)	1	-
Do you have diabetes-related complications?	Yes	40 (35%)	74 (64.9%)	0.848	0.001
	No	59 (58.4%)	42 (41.6%)	1	-
Do you have other related health problems?	Yes	47 (21.9%)	57 (26.5%)	0.991	0.915
	No	52 (24.2%)	59 (27.4%)	1	-

TABLE 3: Depression among type 2 diabetes patients (N = 215) in relation to their sociodemographic data

The results, as presented in Table 3 and Table 4, indicate that diabetes-related complications accounted for 64.9%, with cardiovascular disease being the most common, 72 participants of which 49 (68.1%) had depression. The findings suggest that there is a significant association between cardiovascular disease and depression ($p=0.005$). As for other medical conditions, hypertension (41%) was the most common among patients, followed by thyroid disease (6.5%) and colon cancer (1.9%).

Variables		No depression, N (%)	Depression, N (%)	Odds ratio	p-Value
Cardiovascular	Yes	23 (10.7)	49 (22.8%)	2.042	0.005
	No	76 (35.3)	67 (31.2%)	1	-

Diabetic foot	Yes	9 (4.2%)	22 (10.2%)	3,174	0.063
	No	90 (41.9%)	94 (43.7%)	1	-
Nephropathy	Yes	8 (3.7%)	21 (9.8%)	2,270	0.052
	No	91 (42.3%)	95 (44.2%)	1	-
Retinopathy	Yes	6 (2.8%)	19 (8.8%)	2,657	0.032
	No	93 (43.3%)	97 (45.1%)	1	-
Neuropathy	Yes	4 (1.9%)	7 (3.3%)	1,072	0.508
	No	95 (44.2%)	109 (50.7%)	1	-
Impotence	Yes	2 (0.9%)	1 (0.5%)	0.162	0.471
	No	97 (45.1%)	115 (53.5%)	1	-
Hypertension	Yes	39 (18.1%)	50 (23.3%)	1,597	0.681
	No	60 (27.9%)	66(30.7%)	1	-
Colon cancer	Yes	4 (1.9%)	0 (0.0%)	0.000	0.029
	No	95 (44.2%)	116 (54%)	1	-
Thyroid disease	Yes	6 (2.8%)	8 (3.7%)	1,289	1.000
	No	93 (43.3%)	108 (50.2%)	1	-
Lymphoma	Yes	1 (0.5%)	0 (0.0%)	123,113	0.278
	No	98 (45.6%)	116 (54%)	1	-
Prostate cancer	Yes	0 (0.0%)	1 (0.5%)	4,849	0.354
	No	99 (46%)	115 (53.5%)	1	-
BPH	Yes	2 (0.9%)	1 (0.5%)	0.717	0.471
	No	97 (45.1%)	115 (53.5%)	1	-
Colorectal cancer	Yes	1 (0.5%)	0 (0.0%)	0.000	0.278
	No	98 (45.6%)	115 (54%)	1	-
Cerebrovascular accident	Yes	0 (0.0%)	2 (0.9%)	9405	0.189
	No	99 (46%)	114 (53%)	1	-
Osteoporosis	Yes	0 (0.0%)	2 (0.9%)	4,201	0.189
	No	99 (46%)	114 (53%)	1	-
Pneumonia	Yes	1 (0.5%)	1 (0.5%)	0.337	0.910
	No	98 (45.6%)	115 (53.5%)	1	-
Pleural effusion	Yes	0 (0.0%)	3 (1.4%)	2359	0.107
	No	99 (46%)	113 (52.6%)	1	-
Hepatitis	Yes	0 (0.0%)	1 (0.5%)	2,706	0.354
	No	99 (46%)	115 (53.5%)	1	-
Glaucoma	Yes	0 (0.0%)	1 (0.5%)	0.089	0.354
	No	99 (46%)	115 (53.5%)	1	-
HBA1C	Normal	6 (8.2%)	2 (2.7%)	1	0.255
	High	35 (47.9%)	30 (41.1%)	2,571	-

TABLE 4: Prevalence of depression in relation to associated complications

Discussion

Relationship with depression

This study aimed to determine the prevalence of depression in patients with T2DM at KAUH in Jeddah and to identify potential risk factors for depression in these patients. The findings on the relationship between depression and diabetes control, on the other hand, are debatable. Several studies have looked into the bi-directional relationship between depression and diabetes [16]. Most of these studies suggest that depression is a significant cause of diabetes, rather than the other way around [17]. Depression raises the risk of type 2 diabetes by 60%, while diabetes only increases the risk of depression by a small amount [18]. Patients with diabetes, on the other hand, are more prone to develop depression, according to other studies. In diabetic individuals, a meta-analysis found a relationship between mental illness and hyperglycemia (type 1 and type 2) [19]. In addition, a systematic review and meta-analysis reported that individuals with type 2 diabetes have a slightly higher chance of getting depression [18].

Moreover, global estimates of the prevalence of depression and anxiety among patients with diabetes appear to vary by country. Although data from developing countries are scarce, studies from Asia report depression prevalence rates ranging from 17% to 44% and anxiety prevalence rates ranging from 4% to 58% [6,20-24]. The main finding of the present study was that more than half of the patients (54%) suffered from depression, which is higher than the numbers reported in previous studies conducted in other regions of Saudi Arabia, such as Qassim and Arar (38.4% and 37.4%, respectively) [25,26]. In addition, other studies in Bangladesh and India revealed that 61.9% and 87% of the participants had depressive symptoms, respectively, which are higher than the results of this study [20-30]. Different settings (primary versus secondary and tertiary healthcare centers) and participants' sociodemographic characteristics could explain the variation in depression prevalence.

Previous cross-sectional studies conducted in Saudi Arabia in 2017 and 2018 revealed that 34.8% and 34.7% of the participants experienced depression, respectively, with females being more likely to experience depressive symptoms [25,26]. Furthermore, in this study, the majority of the patients with type 2 diabetes had a high proportion of diabetes-related complications. Additionally, one or more complications were found to be significantly associated with depression in patients with type 2 diabetes ($p=0.001$). The findings are consistent with recent studies from other countries that found a link between depression and diabetes-related complications [29,30]. Cardiovascular disease was the most common medical condition among study participants, which was an independent factor for depression in people with diabetes in various other studies [30-32]. These findings suggest that living with a life-long chronic disease with complex symptomatology and multiple complications may lead to depression.

Moreover, a significant relationship was found between depression and participants' employment status. Consistent with Qassim's study, retired and unemployed participants, mainly consisted of older women who were housewives, reported lower levels of depression than employed individuals [25]. This could be because of the absence of work stress, as well as the provision of free health care systems, which enable patients to take good care of their health and maintain regular medication intake.

Factors associated with depression

The results revealed a significant association between exercise and depression, with the majority of patients with T2DM who did not exercise being more susceptible to depression than those who exercised. Patients who exercised had a one-third lower risk of depression than those who did not exercise (odds ratio {OR}=0.307, 95% CI: 0.167-0.562, $p=0.000$). In contrast, antidepressants and regular exercise helped prevent depressive symptoms, this finding is consistent with a study conducted in Jazan, Saudi Arabia, which found a close association between physical inactivity and depression; this can be explained by the fact that a sedentary lifestyle leads to depression [33]. Moreover, the findings suggest an association between patients with at least one diabetes-related complication and depression. Patients who had diabetes-related complications were twice as likely to develop depression than those who did not (OR=2.453, 95% CI: 1.384-4.349, $p=0.002$). This finding is consistent with that of recent studies conducted in other countries that have found a link between depression and diabetes-related complications [29,30].

Limitations

Conducting this study in one governorate and a relatively small study population limits generalizing study results. In addition, other factors such as a family history of depression or other psychiatric disorders and a previous diagnosis of depression must be considered when diagnosing the cases and monitoring disease progression. On the other hand, this study contributed new information about the prevalence of depression among type 2 diabetes patients and the link between diabetes complications and depression.

Conclusions

Our research aimed to determine the prevalence of depression among T2DM patients at KAUH in Jeddah, Saudi Arabia, and the risk factors that contribute to it. The primary outcome of our study was that more than half of the study participants (54%) were diagnosed with depression ranging from mild to severe, with the most associating risk factor for depression in these patients being diabetes-related complications, most notably, cardiovascular complications. Our findings also revealed significant associations between depression and lack of exercise, having at least one diabetes-related complication, and being employed. We recommend regular screening for depression in patients diagnosed with diabetes and exercise prescription at their regular visits. Furthermore, future research with larger sample sizes and control subjects is required to investigate the causes and outcomes of the increasing rates of psychological distress among Saudi patients with diabetes.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. Ethics Committee of King Abdulaziz University Hospital (KAUH) issued approval #223-21. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

The authors would like to thank all the patients who participated in the study. Authors' contributions - Bader Al Qusaibi, Hamza Fadel: development of study proposal and questionnaire, translation of questionnaire from English to Arabic, data collection, writing parts of the study. Abdulaziz Alariefy, Abdulaziz Alzubaidi, Basim Almalki, Loai Bahkali: development of study proposal and questionnaire, data collection, writing parts of the study. Hamza Fadel, Bader Al Qusaibi, Abdulaziz Alariefy, Abdulaziz Alzubaidi, Basim Almalki, Loai Bahkali: review of proposal and questionnaire, data analysis, interpretation of results, writing parts of the study, and final editing. Dr. Hala Mosli, Dr. Wid Kattan: review of the questionnaire, interpretation of results, final editing of the study.

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