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Prevalence of depression in adults with type 2 diabetes mellitus and associated factors

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Abstract

Introduction: People with type 2 diabetes can suffer psychological disorders such as depression, which affect their physical, mental, and emotional state. **Objective**: The aim of this study to identify the prevalence of depression and factors associated with depressive symptoms in adults with type 2 diabetes. **Material and methods**: Cross-sectional study in 155 adults with type 2 diabetes from Mexico City. Sociodemographic, anthropometric, clinical, diet and habits characteristics were evaluated. Depressive symptoms were measured with the Zung Self-Rating Depression Scale. Logistic regression analysis was performed.

Results: The prevalence of depressive symptoms was 29.7%. The associated factors were physical inactivity, living alone, a lower educational level, hypertension, hyperglycemia, and the duration of diabetes. The risk of having depressive symptoms was 2.1 (95% CI 1.0 - 4.7) with glucose values ≥130 mg / dL, 3.6 (95% CI 1.2-11) for hypertension, 3.5 (95% CI 1.3-9.5) when living alone and 2.9 (CI95% 1.3-6.4) due to physical inactivity.

Discussion: The factors associated with depression in patients with T2D were hyperglycemia, hypertension, longer duration of diabetes, a lower educational level and living alone. Blood glucose concentrations and longer duration of diabetes in years were the variables that explained a higher score for depressive symptoms.

Conclusions: Lack of recognition of depressive symptoms or late detection leads to complications of diabetes. These patients require adequate health education, with support to develop self-care and emotional adjustment strategies against depression.

Keywords: *Depressive symptoms, type 2 diabetes, sociodemographic factors, hyperglycemia, habits*

Introduction

Type 2 diabetes mellitus (T2DM) is a condition commonly accompanied by psychological alterations that affect the physical, mental, and emotional state, the most frequent being anxiety and depression[1,2]. The prevalence of depressive symptoms ranges from 20 to 82% in patients with T2DM[3-6] causing greater loss of health, increased functional disability, and reduced life expectancy.[7]

In the 2018 *National Health and Nutrition Survey*, 10.3% of the adult population had T2DM, out of 82.7 million people over 20 years of age[8]. The frequency of depression in individuals with T2DM in Mexico was 44.6%[3] while, in the general population, depression is 4.8%.[9]

People with diabetes and depression maintain poor self-care and metabolic control[10-13]. In addition, they have low therapeutic compliance, do not follow a correct diet, and do little physical activity[6,14]. Weikert et al. mention that depression is a result of the psychosocial burden of having T2DM and that the presence of depressive symptoms is related to an excessive burden of disease; they found that depression was higher in people with a diagnosis of T2DM[15]. The coexistence of depressive symptoms and diabetes is associated with increased morbidity and mortality rates[16], as well as increased healthcare costs[7]. The average healthcare expenditure for patients with diabetes and depression is four times higher than for those without.[11]

It has been found that the risk factors for the development of depression in the T2DM population are associated with comorbidities such as macrovascular and microvascular diseases, a longer evolution time of T2DM, being sedentary or having little physical activity and increased blood lipids, in addition to sociodemographic risk factors such as being female, single, unemployed, living alone, low educational and socioeconomic levels[12,14,17,18]. Early intervention of depressive signs once diagnosed in patients with T2DM[3], is useful since 40% of them begin to manifest within the first five years[19]. The purpose of the research was to identify the prevalence of depression and factors associated with depressive symptoms in the adult population with type 2 diabetes mellitus.

Material and methods

This is an analytical cross-sectional study, conducted in an urban area of Mexico City. The participants were patients older than 20 years of age, of both sexes, who attended the health center in the Tlalpan district, with a previous diagnosis of type 2 diabetes mellitus, and agreed to participate in the study. Consecutive convenience sampling was performed. The sample size was calculated by estimating a proportion for a finite population. The information was collected after explaining to the adults what the project consisted of and obtaining their signatures on the informed consent letter. A questionnaire was applied that included information about sex, age, marital status, whether they lived alone, education, occupation, and time of evolution of the disease in years. The following variables were considered in the description of the population: 1) age, grouped into those under 50 years, 50 to 60 years, and over 60 years; 2) marital status, classified as single, married, and living alone; 3) education in three categories: no studies, basic and higher; and 4) occupation, into employed, unemployed and without pension. Another category to be considered was habits: 1) Alcohol consumption, 2) Smoking, and 3) Physical inactivity. To determine the state of nutrition and health, anthropometric (weight, height, and waist circumference), biochemical (blood glucose), clinical (blood pressure), and dietary (calories and macronutrients) measurements were taken, as well as psychological tests. Weight was measured using a TANITA UM-061 electronic floor scale with an accuracy of 100 g, weighed with minimal clothing and without shoes. Height was measured using a SECA 206 stadiometer with an accuracy of 1 mm, standing upright and without shoes. Anthropometric procedures were performed in a standardized manner using the techniques described by Lohman[20].

Personnel was standardized according to Habicht's method[21]. To evaluate cardiovascular risk, waist circumference was obtained because it is an easy and useful tool in overweight and obese patients[22] with the following cut-off points by sex: ≥90 cm in men and ≥ 80 cm in women, according to the classification of NOM-043-SSA2-2012.[23] This was measured with a SECA 201 fiberglass tape with an accuracy of ± 0.1 cm, taking into account the midline on both sides of the body between the lower costal edge and the upper edge of the iliac crest. With the weight and height, the body mass index (BMI) was calculated by dividing the weight by the squared height, using the reference standards of the official Mexican standard NOM-043-SSA2-2012[23]. A biochemical evaluation was performed to determine fasting capillary glucose values using an ACCU-CHEK brand glucometer, as well as test strips of the same brand. Patients were classified as having hyperglycemia when they presented glucose values ≥ 130 mg/dL[24]. Blood pressure was measured with an OMRON model HEM-781INT digital blood pressure monitor. The participant was asked to be seated and quiet for a minimum time of 5 minutes before the measurement. Arterial hypertension was considered when the systolic blood pressure (SBP) was ≥130 mmHg and the diastolic blood pressure (DBP) was ≥80 mmHg[25].

To quantify energy intake and the distribution of macronutrients and fiber, the 24-hour recall survey was applied. The energy calculation, macronutrient distribution, and the amount of fiber consumed were performed using the recipe and nutritional calculation systems program (SCVAN) of the Department of Applied Nutrition and Nutritional Education of the *National Institute of Medical Sciences and Nutrition Salvador Zubirán*.[26]

Among the psychological tests, the Miller and Smith stress vulnerability scale[27], an internationally validated instrument that includes 20 items, was applied. The cut-off points were: <30, not vulnerable to stress; 30 to 49, vulnerable to stress; 50-75, seriously vulnerable to stress; and >75, extremely vulnerable to stress. For the detection of depressive symptoms, the Zung depression scale[28] was used, which is composed of 20 items, the scores range from 20-80 and the cut-off points: <35, no risk of depressive symptoms; 36-51, mild risk of depression; 52-68, moderate risk of depression and over 69, severe risk of depression, according to Conde et al.[29]

Statistical analysis

Descriptive statistics were performed using measures of central tendency and dispersion for quantitative variables and percentages for categorical variables. For the comparison of quantitative variables in two independent groups (depressive symptoms), the nonparametric Mann-Whitney "U" test was used. To relate depressive symptoms with sex, nutritional status, cardiovascular risk, vulnerability to stress, sociodemographic, and clinical variables, Pearson's $\chi 2$ test was used. A logistic regression analysis was performed, with the dependent variable being depressive symptoms, as a nominal variable and classifying it as with and without depressive symptoms. The model was multivariate and adjusted for the following covariates: arterial hypertension, living alone, physical inactivity, and glucose ≥ 130 mg/dL. The Hosmer-Lemeshow goodness-of-fit test was used. Statistically significant differences were considered to exist when $p<0.05$. The analysis was performed with the SPSS statistical package version 21.0 for Windows.[30]

Ethical considerations

The research was approved by the research and ethics committee of the *National Institute of Medical Sciences and Nutrition Salvador Zubirán*.

Results

A total of 155 adult men and women with a diagnosis of T2DM were studied, of whom 126 (81.3%) were women, with an age range of 22 to 87 years and a median of 63 years. The prevalence of depressive symptoms was 29.7%, being higher in women (30.7%). 94.8% of adults had a vulnerability to stress, being higher in those with depressive symptoms (97.8%) but no statistically significant association was found ($p = 0.275$) (Table 1).

Table 2 shows that the combined prevalence of overweight was 75% (overweight 38.5% and obese 36.5%). Cardiovascular risk was 80.6%, hypertension 78.3%, and hyperglycemia 51%. The time of evolution with T2DM was from recent diagnosis up to 45 years, the period with disease progression being longer in people with depressive symptoms (15 *vs.* 7 years). People with T2DM and depressive symptoms presented more arterial hypertension and blood glucose values above 130 mg/dL with a statistically significant difference of $p<0.05$. The median blood glucose concentrations of adults with these alterations were higher (160 *vs.*126 mg/dL) with a $p<0.014$. No statistically significant difference was found in energy, macronutrients, and fiber intake for having or not having depressive symptoms.

When evaluating the relationship between the different variables with depressive symptoms (Table 3), a model was obtained in which it was observed that an increase in blood glucose concentrations and the time of evolution in years are the variables that explain a higher score of depressive symptoms.

The variable most associated with depressive symptoms was having arterial hypertension (OR 3.6); CI 1.2-11; $p=0.027$, followed by living alone (OR 3.5); CI 1.3-9.5; $p=0.014$, physical inactivity (OR 2.9); CI 1.3-6.4; $p=0.007$ and glucose above 130 mg/dL (OR 2.1); 95% CI 0.99-4.7; $p=0.054$ model with Hosmer Lemeshow test=0.809 (Table 4).

Discussion

In our study, no significant difference was found between depressive symptoms by sex, but it was higher in women and this may be due to social, cultural, biological, hormonal, and personality factors, which is consistent with other studies.[4,5,6,31]

Physical inactivity was found to be associated with the presence of depressive symptoms in people with T2DM. Holt et al. report that people with depression are more likely to be sedentary and to eat diets rich in saturated fats and refined sugars[13]. Salinero et al. mention that being sedentary is a factor in generating depression.[5]

The condition of living alone is associated with depressive symptoms in this study, Roy and Wu[7,14] mention that patients with this characteristic present a higher risk of depression. Having T2DM, depressive symptoms, and living alone are associated, affecting interpersonal behavior and causing social isolation, and disconnection from important activities including self-care, which has been related to hyperglycemia and diabetes complications.[10]

A statistically significant difference was also found for those with no education versus those with a better level of education, similar to other studies, in which there was an association between depression and lower educational level.[5,17]

Arterial hypertension is also associated with depressive symptoms and may be due to physiological mechanisms involving the effects of the sympathetic nervous system, such as an elevation of noradrenaline and adrenaline[32], which increases endothelial resistance, cardiac output, and renin release leading to an increase in blood pressure.[33]

An association was found between depression and elevated serum glucose values (≥ 130 mg/dL), a result consistent with that reported in the literature, where depression has been shown to cause hyperglycemia and poor metabolic control[11]. Roy and Weber[7,34] reported that high fasting insulin values, elevated 2-hour glucose concentrations, and insulin resistance are significantly associated with higher depression scores.

The time of evolution in years explains a higher score of depressive symptoms. It has been found that people with T2DM with a longer duration of the disease present chronic stress, demand greater self-care attention, and must receive treatment for comorbidities, which causes greater depression.[11]

One of the limitations of the study is that, since it was a cross-sectional study, it was not possible to establish causality, and prospective studies are required to determine the role of the different

Table 1. Characteristics of the population with T2DM

Variables	Total population N=155 n (%)	Depressive symptoms		P
		Si n=46 n (%)	No n=109 n (%)	
Characteristics of the population				
Women	126 (81.3)	39 (84.8)	87 (79.8)	0.469
Men	29 (18.7)	7 (15.2)	22 (20.2)	
Age groups				
< 50 years	23 (14.8)	7 (15.2)	16 (14.7)	0.78
50-60 years	36 (23.2)	9 (19.6)	27 (24.8)	
> 60 years	96 (61.9)	30 (65.2)	66 (60.6)	
Marital status				
Singles	70 (45.2)	24 (52.2)	46 (42.2)	0.254
Married	85 (54.8)	22 (47.8)	63 (57.8)	
Living alone	26 (16.8)	12 (26.1)	14 (12.8)	0.044 [a]
Education				
No education	21 (13.6)	11 (23.9)	10 (9.3)	0.040 [a]
Basic	104 (67.5)	29 (63.0)	75 (69.4)	
Higher	29 (18.8)	6 (13.0)	23 (21.3)	
Occupation				
Employee	37 (23.9)	11 (23.9)	26 (23.9)	0.994
Unemployed	118 (76.1)	35 (76.1)	35 (76.1)	
No pension	47 (30.3)	15 (32.6)	32 (29.4)	0.687
Habits				
Alcohol consumption	52 (33.5)	17 (37.0)	35 (32.1)	0.559 [a]
Smoking	51 (32.9)	19 (41.3)	32 (29.4)	0.148 [a]
Physical inactivity	66 (42.6)	26 (56.5)	40 (36.7)	0.023 [a]
Vulnerability to stress	147 (94.8)	45 (97.8)	102 (93.6)	0.275

[a] Test x^2
IQR= interquartile range

Table 2. Distribution of nutritional, anthropometric, clinical, and dietary variables in the population with T2DM

Variables	Total population n= 155	Depressive symptoms		P
		Si n=46 n (%)	No n=109 n (%)	
Nutritional status and health				
Overweight and obesity	116 (75.0)	34 (73.9)	82 (75.2)	0.863 a
Cardiovascular risk	125 (80.6)	39 (84.8)	86 (78.9)	0.397 a
Arterial hypertension	119 (78.3)	40 (88.9)	79 (73.8)	0.040 a
Hyperglycemia	78 (51.0)	30(65.2)	48 (44.9)	0.021 a
	Median (IQR)			
Age (years)	63 (54-71)	63.5 (56-69.5)	62 (54-71)	0.665 b
Anthropometrics and clinical				
BMI (kg/m)2	27.9 (25.0-31.6)	27.7 (24.9-30.8)	27.9 (25.0-31.9)	0.338 b
Waist circumference (cm)	93 (86.0-99.0)	92 (86.8-97.0)	93.5 (85.0-100.2)	0.380 b
Glucose (mg/dl)	132 (109.8-165.0)	160 (112.2-218.0)	126 (108.0-154.0)	0.014 b
SBP (mm/Hg	130 (114.0-140.0)	130 (120.0-140.0)	125 (110.0-141.5)	0.099 b
DBP (mm/Hg)	80 (70.0-80.8)	80 (72.5-90.0)	80 (70.0-80.0)	0.060 b
Dietetics				
Caloric intake (kcal/day)	1379 (1139.3-1675.8)	1348.5 (1110.2-1606.2)	1427 (1141-1715)	0.348 b
Protein (%)	17.2 (14.3-20.0)	17.7 (15.0-20.1)	17 (14.1-20.0)	0.223 b
Carbohydrates (%)	53.7 (47.0.-60.0)	52.8 (44.8-59.5)	54.8 (47.4-61.4)	0.304 b
Lipids (%)	29.8 (24.0-35.6)	30.9 (25.0-35.4)	29 (23.3-35.9)	0.686 b
Fiber adequacy (%)	35.6 (23.6-67.4)	33.0 (20.1-63.6)	35.8(27.6-72.2)	0.554 b
Evolution of the disease (years)	10 (3-17)	15 (4-20)	7 (3-15)	0.009 b
a Test X2 b Mann-Whitney U test IQR= interquartile range				

Table 3. Linear regression for presenting depressive symptoms in the population with T2DM

Variable	Beta	Standar error	Interval	p
Blood glucose (mg/dL)	0.037	0.017	0.003-0.071	0.034
Time of evolution (years)	0.185	0.093	0.001-0.368	0.048

R= 0.259 R^2 corrected = 0.054

Table 4. Odds ratio and confidence intervals (95% CI) of presenting depressive symptoms

Variables	Beta	OR	IC 95%	p[a]	Hosmer-Lemeshow test	R^2 de Nagelkerke
Hipertensión arterial	1.27	3.6	1.2-11	0.027	0.89	0.187
Vivir solo	1.25	3.5	1.3-9.5	0.014		
Inactividad física	1.1	2.9	1.3-6.4	0.007		
Glucosa ≥ 130 mg/dL	0.77	2.1	0.99-4.7	0.054		

[a] Prueba X^2 de Mantel-Haenszel
OR= Odds ratio
IC 95%= Intervalo de confianza

factors associated with depression and T2DM; however, it does provide information for public health interventions by identifying related variables. A second limitation was not having glycosylated hemoglobin data, which would have allowed the evaluation of glycemic control. A third limitation was not having a descriptive analysis of comorbidities and complications of T2DM.

Conclusions

Lack of recognition of depressive symptoms or late detection leads to poor control of diabetes, which affects the quality of life of the patients and their families, increasing the need for more hospital care and, as a consequence, increasing healthcare costs. Patients with diabetes require adequate health education, with support to develop strategies for self-care and emotional adjustment against distress, depression, and anxiety, allowing them to have better metabolic control and quality of life.

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Declaration of conflicts of interest

The authors declare that they have no conflicts of interest.

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Artículo sin conflicto de interés