Effect of Depression on Diabetes Self-Care in Type 2 Diabetes Patients at a Saudi Teaching Hospital: A Cross-Sectional Study

Ranya Alawy Ghamri, Maryam Abdulhamid Jabali

Department of Family Medicine, Faculty of Medicine, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia

Abstract

Aim: This study aimed to assess the relationship between depression and diabetes, especially with regard to diabetes self-care, treatment compliance, and preventive care. Materials and Methods: This is a cross-sectional survey of adult diabetes patients at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. The Patient Health Questionnaire-9 was used to assess depression. Results: A total of 346 patients were included: 266 (77%) women and 80 (23%) men. While 20/3465 (59%) patients were on oral hypoglycemic drugs (OHA), 71/346 (20%) were on OHA + insulin and 70/346 (20%) were on insulin alone ($P < 0.001$). On binary logistic regression analysis, Saudi ethnicity, female sex, and age 18–29 years were more likely to be associated with depression ($P < 0.001$). Patients receiving treatment with OHA alone, eating a healthy diet at least once a week, consuming five servings of fruits/vegetables at least once a week, complying with antidiabetic and antihypertensive treatment, and receiving retinal examination in the previous year were less likely to have depression. Conclusion: Depression in diabetes is more likely in patients of young age who do take care to eat a healthy diet or comply with advice regarding drug therapy, exercise, and follow-up examinations.

Keywords: Depression, diabetes mellitus, medication adherence, Patient Health Questionnaire, preventive care, self-care

Introduction

Depression is a major problem in patients with diabetes mellitus (DM), with the prevalence reported to be 15%–20% in diabetics versus 2%–9% in the overall population.[1] Depression is associated with poor self-care and therefore with increased risk of persistent hyperglycemia, diabetes-related complications, and mortality.[2-5] The dose–response relationship between depression and self-care attitudes has not been fully clarified.[6]

DM is an increasingly important global health concern.[7] In Saudi Arabia, rapid economic growth and changing lifestyles have resulted in a marked increase in the prevalence of DM over the last two decades.[8] According to a World Health Organization study, 890,000 Saudi citizens were diagnosed with diabetes in 2000, and the number is expected to exceed 2,523,000 in 2030. Diabetes and depression are both triggered by factors such as stress, sleep deprivation, sedentary lifestyle, and unhealthy eating habits.[9] Consequently, the possibility of both conditions occurring together is high.[10] Moreover, while a chronic illness such as diabetes could be a cause of depression, it is also true that depressed individuals are likely to have poor diabetes control because of poor compliance with treatment.[6-10] Research performed among diabetes patients indicates that major depression associated with diabetes is most probably diagnosed in patients with physical inactivity, unhealthy lifestyle, and much less commitment to medication.[10] Preventive care does not indicate distinctions between depressed and non-depressed patients.[11]

A previous study from the eastern province of Saudi Arabia supports the relationship between diabetes and depression,[12] but similar studies have not been conducted in Jeddah. The current study aimed to determine the relationship between...
depression and diabetes and examine how depression affected self-care in diabetes patients in Jeddah, Saudi Arabia.

**Materials and Methods**

This cross-sectional study was carried out from September 2018 to September 2019 at the Family Medicine Clinics of King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia. The Ethical Research Committee of the Faculty of Medicine, KAUH, approved the research (No. 366-17), and all patients provided written informed consent for participation in the study. Participation was voluntary, and the participants were free to quit the study at any time.

The study sample was randomly selected from among the patients attending the family medicine clinics. Adults (≥18 years old) of either sex who had been diagnosed with type 2 DM within the past few years were eligible for inclusion. Patients not taking antidiabetic medication and those with serious comorbidities such as uncontrolled hypertension or cardiovascular or renal failure were excluded from the study.

The study questionnaire was based on previous studies. It consisted of four parts: part one included questions on baseline demographics such as age, sex, weight, height, nationality, and educational status; parts two and three included queries on diabetes-related self-care activities in the past week (e.g., diet, compliance with medication, and preventive care); and part four contained the Patient Health Questionnaire-9 (PHQ-9) for assessing depression. The PHQ-9 diagnoses depression according to the DSM-IV criteria and also grades the severity of the depression. It contains nine items, each of which is scored on a scale of 0–3 (where 0 indicates “not at all” and 3 indicates “nearly every day”). Thus, the total score can range from 0 to 27, with scores of 1–9 denoting minimal-to-mild depression and 10–27 denoting moderate-to-severe depression. The incidence levels of depression in diabetic patients internationally were reported at 12% to 18%.

**Data analysis**

SPSS version 21 (IBM Corp., Armonk, NY, USA) was used for data analysis. Qualitative variables were summarized as frequencies and percentages and analyzed using the Chi-square test. Quantitative variables were summarized as the means (± standard deviation). Binary logistic regression was used to examine the association of different parameters with the PHQ-9 score. Statistical significance was at $P \leq 0.05$.

**Results**

A total of 346 patients were included in this study. Table 1 summarizes the characteristics of the patients. While 44/346 (12.7%) patients had mild depression, 49/346 (14.1%) had moderate-to-severe depression and 9/346 (2.6%) had severe depression. The majority of patients (244/346, 70%) were found to be at a minimal level of depression, and among these, 184/244 (75%) were females and 60/244 (25%) were males [Figures 1 and 2].

The PHQ-9 score was higher for underweight patients and obese patients than for normal-weight and overweight patients ($P = 0.017$). The PHQ-9 score was also higher for patients taking insulin alone or insulin plus Oral hypoglycemic agents (OHA) than for patients taking only OHA ($P < 0.001$; Table 1).

The PHQ-9 scores were statistically significantly lower for (1) patients reporting healthy eating at least once a week than for patients reporting less frequent healthy eating ($P < 0.001$); (2) patients reporting consumption of five servings of fruits/vegetables at least once a week than for patients with less frequent fruit/vegetable consumption ($P < 0.001$); and (3) patients who underwent microalbuminuria screening within the previous year than for those who did not undergo the screening ($P < 0.001$). The PHQ-9 scores were comparable between patients complying and not complying with lipid-lowering and antihypertensive treatment and between patients undergoing or not undergoing glycated hemoglobin (HbA1c) test or fundoscopic examination within the previous year [Table 1].

On binary logistic regression analysis, the factors significantly associated with the risk of depression included Saudi ethnicity, female sex, age 18–29 years, educational status, treatment with OHA alone, poor compliance with antihypertensive treatment, poor compliance with healthy eating advice (i.e., healthy eating at least once a week and five servings of fruits/vegetables at least once a week), and poor compliance with follow-up advice (i.e., failure to undergo fundoscopic examination, microalbuminuria screening, or HbA1c test at least once a year) [Table 2].

**Discussion**

This study aimed to determine the relationship between diabetes and depression in patients residing in Jeddah. Factors associated with depression included young age (18–29 years), female sex, education, treatment with OHA alone, poor dietary practices, poor compliance with antidiabetic or antihypertensive treatment, and failure to screen for potential complications (microalbuminuria and retinopathy).

A previous study found that compliance with diabetes treatment was worse in patients with severe depression than in those with milder disease (15% vs. 7%).

![Figure 1: Various levels of depression according to the Patient Health Questionnaire-9 among the study participants](image)
Table 1: Characteristics of the study participants

| Parameter                           | n (%)  | P     | PHQ-9 score | P     |
|-------------------------------------|--------|-------|-------------|-------|
| Age group (years)                   |        |       |             |       |
| 18-29                               | 23 (6.6)| 0.543 | 2.23±1.08   | 0.543 |
| 30-39                               | 151 (43.6)| 2.56±1.07 |
| 40-59                               | 155 (44.8)| 3.85±0.47 |
| ≥60                                 | 17 (4.9) | 3.34±0.45 |
| Sex                                 |        |       |             |       |
| Female                              | 80 (23.1)| 0.406 | 3.60±0.35   | 0.406 |
| Male                                | 266 (76.9)| 3.0±0.56  |
| Nationality                         |        |       |             |       |
| Non-Saudi                           | 158 (45.7)| <0.001| 3.46±0.48  | 0.999 |
| Saudi                               | 188 (54.3)| 3.46±0.38 |
| Education level                     |        |       |             |       |
| Uneducated                          | 83 (24) | 0.187 | 3.79±1.07   | 0.187 |
| Elementary school                   | 46 (13.3)| 3.56±0.74 |
| Intermediate                        | 45 (13) | 5.11±1.08 |
| Secondary school                    | 83 (24) | 2.78±0.55 |
| University                          | 89 (25.7)| 2.89±0.56 |
| BMI                                 |        |       |             |       |
| Underweight                         | 106 (30.6)| 0.04  | 7.22±2.4    | 0.017 |
| Normal weight                       | 155 (44.8)| 3.16±0.64 |
| Overweight                          | 59 (17.1)| 2.37±0.44 |
| Obese                               | 26 (7.5) | 4.10±0.48 |
| Treatment                           |        |       |             |       |
| Insulin alone                       | 70 (20.2)| <0.001| 5.67±0.82  | <0.001|
| OHA                                 | 205 (59.2)| 2.43±0.32 |
| OHA + insulin                       | 71 (20.5)| 4.25±0.76 |
| Part II: Diabetes self-care         |        |       |             |       |
| Healthy eating at least once weekly |        |       |             |       |
| No                                  | 152 (43.9)| 0.011 | 4.64±0.52   | <0.001|
| Yes                                 | 194 (56.1)| 2.53±0.33 |
| Five servings of fruits/vegetables at least once weekly |        |       |             |       |
| No                                  | 120 (34.7)| 0.003 | 4.96±0.61   | <0.001|
| Yes                                 | 226 (65.3)| 2.64±0.32 |
| High-fat foods ≥6 times weekly       |        |       |             |       |
| No                                  | 260 (75.1)| 0.276 | 3.37±0.34   | 0.611 |
| Yes                                 | 86 (24.9) | 3.37±0.65 |
| Physical activity for ≥30 min at least once weekly |        |       |             |       |
| No                                  | 189 (54.6)| 0.322 | 3.68±0.44   | 0.429 |
| Yes                                 | 157 (45.4)| 3.19±0.40 |
| Smoking                             |        |       |             |       |
| No                                  | 298 (86.1)| 0.073 | 3.36±0.31   | 0.447 |
| Yes                                 | 48 (13.9) | 4.04±0.97 |
| Test blood glucose less than once weekly |        |       |             |       |
| No                                  | 148 (42.8)| 0.061 | 3.35±0.44   | 0.753 |
| Yes                                 | 198 (57.2)| 3.54±0.41 |
| Feet checked less than once weekly  |        |       |             |       |
| No                                  | 195 (56.4)| <0.001| 3.62±0.42   | 0.459 |
| Yes                                 | 151 (43.7)| 3.16±0.43 |
| Part III: Medication compliance and preventive care |        |       |             |       |
| Compliance with antidiabetic medication |        |       |             |       |
| No                                  | 27 (7.8) | 0.879 | 4.29±1.2    | 0.427 |
| Yes                                 | 319 (92.2)| 3.39±0.31 |

Contd...
Table 1: Contd...

| Parameter                                                                 | n (%)   | P   | PHQ-9 score | P    |
|---------------------------------------------------------------------------|---------|-----|-------------|------|
| No                                                                        | 145 (41.9) | 0.041 | 3.18±0.49 | 0.442 |
| Yes                                                                       | 201 (58.1) |       | 3.62±0.38 |       |
| Compliance with antihypertensive treatment                                |         |     |             |      |
| No                                                                        | 166 (48.0) | 0.081 | 3.90±0.48 | 0.165 |
| Yes                                                                       | 180 (52.0) |       | 3.05±0.38 |       |
| HbA1c test within the last year                                           |         |     |             |      |
| No                                                                        | 74 (21.4) | 0.002 | 3.60±0.73 | 0.804 |
| Yes                                                                       | 272 (78.6) |       | 3.42±0.33 |       |
| Retinal examination within the last year                                  |         |     |             |      |
| No                                                                        | 132 (38.2) | 0.585 | 3.43±0.50 | 0.953 |
| Yes                                                                       | 214 (61.8) |       | 3.47±0.38 |       |
| Less than two fundoscopic examinations within the last 2 years (for patients with retinopathy) |         |     |             |      |
| No                                                                        | 243 (70.2) | 0.046 | 3.14±0.34 | 0.104 |
| Yes                                                                       | 103 (29.8) |       | 4.22±0.60 |       |
| Microalbuminuria test within the last year                                |         |     |             |      |
| No                                                                        | 149 (43.1) | 0.173 | 2.69±0.39 | 0.028 |
| Yes                                                                       | 197 (56.9) |       | 4.04±0.44 |       |

PHQ-9: Patient Health Questionnaire-9, BMI: Body mass index, OHA: Oral hypoglycemic agent, HbA1c: Glycated hemoglobin

Table 2: Binary logistic regression analysis showing the relationship of different parameters with Patient Health Questionnaire-9 score

| Parameter                                                                 | OR     | 95% CI       | P   |
|---------------------------------------------------------------------------|--------|--------------|-----|
| Age group (years)                                                         |        |              |     |
| ≥60                                                                       | 1      |              |     |
| 18-29                                                                     | 1.116  | 0.599-2.080  | <0.001 |
| 30-39                                                                     | 0.243  | 0.029-2.040  | 0.193 |
| 40-59                                                                     | 0.683  | 0.179-2.604  | 0.576 |
| Sex                                                                       |        |              |     |
| Male                                                                      | 1      |              |     |
| Female                                                                    | 1.466  | 0.663-3.242  | <0.001 |
| Nationality                                                               |        |              |     |
| Non-Saudi                                                                 | 1      |              |     |
| Saudi                                                                     | 1.336  | 0.732-2.437  | <0.001 |
| Education                                                                 |        |              |     |
| Elementary school                                                         | 1      |              |     |
| Intermediate                                                             | 1.569  | 0.561-4.389  | <0.001 |
| Uneducated                                                                | 2.074  | 0.771-5.578  | <0.001 |
| Secondary school                                                         | 1.409  | 0.542-3.662  | <0.001 |
| University                                                                | 1.159  | 0.459-2.930  | <0.001 |
| Treatment                                                                 |        |              |     |
| Insulin alone                                                             | 1      |              |     |
| OHA alone                                                                 | 2.027  | 0.898-4.572  | <0.001 |
| OHA + insulin                                                            | 0.532  | 0.257-1.101  | 0.089 |
| Part II: Diabetes self-care                                               |        |              |     |
| Healthy eating at least once weekly                                       |        |              |     |
| No                                                                        | 1      |              |     |
| Yes                                                                       | 1.556  | 0.790-3.066  | <0.001 |
| Five servings of fruits/vegetables at least once weekly                    |        |              |     |
| No                                                                        | 1      |              |     |
| Yes                                                                       | 2.460  | 1.247-4.853  | 0.009 |
| High-fat food ≥6 times weekly                                             |        |              |     |

Contd...
Recent research has shown that depressed individuals have a high risk of diabetes (relative risk: 1.60) and, conversely, that diabetes can increase the risk of depression.\[16\] A prospective research examined significant depression-related variables at a 5-year follow-up in diabetic patients. With baseline minor and major depression with diabetes, the number of symptoms of cancer, and one or more cardiovascular processes during the 5-year follow-up were autonomous predictors of significant depression at this 5-year time point.\[17\] Several studies show that depression in diabetes is associated with increased risk of mortality.\[18-21\] It is likely that depression and diabetes act synergistically to increase mortality risk. Egede et al., for example, found that the all-cause mortality was 1.88 times higher in patients with diabetes alone and 2.50 times higher in patients with both diabetes and depression.\[22\] Interestingly, Katon et al. described higher prevalence of microvascular and macrovascular complications (36% and 24%, respectively) in patients with diabetes and comorbid depression than in patients with diabetes alone.\[23\] The above findings are consistent with our finding that major depression was associated with noncompliance with medications.

In our study, 29.4% of the patients had depression. This was lower than the 37.6% prevalence reported in a previous study. In the latter study, depression was not associated with age, gender, or eye complication.\[24\] In another study, the factors associated with depression included patient’s sex, marital status, family history of depression, HbA1c and fasting blood glucose levels, insulin therapy, number of nondiabetes-related

| Parameter                                                      | OR  | 95% CI   | P    |
|---------------------------------------------------------------|-----|----------|------|
|                                                              |     |          |      |
|                                                              |     | Lower    | Upper|
| Physical activity ≥30 min at least once weekly                |     | 0.750    | 1.457| 0.396|
|                                                              |     | 1.032    | 1.884| 0.919|
| Smoking                                                      |     | 1.269    | 2.971| 0.583|
| Blood glucose test less than once weekly                     |     | 0.804    | 1.518| 0.501|
| Foot care less than once weekly                               |     | 0.000    | 0.000| 0.999|
| Compliance with antidiabetic medication                       |     | 2.035    | 5.469| <0.001|
| Compliance with lipid-lowering medication                    |     | 0.737    | 1.453| 0.378|
| Compliance with antihypertensive treatment                   |     | 1.396    | 2.627| 0.049|
| HbA1c test within the last year                               |     | 1.322    | 2.869| 0.480|
| Retinal examination within the last year                     |     | 2.089    | 4.499| <0.001|
| Less than two fundoscopic examinations within the past 2 years (among patients with retinopathy) |     | 0.383    | 0.806| 0.011|
| Microalbuminuria test within the last year                   |     | 0.384    | 0.752| 0.005|

PHQ levels 1-9 (minimal to mild) and 10-27 (moderate to severe) were used to calculate OR. P≤0.05 denotes a statistically significant result. PHQ-9: Patient Health Questionnaire-9, OHA: Oral hypoglycemic agent, HbA1c: Glycated hemoglobin, OR: Odds ratio, CI: Confidence interval.
drugs, compliance with therapy, and presence of diabetic complications. [25] These findings are largely similar to our results. Hussain et al. reported 38% prevalence of depression in diabetic patients, with the depression often associated with the presence of diabetic complications. [26] A Saudi study reported a low level of self-care management, and importantly, patients >50 years were more likely to take appropriate care by themselves with females being more likely to take necessary self-care, educated patients were more likely to take the proper care of themselves. [27]

**Limitations of the study**

The limitations of this study include small sample size and possible observer and selection bias.

**Conclusion**

Older age, poor dietary practices, poor compliance with medication, lack of regular exercise, and irregular follow-up examinations are associated with depression in diabetes patients in Saudi Arabia. Further studies are necessary to investigate the causal relationship between diabetes and depression.

**Financial support and sponsorship**

Self-funded.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Young-Hyman D, de Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial care for people with diabetes: A position statement of the American Diabetes Association. Diabetes Care 2016;39:2126-40.
2. Kirkman MS, Briscoe VJ, Clark N, Florez H, Haas LB, Halter JB, et al. Diabetes in older adults. Diabetes Care 2012;35:2650-64.
3. Moulton CD, Pickup JC, Ismail K. The link between depression and diabetes: The search for shared mechanisms. Lancet Diabetes Endocrinol 2015;3:461-71.
4. Fisher L, Gonzalez JS, Polonsky WH. The confusing tale of depression and distress in patients with diabetes: A call for greater clarity and precision. Diabet Med 2014;31:764-72.
5. Ahola AJ, Groop PH. Barriers to self-management of diabetes. Diabet Med 2013;30:413-20.
6. Hermanns N, Caputo S, Dzida G, Khunti K, Meneghini LF, Snoek F. Screening, evaluation and management of depression in people with diabetes in primary care. Prim Care Diabetes 2013;7:1-10.
7. Alothabi A, Perry L, Gholizadeh L, Al-Ganmi A. Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. J Epidemiol Glob Health 2017;7:211-8.
8. Albarrak AI, Mohammed R, Assery B, Allam D, Morit SA, Saleh RA, et al. Evaluation of diabetes care management in primary clinics based on the guidelines of American Diabetes Association. Int J Health Sci (Qassim) 2018;12:40-4.
9. El-Shaﬁe TM, El-Saghir EO, Ramadan IK. Depression among type 2 diabetic patients. Egypt J Hosp Med 2011;44:258-72.
10. Holt RI, de Groot M, Golden SH. Diabetes and depression. Curr Diab Rep 2014;14:491.
11. Semenkovich K, Brown ME, Sravkic DM, Lustman PJ. Depression in type 2 diabetes mellitus: Prevalence, impact, and treatment. Drugs 2015;75:577-87.
12. El Mahallly AA. Prevalence and predictors of depression among Type 2 diabetes mellitus outpatients in Eastern Province, Saudi Arabia. Int J Health Sci (Qassim) 2015;9:119-26.
13. Lin EH, Katon W, Von Korff M, Rutter C, Simon GE, Oliver M, et al. Relationship of depression and diabetes self-care, medication adherence, and preventive care. Diabetes Care 2004;27:2154-60.
14. Roy T, Lloyd CE. Epidemiology of depression and diabetes: A systematic review. J Affect Disord 2012;142 Suppl: S8-21.
15. Ciechanowski PS, Katon WJ, Russo JE. Depression and diabetes: Impact of depressive symptoms on adherence, function, and costs. Arch Intern Med 2000;160:3278-85.
16. Mezuk B, Eaton WW, Albrecht S, Golden SH. Depression and type 2 diabetes over the lifespan: A meta-analysis. Diabetes Care 2008;31:2383-90.
17. Katon W, Russo J, Lin EH, Heckbert SR, Ciechanowski P, Ludman EJ, et al. Depression and diabetes: Factors associated with major depression at five-year follow-up. Psychosomatics 2009;50:570-9.
18. Park M, Katon WJ, Wolf FM. Depression and risk of mortality in individuals with diabetes: A meta-analysis and systematic review. Gen Hosp Psychiatry 2013;35:217-25.
19. Abi Khalil C, Roussell R, Mohammeci K, Danchin N, Marre M. Cause-specific mortality in diabetes: Recent changes in trend mortality. Eur J Prev Cardiol 2012;19:374-81.
20. Snoek FJ, Bremmer MA, Hermanns N. Constructs of depression and distress in diabetes: Time for an appraisal. Lancet Diabetes Endocrinol 2015;3:450-60.
21. Black SA, Markides KS, Ray LA. Depression predicts increased incidence of adverse health outcomes in older Mexican Americans with type 2 diabetes. Diabetes Care 2003;26:2822-8.
22. Egede LE, Nietert PJ, Zheng D. Depression and all-cause and coronary heart disease mortality among adults with and without diabetes. Diabetes Care 2005;28:1339-45.
23. Katon W, Fan MY, Unützer J, Taylor J, Pincus H, Schoenbaum M. Depression and diabetes: A potentially lethal combination. J Gen Intern Med 2008;23:1571-5.
24. Albasheer OB, Mahfous MS, Solan Y, Khan DA, Muqri MA, Almutairi HA, et al. Depression and related risk factors among patients with type 2 diabetes mellitus, Jazan area, KSA: A cross-sectional study. Diabetes Metab Syndr 2018;12:117-21.
25. Aljuaid MO, Almutairi AM, Assiri MA, Almalki DM, Alswat K. Depression and diabetes: A meta-analysis and systematic review. Diabetes Metab Syndr 2013;7:217-25.
26. Alotaibi A, Perry L, Gholizadeh L, Al-Ganmi A. Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. J Epidemiol Glob Health 2017;7:211-8.
27. Holt RI, de Groot M, Golden SH. Diabetes and depression. Curr Diab Rep 2014;14:491.

Figure 2: Gender-wise comparison of different categories of depression according to the Patient Health Questionnaire-9