



PSYCHOLOGICAL STRESS AND DEPRESSION IN TYPE 2 DIABETES PATIENTS

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ABSTRAC

The condition known as type 2 diabetes mellitus (T2DM), a chronic metabolic disease, is frequently associated with psychological conditions like stress and depression, which can impair glycemic control and overall disease management. To assess the correlation between depressive symptoms and glycemic control in T2DM patients and to evaluate the association among perceived stress and glycemic control in diabetics with or without symptoms of depression. 400 T2DM patients who visited the General Medicine Outpatient Department of Narayana Medical College and Hospital in Andhra Pradesh participated in a prospective observational cross-sectional study. Depression and perceived stress were measured using the Beck Depression Inventory-II (BDI-II) and Perceived Stress Scale-10 (PSS-10), respectively. Clinical and biochemical parameters, including Body mass index (BMI), lipid profile, fasting blood sugar, and HbA1c, were assessed. Statistical analysis was performed using SPSS version 23. Depression and perceived stress were highly prevalent among the study participants. Significant associations were observed between depression, elevated HbA1c, fasting blood sugar, obesity, dyslipidemia, prolonged duration of diabetes, and lack of physical activity. Psychological stress and depression are common among patients with T2DM and are significantly connected with poor glycemic control. Routine psychological assessment should be integrated into diabetic care.

Keywords: T2DM; Depression; Psychological Stress; Glycemic Control; HbA1c

1. INTRODUCTION

A chronic metabolic illness is Type 2 diabetes mellitus (T2DM), which is caused due to insulin resistance and insulin secretion dysfunction, resulting in sustained hyperglycemia. It ranks among the most prevalent non-communicable diseases globally and is a major health challenge due to the long-term complications and rising prevalence of the disease.¹ The disease is characterized by serious morbidity and mortality owing to its cardiovascular, renal, neurological, and ophthalmic complication. The increasing prevalence of diabetes has been significantly attributed to rapid urbanization, sedentary lifestyle, poor dietary habits, obesity and the aging of populations in India and globally, which has led to an increasing number of diabetic people in both urban and rural areas. South India has registered very high rates of T2DM due to lifestyle changes, less physical activity, and growing obesity² other than physical complication, diabetes has become a disease closely linked to psychological and emotional disruptions that adversely affect the disease outcomes and quality of life.

Diabetes supervision involves a life-long process of adherence to medications, dietary changes, regular monitoring of blood sugar levels, and constant medical supervision. All these factors involve significant emotional stress for diabetic patients that can lead to psychological disorders.³ Diabetes

distress is a term that describes the emotional strain experienced by people with diabetes due to the condition and all the problems that come with it.⁴ The most common mental health problems seen among people with T2DM include depression and stress.⁵ Emotional problems of diabetic patients may stem from the fear of complications, economic pressure, physical limitation, social restriction, and worries about the future course of the disease. Earlier research shows that diabetes-related emotional problems are common among patients with T2DM and could be detrimental to the treatment results.⁶ People with psychological problems usually show poor compliance with medications, lack of motivation, poor health habits, and insufficient involvement in self-management activities.

Depression has been increasingly viewed as a significant cause of unfavorable health status in T2DM patients.⁷ The association between diabetes and depression is said to be two-way in that not only can diabetes lead to the development of depression but also depression can exacerbate the condition of diabetes.³

Many biological pathways have been suggested that can provide an explanation for such a link. HPA axis dysfunction and cortisol dysregulation have been identified in both conditions.³ Stress response pathways, being constantly activated, can contribute to poor glucose regulation, insulin resistance, and inflammation. Therefore, poor metabolic health can result from such biological processes. Additionally, inflammatory factors and alterations in neurotransmission may be responsible for the onset of depression in diabetics.⁸ Behavioral elements are also significant in the link between depression and diabetes. Depression can affect an individual's motivation and decrease his adherence to taking medication, dietary restrictions, blood sugar checks, and exercise.⁸ People suffering from depression tend to exhibit poor self-management behaviors, causing their blood glucose to remain uncontrolled. Psychological distress might also lower self-efficacy, which impacts diabetes management overall.²

Stress has significant implications for the development and management of diabetes. Stress is known to activate the hormonal system through the secretion of cortisol and catecholamines, which could lead to insulin resistance and poor glucose regulation.¹ Chronic stress may thus lead to inadequate glycemic control and diabetic complications. Diabetic patients could experience stress due to their occupation, economic problems, fear of complications, social constraints, and lifelong medical care.⁹ Any metabolic problems caused by stress can make one's condition of diabetes worse. Depression and anxiety, along with other microvascular complications, have been linked to stress in people suffering from T2DM previously.¹⁰

While a few studies have focused on depression and stress in diabetics, there is a lack of information about Andhra Pradesh with regards to both of these aspects. However, the majority of research has mainly concentrated on metabolic disturbances as well as physiological consequences, with relatively few works paying attention to psychological factors. There are few regional studies conducted that take into consideration not only the incidence of depression but also stress in diabetics. Given the importance of psychological problems in affecting diabetes treatment compliance and disease management, there should be greater emphasis placed on psychosocial assessment in diabetic clinics.^{11,12}

This current study was conducted to measure psychological stress and depression amongst individuals suffering from T2DM and further determine its association with blood glucose levels along with other physiological variables. This study's main focus was on psychological stress and depression in people with type 2 diabetes.

Objectives

1. To evaluate the association between depressive symptoms and glycemic control in patients with T2DM.
2. To assess the relationship between glycemic control and perceived stress in T2DM patients with or without depressive symptoms.

2. METHODOLOGY

2.1 Study Setting and Design

This observational study was done on patients at Narayana Medical College & Hospital, Chinthareddypalem, Nellore district, Andhra Pradesh. The study was performed on patients who attended the OPD of General Medicine. The duration of this study is 2 years.

2.2 Study Population and Sample Size

In this investigation, subjects with T2DM were recruited as the study population. The sample size for this investigation was attained using data from a previous study carried out in Nellore, Andhra Pradesh, which revealed that about 20% of the diabetic population suffers from depression.

2.3 Eligibility Criteria

The requirements for inclusion involved patients aged 30–65 years, both male and female, who had T2DM for a period of 1-10 years and who were willing to give informed consent. Exclusion criteria were: patients younger than 30 years or older than 65 years, who were not willing to participate, or those with an organic disorder; seizure disorders; mental retardation; persistent neurological deficit; chronic illness such as chronic obstructive lung disease; heart disease history; hypertension; dyslipidemia; thyroid disorders; chronic kidney disease; mental health disease hi; co-occurring mental health conditions; and psychoactive substance addiction.

2.4 Data Collection Tools

Socio-demographic and lifestyle data were gathered through a semi-structured proforma. The BDI-II scale was applied for the assessment of depression, and it contains 21 items and categorizes results into minimal, mild, moderate, and severe depression. The PSS-10 scale was used for the assessment of perceived stress, and it contains 10 items and categorizes the results into very low, low, average, high, and very high stress.

2.5 Clinical and Biochemical Parameters

Clinical and biochemical data were collected through review of patients' medical records. This data was composed of fasting blood glucose (FBS), glycated haemoglobin (HbA1c), lipids consisting of blood pressure, triglycerides, LDL-C, body mass index (BMI), HDL-C, and total cholesterol. In accordance with WHO guidelines, measurements of weight, waist, and hip circumference, height, were also taken.

2.6 Statistical Analysis

The gathered data was stored and analysed using SPSS version 23. Continuous data were shown as mean $\pm$ standard deviation, whereas categorical data were shown as percentages. Associations among variables were tested using chi-square test, Pearson's correlation analysis, and univariate regression analysis. The statistical implication level used for all statistical tests was a p-value of less than 0.05.

2.7 Ethical Consideration

Approval from the Institutional Ethical Committee was sought before carrying out the experiment. Consent from the participants was sought before admitting them into the study.

3. RESULTS

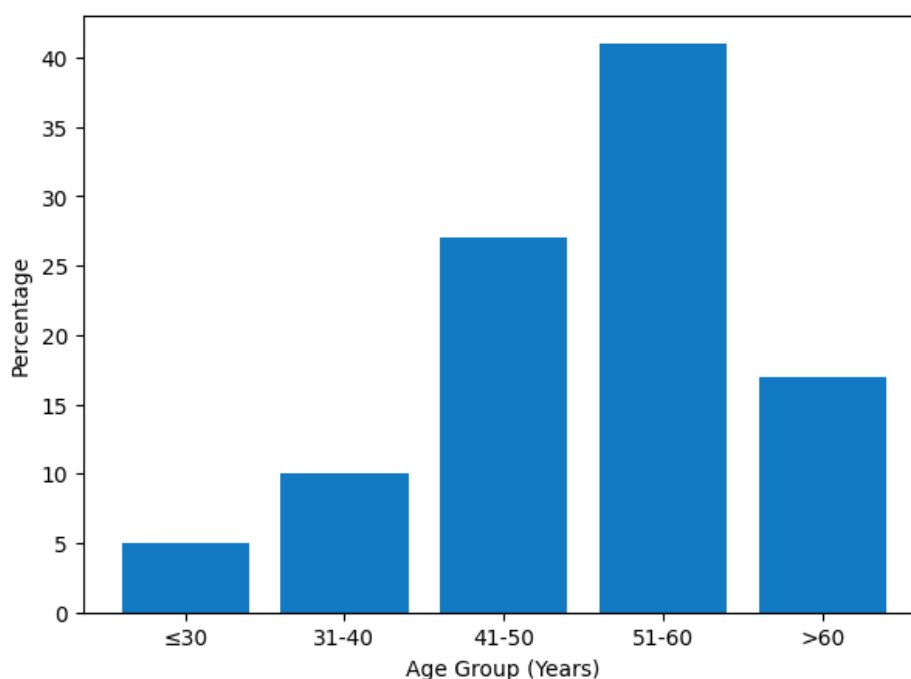
3.1 Demographic Features

The predominant demographic of the study subjects was middle age with a higher male predominance as compared to women (Table 1). Most of the subjects were married as well as working. In terms of educational status, most subjects were graduates from schools or colleges. Only few subjects were illiterates.

Table 1. Participants' sociodemographic characteristics

Variable	Classification	Distribution (%)
Age group (years)	≤30	5%
	31-40	10%
	41-50	27%
	51-60	41%
	>60	17%
Sex	Male	62%
	Female	38%
Marital status	Married	79%
	Unmarried	3%
	Divorced	5%
	Widow/Widower	13%
Educational qualification	School level	42%
	College/University level	51%
	Illiterate	7%
Occupational status	Employed	62%
	Unemployed	38%

Table 1 presents the study sample's demographic profile, which indicates dominance of marriage, education, and employment among the patients of T2DM. The age distribution of the study subjects with T2DM has been presented in Figure 1.

**Figure 1.** Age distribution of patients with T2DM

According to Figure 1, the majority of participants were between the ages of 51 and 60, with those between the ages of 41 and 50 coming in second.

3.2 Clinical Characteristics

The clinical evaluation showed that being overweight and poorly controlled diabetes mellitus are common amongst the patients included in this study. It was noted that the most of the patients have high levels of fasting blood sugar and hemoglobin A1C. Duration of the disease and treatment is

mainly in the intermediate stage, while oral hypoglycemics are the most commonly prescribed form of treatment.

Table 2. Clinical characteristics

Clinical Parameter	Classification	Distribution (%)
Body Mass Index (kg/m ²)	≤25	29%
	25-30	50%
	>30	21%
Fasting Blood Sugar (mg/dL)	≤110	12%
	110-125	18%
	>125	70%
HbA1c level (%)	<7	38%
	≥7	62%
Duration of diabetes	<5 years	38%
	5-10 years	52%
	>10 years	10%
Duration of treatment	<5 years	42%
	5-10 years	54%
	>10 years	4%
Treatment modality	Oral medication	60%
	Injectable therapy	28%
	Combined oral and injectable therapy	12%

The characteristics associated with metabolism and treatments of the study participants have been described in Table 2, and it appears that poor glycemic control and obesity were common among the diabetic participants. Figure 2 shows the Body Mass Index (BMI) distribution among patients of T2DM.

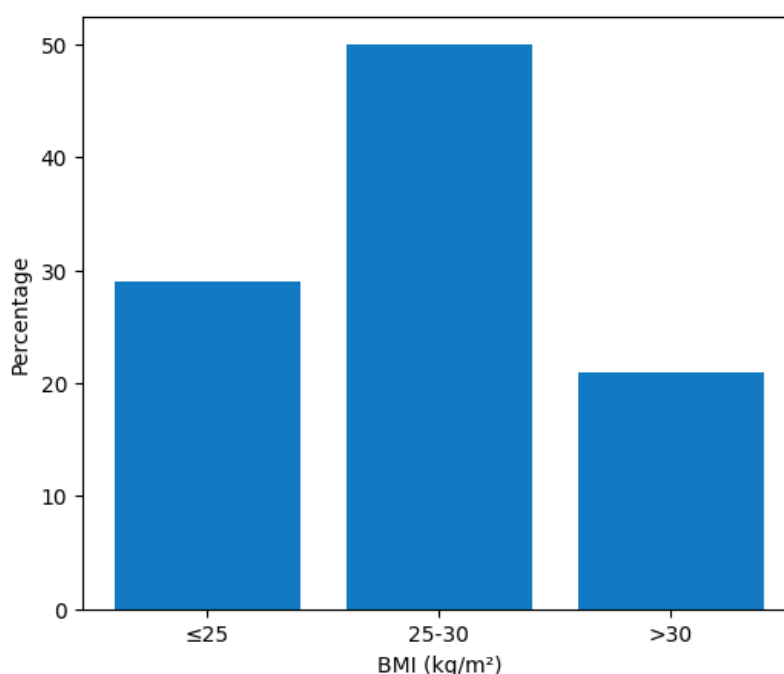


Figure 2. BMI distribution among patients with T2DM

As evident from Figure 2, most of the participants had excess weight, followed by normal BMI participants and obesity participants. Conversely, Figure 3 shows the HbA1c values of individuals with T2DM.

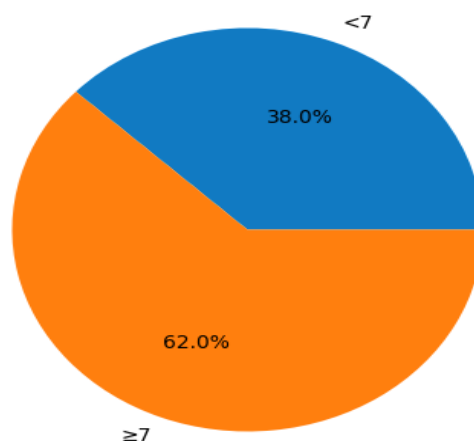


Figure 3. Distribution of HbA1c levels among patients with T2DM

As indicated by Figure 3, a large proportion of the participants had HbA1c values of $\geq 7\%$, suggesting that the study participants were poorly controlled.

3.3 Prevalence of Depression

Participants of the current study exhibited a prevalence of depression based on their BDI-II scores. Moderate depression was prevalent in the largest number of participants, followed by borderline and mild depression. The prevalence of depression levels is revealed in Table 3 below.

Table 3. Distribution of depression severity according to BDI-II scores

Depression Severity	BDI-II Score Range	Participants (%)
Minimal depression	1-10	23%
Mild depression	11-16	10%
Borderline depression	17-20	20%
Moderate depression	21-30	40%
Severe depression	≥ 31	7%

As Table 3 indicates, different levels of depressive symptoms were exhibited by the study subjects, with moderate depression being the most common group. The prevalence of different levels of depression amid T2DM patients built on the BDI-II scale is shown in Figure 4.

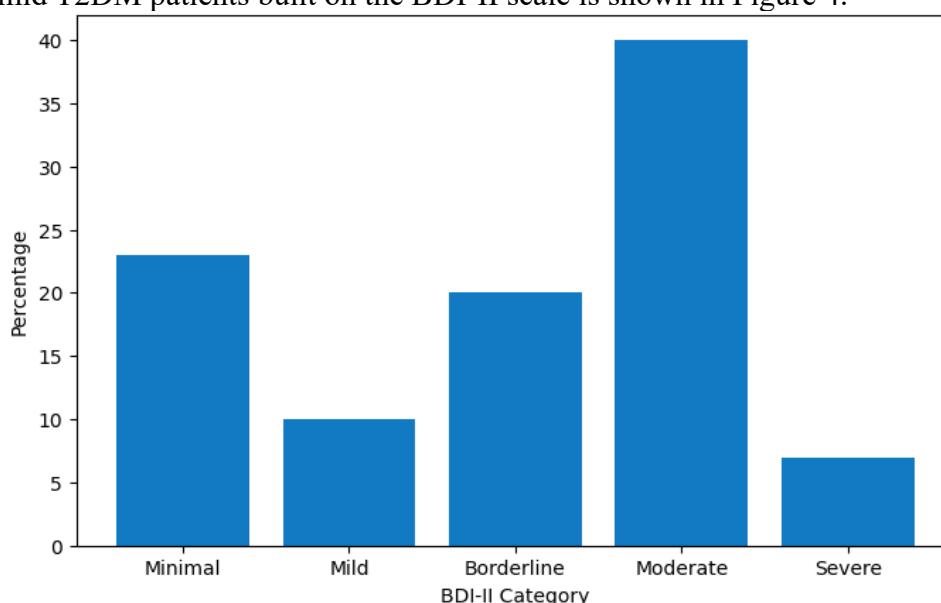


Figure 4. Distribution of depression severity according to BDI-II categories

As shown in Figure 4, moderate depression was the highest category reported by the study subjects, followed by minimal and borderline depression.

3.4 Prevalence of Perceived Stress

Stress perception was extremely common in participants who had been diagnosed with T2DM. Majority of the participants were found to have average to high levels of professed stress, as restrained by the PSS-10 scale.

Table 4. Distribution of perceived stress levels according to PSS-10

Perceived Stress Level	PSS-10 Score Range	Participants (%)
Very low stress	0-7	1%
Low stress	8-11	16%
Average stress	12-15	48%
High stress	16-20	32%
Very high stress	21- 40	3%

Stress intensity was classified between low and very high among the subjects, with the majority belonging to the average and high categories. The classification of perceived stress levels among patients with T2DM based on the PSS-10 scale categories is depicted in Figure 5.

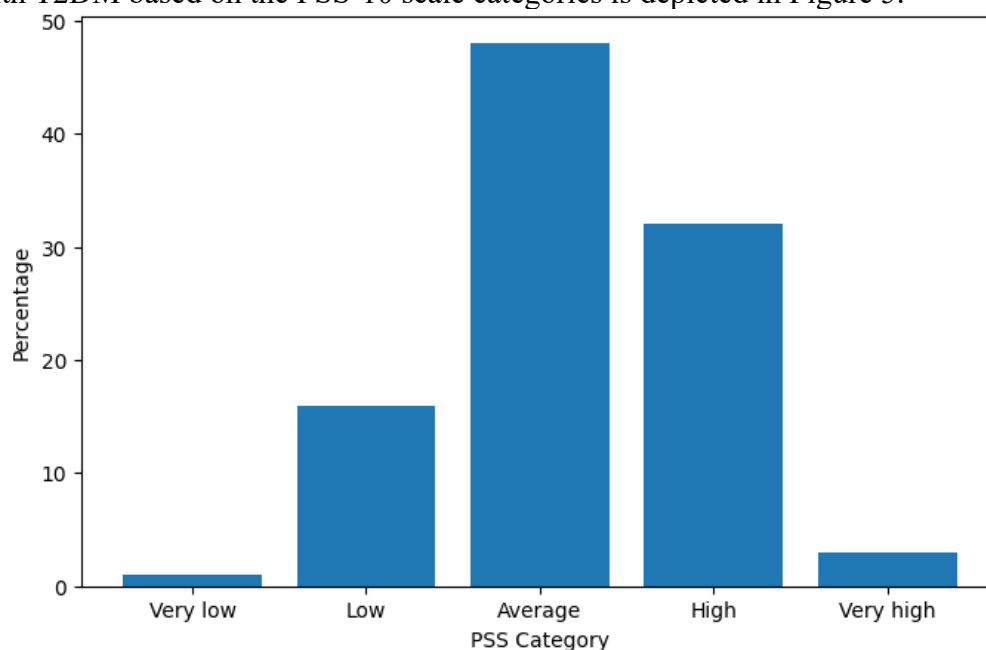


Figure 5. Distribution of perceived stress levels according to PSS-10 categories

According to Figure 5, average and high levels of stress were the two categories mostly observed in the study participants.

3.5 Association Between Demographic and Depression Variables

Sociodemographic factors were shown to be highly correlated with depression. Those who had higher scores in depression were seen in old age people, those who are married, and less educated. Socio-demographic variables associated with depression can be found in Table 5.

Table 5. Association Between Demographic and Depression Variables

Variable	Significant Finding	p-value
Age	Higher depression in older age groups	<0.001
Gender	Higher depression among females	0.701
Marital status	Significant association observed	<0.001

Religion	Significant association observed	<0.001
Education	Low education associated with depression	<0.001

Table 5 demonstrates that socio-demographic factors played an substantial role in the occurrence of depressive symptoms among diabetic individuals.

3.6 Association Between Depression and Disease-related Variables

Depression was substantially associated with disease-related variables, including poor glycemic control, obesity, prolonged diabetes, treatment duration, high BP, and dyslipidemia. Patients on injectable drugs also had higher depression scores. This is illustrated in Table 6.

Table 6. Association between disease-related variables and depression

Variable	Significant Finding	p-value
BMI	Higher BMI associated with depression	<0.001
FBS	Elevated FBS associated with depression	<0.001
HbA1c	Poor glycemic control associated with depression	0.025
Duration of diabetes	Longer duration associated with depression	<0.001
Duration of treatment	Longer treatment duration associated with depression	<0.001
Medication type	Injectable therapy associated with depression	<0.001
Hypertension	Significant association observed	<0.001
Lipid abnormalities	Dyslipidemia associated with depression	<0.001

Table 6 shows that metabolic abnormalities and disease progression had a substantial connection with depression among individuals with T2DM.

3.7 Correlation Analysis

Significant correlations were found between the level of depression and demographic and clinical factors (Table 7). There were positive correlations between depression and glycemic indexes, obesity, and disease duration, while physical activity was inversely correlated to stress.

Table 7. Correlation analysis between depression and clinical parameters

Parameter	Association with Depression
HbA1c	Significant positive association
BMI	Significant positive association
FBS	Significant positive association
Duration of diabetes	Significant positive association
Duration of treatment	Significant positive association
Physical activity	Inverse association with stress

Table 7 demonstrates that worsening clinical and metabolic parameters were associated with higher depression and stress levels.

3.8 Predictors of High Stress

Higher levels of stress correlated significantly with being young, working as professionals, and not engaging in any physical activity. The significance of the predictors persisted even when multivariate regression was conducted. Table 8 shows the predictors of high stress.

Table 8. Predictors of high perceived stress

Variable	Association
Younger age group	Significant association with high stress
Professional occupation	Significant association with high stress
Lack of physical activity	Significant association with high stress

In Table 8, we observe that occupational factors and a sedentary lifestyle was crucial in increasing the levels of stress among diabetic patients.

4. DISCUSSION

Depression and perceived stress were found to be prevalent in this current study involving T2DM patients. There was a substantial relationship among psychological morbidity and factors such as inadequate glycemic control, obesity, high blood pressure, dyslipidemia, long duration of illness, and decreased physical activity. It is known that emotional problems as well as depression, lead to poor health management among diabetic patients.¹³ The prevalence of depression, stress, and emotional complications of diabetes has also been shown by earlier research conducted in India and other countries. Cognitive behavioral interventions along with stress relief techniques, have improved emotional well-being and metabolic control in patients suffering from T2DM.^{14,15} The longitudinal findings also indicate the negative impact of T2DM on the mental health and quality of life of the affected individuals.¹⁶

In the current study, there was a relation between depressive symptoms and glycemic control where high levels of depressive symptoms were noted in people who had high levels of HbA1c and FBS. There is literature that supports the interrelation between depression and diabetes due to behavior and metabolic factors.¹⁷ Another study showed that insulin resistance was common for both conditions.¹⁸ Psychological stress can interfere with self-care activities, compliance with therapy, nutritional management, and exercise. This emotional state, together with illness perceptions, coping mechanisms, and low self-efficacy, can further affect diabetes complications negatively.¹⁹ Elevated stress levels in the current study were associated with low physical activity, work stress, and other lifestyle factors. Studies in this context have indicated that stress and depression are associated with inadequate metabolic management and emotional distress in individuals with diabetes.²⁰ Stress-induced psychological problems can impair resilience and treatment adherence. Diabetes-related distress could act as an intermediary factor connecting depression and adherence to treatment among people with T2DM.²¹

Poor management skills and diabetes-related distress have also been identified as risk factors for negative glycosylation results.²² In addition to the significant relationships found between psychological problems and clinical variables, there were also important links between psychological distress and patient demographics such as sex, age, and education level. Female subjects had higher rates of depressive symptoms and stress, whereas aging was linked to greater psychological distress, likely due to a longer history of the condition and anxiety about complications. Subjects who lacked formal education had greater psychological distress. The literature has clearly highlighted the importance of addressing psychological requirements in diabetic patients.²³

Various biological and psychosocial factors could serve to link depression and diabetes. For example, disturbances in the hypothalamic-pituitary-adrenal axis and the process of abnormal cortisol secretion could play an instrumental part in the emergence of insulin resistance, inflammation, and poor glucose metabolism, whereas continuous stress could further aggravate metabolic conditions and affect emotional health. On top of that, both depression and diabetes distress can have negative effects on motivation, treatment compliance, and healthy lifestyle choices. It is hence crucial to differentiate between diabetes distress and major depression.²⁴ The outcomes obtained from this current investigation highlight the significance of conducting psychological screening tests among T2DM patients. The early detection of depressive symptoms, stress levels, and other emotional complications associated with the disease can be instrumental in enhancing treatment compliance and glycemic control. Several research studies have indicated that the evaluation of diabetes-related distress plays a key role in the delivery of effective diabetic healthcare services.²⁵

In this study, a sufficient number of participants were considered, and standardized scales such as the Perceived Stress Scale-10 and the Beck Depression Inventory-II were used for the detection of psychological illness in patients with T2DM. Another significant advantage of the research was that the examination of depression, stress, glycaemic parameters, and clinical variables was conducted simultaneously. Nevertheless, the study had some weaknesses, such as the cross-sectional character of the research, monofocal location, use of self-administered tests, and absence of longitudinal analysis.

5. CONCLUSION

Results obtained from this current study revealed high occurrence rates of depression and stress levels among patients suffering from T2DM (T2DM). Several associations have been established between poor psychological status and bad glycemic indicators, such as high levels of fasting blood sugar as well as HbA1c. The presence of other factors like obesity, high BP, high cholesterol levels, a long history of diabetes, and lack of exercise has also been associated with higher depression and stress levels among diabetes patients. These factors may potentially affect treatment compliance, self-management activities, and other lifestyle changes, leading to poor control of diabetes and hence the likelihood of developing serious complications. Among the demographic variables linked with the presence of psychological disorders were female sex, advanced age, and low education. This paper brings out the significance of psychological assessment being incorporated into diabetic treatment procedures. The use of standardized assessment tools to screen for depression and stress can aid in the effective management of the condition. The inclusion of counselling services and stress management techniques can lead to better metabolic control among individuals suffering from T2DM.

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