Research Article

Prevalence of Depression and Suicide Risk among Maya Adults with Type 2 Diabetes

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Abstract

Background: Major depressive disorder (MDD) is a prevalent psychiatric condition that often coexists with neurological and metabolic diseases, significantly affecting prognosis and survival. MDD is a well-recognized risk factor for suicide, with the state of Yucatán ranking among the highest in Mexico. The Yucatán population, characterized by a unique ancestral Mayan genetic background, represents a relevant group for investigating mental health determinants. Depressive episodes in patients with T2D have been associated with inadequate metabolic control, increased complications, and reduced life expectancy among the economically active population. Methods: A descriptive, comparative, cross-sectional study was conducted among 155 adult Maya-mestizo patients attending the High Specialty Regional Hospital of the Yucatán Peninsula (HRAEPY). All participants had T2D. Data were presented as frequencies and compared using the Chi-square test (χ^2). Statistical analyses were performed with SPSS version 21.

Results: Among the 155 participants with diabetes, 59% met diagnostic criteria for depression. The mean age was 49 years, with females comprising 69.4% of the sample. Severe suicide risk was identified in 16.1% of participants. A total of 20.6% of participants declared poor pharmacological adherence. Within this subgroup, 44.6% presented depressive symptoms (16.2% were receiving antidepressant treatment), and 32.4% showed suicidal risk (24.3% mild and 8.1% severe).

Conclusion: Depression and high suicide risk were highly prevalent among Maya-mestizo patients with T2D. These findings underscore the need for systematic mental health screening in vulnerable ethnic populations with metabolic disorders to improve clinical outcomes and quality of life.

Introduction

Major depressive disorder (MDD) is one of the most prevalent and disabling psychiatric disorders worldwide. It is characterized by persistent sadness, anhedonia, fatigue, cognitive impairment, and disturbances in sleep and appetite that significantly affect social and occupational functioning. Global estimates suggest a lifetime prevalence of 10–15%, with annual rates of approximately 7%. Notably, the disorder shows strong demographic gradients: it is nearly twice as common in women as in men and peaks in early adulthood [1]. Depression is not only a mental-health challenge but a major determinant of physical health outcomes, given its established association with chronic non-communicable diseases such as diabetes, cardiovascular disease, and neurodegenerative disorders.

In Mexico, depression represents a major contributor to disability-adjusted life years (DALYs) due to mental and behavioral disorders.

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Major depressive disorder; Type 2 diabetes; Suicide risk; Maya population; Metabolic disorders

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National surveys have estimated that around 7–8% of adults experience a major depressive episode each year, second only to alcohol-use disorders in prevalence [2]. Data from the 2021 Encuesta Nacional de Bienestar Autorreportado (ENBIARE) revealed regional disparities, with Yucatán, Campeche, and Quintana Roo showing some of the highest self-reported rates of depressive symptoms nationwide (16.7%, 14.7%, and 11.5%, respectively) [3]. These same states also report elevated suicide mortality, particularly among young adults. According to official vital-statistics data, Yucatán and Campeche consistently rank among the top three Mexican states in suicide rates, with approximately 23.5 and 18.8 deaths per 100,000 inhabitants aged 15–29 years, respectively [4]. This convergence of high depression prevalence and suicide risk highlights an urgent need for mental-health research and intervention in the Yucatán Peninsula.

The population of Yucatán possesses a distinctive genetic and cultural heritage, with a substantial proportion of individuals of Maya ancestry. Genetic admixture analyses have demonstrated unique ancestral components that may influence both metabolic and neuropsychiatric phenotypes [5]. This distinctive background, combined with socioeconomic disparities and limited access to specialized psychiatric services, may contribute to an increased vulnerability to depression and its consequences. Furthermore, the coexistence of chronic metabolic diseases, particularly T2D, adds a complex biomedical dimension to this regional burden.

T2D is a chronic metabolic disorder of multifactorial origin characterized by insulin resistance, β-cell dysfunction, and persistent hyperglycemia. Mexico ranks among the countries with the highest prevalence of T2D globally; estimates indicate that approximately 12.8% of the adult population is affected, with many cases remaining undiagnosed (5.8%) [6,7]. In Yucatán, data from the Encuesta Nacional de Salud y Nutrición (ENSANUT 2018) report a prevalence of 9.2% among adults aged ≥20 years, higher in women (11%) than in men (7.2%). The chronicity of T2D, frequent complications, and the demands of lifelong self-management impose a significant psychological burden, predisposing patients to depression, anxiety, and other emotional disturbances.

A robust body of evidence supports a bidirectional relationship between T2D and depression. Meta-analyses have shown that individuals with diabetes have nearly twice the risk of developing depression compared with non-diabetic controls, while depression itself increases the risk of incident diabetes by approximately 60%; globally, about 28% of patients with type 2 diabetes experience some degree of depression, and 14.5% meet criteria for major depressive disorder [8-10]. Pathophysiological mechanisms proposed for this interaction include dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis, systemic inflammation (elevated interleukin-6 and tumor necrosis factor-α), autonomic nervous system imbalance, and metabolic alterations linked to insulin resistance. Behavioral factors such as physical inactivity, poor dietary adherence, and reduced treatment compliance also exacerbate this relationship. Clinically, comorbid depression in T2D has been associated with higher glycated hemoglobin (HbA1c) levels, increased micro- and macrovascular complications, decreased quality of life, and higher all-cause mortality [11].

These findings highlight the necessity for routine screening and integrated management of depression in populations with high T2D prevalence, particularly in socio-culturally distinctive regions such as the Yucatán Peninsula.

In summary, the intersection between depression and diabetes represents a pressing biomedical and public-health issue in Mexico. Within the Yucatán Peninsula, the combination of elevated T2D burden, high prevalence of depressive symptoms, distinctive genetic ancestry, and limited mental-health infrastructure underscores the importance of targeted research and culturally appropriate screening strategies. Understanding the frequency and severity of depression and suicide risk in Maya-mestizo patients with T2D is essential for guiding preventive, diagnostic, and therapeutic interventions that can improve both metabolic and mental-health outcomes. This study aimed to determine the frequency of depression and suicide risk in diabetic patients of Maya ancestry who receive medical care at the High Specialty Regional Hospital of the Yucatán Peninsula (HRAEPY).

Methods

Study Design

This was a prospective, cross-sectional, analytical, observational case–control study conducted at the High Specialty Regional Hospital of the Yucatán Peninsula (HRAEPY), Mexico.

Study Population

The study included adult patients (aged 18 years or older) diagnosed with type 2 diabetes mellitus who attended outpatient or inpatient medical services at HRAEPY.

According to the definition proposed by Moreno-Estrada et al. [5], the Maya-mestizo population refers to Mexican individuals who have resided in the state of Yucatán for at least three generations. The genetic composition of this population comprises approximately 50% Amerindian, 45% Eurasian, and 5% African ancestry. The Amerindian component is predominantly of Maya origin, characterized by low gene flow, which results in a genetically distinctive population.

Screening and Assessment Procedures

Eligible participants underwent initial screening to identify depressive symptoms. The Symptom Checklist-90 (SCL-90) was first administered as a general psychological screening tool. Patients who screened positive for potential depression were subsequently evaluated using standardized psychiatric assessment scales in the following order:

a) Hamilton Depression Rating Scale (HAM-D): Used to determine the severity of depression. Scores of 7–17 indicated mild depression, while 18–25 indicated moderate depression.

b) Beck Hopelessness Scale (BHS): Applied to assess levels of hopelessness and suicidal ideation.

c) Karnofsky Performance Status (KPS): Used to evaluate the patient's overall functional capacity.

All instruments were administered once by trained clinical personnel under standardized conditions. The results of these screening scales were compared to determine which showed the strongest association with the clinical diagnosis of depression, as confirmed by a certified mental health specialist. After completing the screening process, participants identified as having major depression were invited to a follow-up visit. During this visit, the psychiatric diagnosis was validated by a psychiatrist or clinical psychologist, and peripheral blood samples were collected after a 12-hour fasting period.

Laboratory Analyses

Blood samples were analyzed using a standardized enzymatic colorimetric method to measure the following biochemical parameters: Hemoglobin concentration, fasting serum glucose, and liver function profile (AST and ALT).

All analyses were performed in the hospital's certified clinical laboratory, following internal quality control protocols.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 21.0 (IBM Corp., Armonk, NY, USA). Participants were stratified into case and control groups based on the presence or absence of depression. Descriptive statistics were used to characterize the study population. The frequency of major depression and suicide risk was calculated.

Categorical variables were compared using the Chi-square (χ^2) test. A 95% confidence level and a 5% margin of error ($\alpha = 0.05$) were applied for all analyses.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and Mexico's national regulations on health research. The study protocol was reviewed and approved by the Research Ethics Committee of the High Specialty Regional Hospital of the Yucatán Peninsula, under approval folio 2021-023.

All participants were informed about the study objectives and procedures, and written informed consent was obtained from each participant before enrollment.

Results

A total of 155 patients with T2D from the state of Yucatán were included in the study. All patients had less than five years since the diagnoses of T2D. Of these, 69.7% were women and 30.3% were men, with a mean age of 49 years. The predominant socioeconomic level was low income (49%). Regarding substance use, 14.2% of participants reported tobacco use, and 23.3% reported alcohol consumption. Moreover, the majority of patients (72.2%) did not engage in regular physical activity (Figure 1).

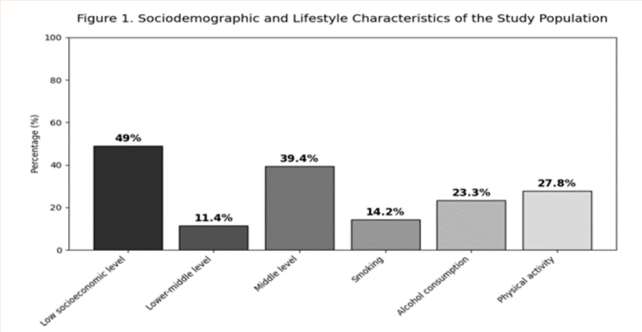

Figure 1: Frequencies of sociodemographic and lifestyle characteristics among the study population. The figure presents the distribution of socioeconomic level, substance use, and physical activity patterns among participants with type 2 diabetes.

Among the total population, 59% met diagnostic criteria for some form of depression. The most frequent depressive subtype was melancholic depression, observed in 76.7% of these cases. Among participants with type 2 diabetes, 20.6% exhibited poor pharmacological adherence and had fasting glucose levels exceeding 140 mg/dL. Within this subgroup of patients with inadequate glycemic control, 44.6% exhibited depressive symptoms, of whom 16.2% were receiving antidepressant treatment. Furthermore, 32.4% of these patients showed suicidal risk, including 24.3% with mild and 8.1% with severe risk levels.

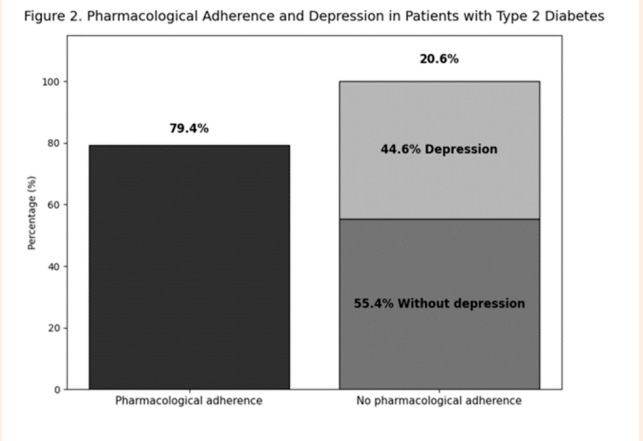

Figure 2: Shows the frequency of depression among diabetic patients without pharmacological adherence.

The mean age of patients diagnosed with depression was 49 years, similar to that of the overall sample. Females accounted for 69.4% of all depression cases, whereas males represented 30.6%, indicating a notable gender disparity. Interestingly, all participants were overweight or obese. No significant differences were observed between women and men, nor between participants with and without depression. Moreover, none of the participants presented anemia or alterations in hepatic transaminase levels (AST and ALT).

Socioeconomic and behavioral patterns among patients with depression mirrored those observed in the general sample.

An interesting result is that 29% of the participants with T2D exhibited some degree of suicidal risk severity. Although less than half of the depressed population, the most frequent severity level was severe suicidal risk, identified in 16.1% of cases. This was followed by mild risk in 8.1% and moderate risk in 4.8% of patients. Overall, these findings demonstrate a high prevalence of depression and significant suicidal risk among diabetic patients of Maya ancestry, particularly among women and individuals of low socioeconomic status.

Discussion

This study identified a high prevalence of depression (59%) among diabetic patients of Maya ancestry attending a tertiary-care hospital in Yucatán, Mexico, with a predominance of female participants and individuals from low socioeconomic backgrounds. These findings are consistent with international and national data indicating that depression is significantly more common in women and in populations exposed to socioeconomic vulnerability [2,12]. The mean age of 49 years observed in our cohort aligns with previous reports suggesting that middle-aged adults with diabetes are at increased risk of depressive disorders [11].

The observed frequency of depression in this study exceeds global estimates for individuals with diabetes, typically ranging from 20% to 30% [8,9]. Several factors may explain this higher prevalence in the Yucatán population, including limited access to specialized mental-health care, chronic socioeconomic stressors, and cultural stigma associated with psychiatric conditions. The strong representation of melancholic depression (76.7%) suggests the presence of more biologically driven depressive phenotypes, potentially linked to neuroendocrine and inflammatory dysregulation associated with chronic hyperglycemia and insulin resistance [13].

The relationship between depression and physical inactivity, observed in nearly 80% of patients with depression, underscores the bidirectional nature of these conditions. Reduced physical activity may exacerbate glycemic control and contribute to worsening depressive symptoms, while depression itself can lead to decreased motivation and self-care adherence [14]. This cycle of mutual reinforcement has been well documented in metabolic psychiatry research and highlights the need for integrated lifestyle and psychosocial interventions.

The prevalence of suicidal risk (29%), with 16.1% classified as severe, is of clinical concern. This proportion surpasses that reported in general diabetic populations (approximately 9–12%) [15], and parallels the elevated suicide rates historically observed in Yucatán and neighboring states [4]. The coexistence of depression, chronic disease burden, and limited access to mental-health services may converge to increase suicidal ideation and behavior in this region. These findings highlight the necessity for systematic suicide-risk screening within diabetes care protocols.

The findings of this study indicate a substantial association between poor pharmacological adherence, inadequate glycemic control, and the presence of depressive symptoms and suicidal risk among adults with T2D. Specifically, 20.6% of participants exhibited poor pharmacological adherence and fasting glucose levels above 140 mg/dL. Within this subgroup, 44.6% presented depressive symptoms, of whom 16.2% were receiving antidepressant treatment, and 32.4% showed suicidal risk, including 24.3% with mild and 8.1% with severe risk. These results highlight the multidimensional nature of diabetes management, in which metabolic, behavioral, and psychological factors are closely intertwined. Previous studies have demonstrated a bidirectional relationship between diabetes and depression, suggesting that depressive symptoms may both result from and contribute to poor glycemic control [9,16]. Depression can impair motivation, concentration, and self-care behaviors, leading to decreased medication adherence, poor dietary habits, and reduced physical activity [17]. Conversely, chronic hyperglycemia and the demands of diabetes self-management can exacerbate psychological

distress, creating a cycle that reinforces both metabolic and emotional dysregulation [18].

The observed association between inadequate glycemic control and suicidal risk aligns with previous evidence indicating that individuals with diabetes are more likely to experience suicidal ideation and attempts compared to non-diabetic populations [19,20]. Poor adherence and uncontrolled glucose levels may contribute to feelings of hopelessness, loss of control, and disease burden, thereby increasing vulnerability to suicidal behavior [21,22]. In our study, the coexistence of non-adherence, depression, and suicidal risk suggests a synergistic interaction that may amplify the adverse mental health outcomes associated with T2D.

From a clinical perspective, these findings emphasize the need for integrated care models that incorporate routine screening for depression and suicidal risk as part of standard diabetes management. Routine assessment using validated instruments such as the Patient Health Questionnaire-9 (PHQ-9) and the Columbia Suicide Severity Rating Scale (C-SSRS) could facilitate early detection and intervention [23]. Moreover, addressing barriers to pharmacological adherence such as depressive symptoms, low health literacy, or socioeconomic constraints may simultaneously improve both psychological wellbeing and glycemic outcomes [24,25].

This study has some limitations. The cross-sectional design precludes establishing causal relationships between depression, adherence, and glycemic control. Additionally, self-reported data on medication adherence may be subject to recall bias. Future longitudinal studies should examine the temporal sequence of these variables and evaluate the efficacy of integrated psychosocial interventions in improving both metabolic and mental health outcomes.

From a public-health perspective, the convergence of high rates of depression, T2D, and suicide risk among Maya-mestizo patients in Yucatán reflects a multidimensional health inequity. Genetic studies have suggested that this population exhibits distinctive ancestral and metabolic profiles [5], which may modulate susceptibility to both metabolic and psychiatric disorders. Integrating culturally sensitive mental-health interventions into diabetes programs could mitigate these vulnerabilities and improve both metabolic outcomes and overall quality of life.

In summary, the present findings reinforce the interdependence of mental and metabolic health in T2D. Poor pharmacological adherence and inadequate glycemic control were strongly associated with depression and suicidal risk, underscoring the importance of holistic, multidisciplinary approaches to diabetes care. Integrating mental health screening and psychological support into diabetes management protocols could substantially reduce the emotional and clinical burden of this chronic condition.

Conclusion

Depression is highly prevalent among diabetic patients of Maya ancestry in the Yucatán Peninsula, with strong associations to female sex, low socioeconomic status, and physical inactivity.

These findings emphasize the urgent need for routine mental-health screening, particularly for depressive and suicidal symptoms, in diabetic populations within culturally distinct and underserved regions. Collaborative models integrating endocrinology, psychiatry, and primary care are essential to improve early detection, adherence to treatment, and long-term prognosis.

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