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# A CROSS-SECTIONAL STUDY: PREVALENCE OF DEPRESSION AMONG DIABETIC PATIENTS

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## Abstract

### Background

Type 2 diabetes mellitus (T2DM) is a growing global health concern, with a significant prevalence in India. Depression is commonly observed in individuals with T2DM, negatively impacting disease management and outcomes. The coexistence of these conditions exacerbates complications and patient well-being. This study seeks to assess the prevalence of depression in patients with T2DM.

### Methods

A cross-sectional study was conducted at Jawaharlal Nehru Medical College & Hospital, Bhagalpur, Bihar, on 480 T2DM patients attending outpatient and inpatient services. Depression was assessed using the Beck Depression Inventory-II (BDI-II), and various disease-related variables were evaluated. Data was collected through interviews, clinical evaluations, and laboratory tests to assess glycemic control and medication adherence.

### Results

The study included 480 diabetic patients, with 85% over 40 years of age and 61.9% male. Moderate depression was observed in 31.3% (n=150) of patients, while 35% (n=168) had no depression. Depression severity was significantly associated with factors such as age, marital status, family history of diabetes, BMI, fasting blood sugar levels, and duration of diabetes ($p<0.001$). A high prevalence of depression was noted in patients with a BMI >30 (63.9%), fasting blood sugar >125 mg/dl (72.7%), and those with diabetes for over 5 years (54.7%).

### Conclusion

The study emphasizes the strong link between depression and factors like age, BMI, diabetes duration, and blood sugar levels, highlighting the need for integrated mental health care in diabetes management.

### Recommendation

Proper screening for depression among diabetic patients with neuropathy and early screening for neuropathy in type 2 diabetic patients to prevent depression is recommended.

**Keywords:** *Depression, Diabetes, Beck Depression Inventory-II, Demographic factors, Disease-related factors.*
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## Introduction

Diabetes mellitus is a long-term metabolic disorder involving abnormalities in the metabolism of carbohydrates, lipids, and amino acids due to either reduced insulin production or decreased cellular sensitivity to insulin. It represents a major global health concern in the 21st century, with Type 2 diabetes mellitus (T2DM) affecting 8–15% of the urban population in India and steadily rising over time [1,2]. Depression, a widespread mental health condition impacting over 350 million individuals globally, is frequently observed alongside diabetes, significantly influencing adherence to treatment, glycemic control, and the risk of complications [3-5]. Worldwide, over 365 million people live with T2DM, while nearly 300 million suffer from major depression. Both conditions are expected to be among the top five contributors to the global disease burden by 2030 [6,7].

This association is especially pertinent in developing countries, where 80% of T2DM cases are found, although most research has focused on high-income countries [8]. Meta-analyses demonstrate that persons with T2DM are twice as susceptible to depression in contrast to their non-diabetic counterparts, underscoring a bidirectional link between the two conditions [9-11]. While depression in diabetes is often attributed to the burden of managing the disease, it can also independently increase the risk of developing T2DM [12]. The coexistence of depression and diabetes worsens outcomes, leading to poorer glycemic control, diminished quality of life, reduced physical activity, higher healthcare costs, and non-adherence to medications and lifestyle modifications [13-

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16]. Due to the significant frequency of both illnesses in India, there is an urgent necessity for focused research [17, 18]. Longitudinal studies, in particular, could provide deeper insights into the interplay between T2DM and depression while accounting for chronic comorbidities and prior mental health histories [19-23].

## Aim of the study

The objective of this study is to evaluate the prevalence of depression among patients with T2DM and to investigate its implications for the management and progression of the disease.

## Methods

### Study Setting

This study was conducted in Jawaharlal Nehru Medical College & Hospital, Bhagalpur, Bihar. The research was carried out over one year, from 15th November 2023 to 14th November 2024.

### Study Population

The study population consisted of 480 patients diagnosed with T2DM who visited the medicine department's outpatient department (OPD) and inpatient wards during the study period.

### Inclusion Criteria

Patients included in the study were those diagnosed with T2DM. Individuals belonging to the Bhagalpur district of any age group and gender visiting the medicine department were eligible to participate, provided they gave informed consent and understood the nature and purpose of the study.

### Exclusion Criteria

Exclusion criteria encompassed patients with physical or mental conditions that could hinder their ability to actively participate in the study. Additionally, individuals unable to provide venous blood samples required for the necessary laboratory investigations were excluded from the research.

### Study Method

The sociodemographic profile of the participants, as well as information regarding their diabetes and its management, was collected using a semi-structured questionnaire. The questionnaire collected data on:

1. Duration of diabetes.
2. Duration and type of treatment.
3. Presence of complications due to diabetes.
4. Patients with a history of diabetes in their family.
5. Body Mass Index (BMI).

Additionally, clinical assessments were performed to evaluate diabetes control using HbA1c levels, fasting blood glucose, and postprandial blood glucose. Depression was examined using the Beck Depression Inventory (BDI-II) [18], while medication adherence was assessed with the help of the 8-item Morisky Medication Adherence Scale (MMAS-8) [19]. Participants underwent a thorough clinical history review, general physical examination, systematic examination, and laboratory investigations, all of which were recorded on a standardized proforma.

### Data Collection

Data were obtained through direct interviews with the participants, which were supplemented by medical records. The semi-structured questionnaire was employed to record information regarding demographics, diabetes history, and any comorbidity. Laboratory investigations, including blood samples for HbA1c, fasting glucose, and postprandial glucose levels, were performed to assess glycemic control. The clinical evaluation also included BMI measurements and a detailed physical examination. Depression and medication adherence scores were calculated using the validated BDI-II and MMAS-8 tools, respectively.

### Statistical Analysis

The data that was collected was analyzed using a statistical software application. Sociodemographic characteristics, diabetes-related variables, and clinical parameters were summarised using descriptive statistics. Continuous variables were computed to determine the mean and standard deviation, while categorical variables were represented as frequencies and percentages. The appropriate statistical measures, including the Chi-square test, t-test, and ANOVA, were employed to analyze the associations between depression, medication adherence, and glycaemic control. The threshold for statistical significance was established at $p < 0.05$.

### Ethical Consideration

Informed consent was taken from all patients in the study.

## Results

The majority of the 480 patients in the study were over 40 years of age (n=408; 85%), with patients aged 51–60 years representing a major portion (n=192; 40%). The eldest patient was 75 years old, and the youngest was 26 years old. Among the total study population, 297 (61.9%) were male, and 183 (38.1%) were female. Most of the patients were married (n=374; 77.9%), and a significant proportion followed the Hindu religion (n=258; 53.8%). Table 1 summarizes the socio-demographic distribution of the study participants.

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**Table 1: Patient distribution based on demographic profile:**

| Variable | No of patients (%) |
|---|---|
| **Age** | |
| ≤ 30 years | 24 (5%) |
| 31 to 40 years | 48 (10%) |
| 41 to 50 years | 129 (26.9%) |
| 51 to 60 years | 192 (40%) |
| > 60 years | 87 (18.1%) |
| **Gender** | |
| Male | 297 (61.9%) |
| Female | 183 (38.1%) |
| **Marital Status** | |
| Married | 374 (77.9%) |
| Unmarried | 19 (4%) |
| Divorced | 24 (5%) |
| Widow/Widower | 63 (13.1%) |
| **Religion** | |
| Hindu | 258 (53.8%) |
| Muslim | 144 (30%) |
| Sikh | 58 (12.1%) |
| Others | 20 (4.1%) |

## Disease-Related Variables

A large proportion of patients (n=374; 77.9%) reported a family history of T2DM. The majority of patients (n=336; 70.0%) had a fasting blood sugar level exceeding 125 mg/dl. Most participants (n=250; 52.1%) were overweight, with a BMI >30 kg/m². Regarding the duration of diabetes, 240 (50.0%) patients had been living with the condition for 5–10 years, and 288 (60.0%) were on oral medications as the primary treatment modality. Table 2 presents details of the disease-related characteristics.

**Table 2: Patient distribution as per medical history:**

| Variable | No of patients (%) |
|---|---|
| **Family History** | |
| Yes | 374 (77.9%) |
| No | 106 (22.1%) |
| **BMI (kg/m²)** | |
| ≤ 25 | 100 (20.8%) |
| 25 to 30 | 130 (27.1%) |
| > 30 | 250 (52.1%) |
| **Fasting Blood Sugar (mg/dl)** | |
| ≤ 110 | 58 (12.1%) |
| 110 to 125 | 86 (17.9%) |
| > 125 | 336 (70%) |
| **Duration of Diabetes (years)** | |
| ≤ 5 | 163 (34%) |
| 5 to 10 | 240 (50%) |
| > 10 | 77 (16%) |
| **Medication** | |
| Oral | 288 (60%) |
| Injection | 134 (27.9%) |
| Oral + Injection | 58 (12.1%) |

## Depression and Its Association with Patient Variables

Based on the BDI-II scores, 35% of the study participants were found to fall within the minimal range (1-10), while 10.2% had mild depression (11-16), Borderline depression (17-20) was present in 16.7% of patients and 31.3% experienced moderate depression (21-30). Severe depression (≥31) affected 6.9% of patients. These percentages highlight the varying severity of depression among the patient population, with a significant portion reporting mild to moderate symptoms (Table 3).

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**Table 3: Patient distribution as per BDI-II:**

| BDI-II | No of patients (%) |
|---|---|
| Minimal (1-10) | 168 (35%) |
| Mild (11–16) | 49 (10.2%) |
| Borderline (17–20) | 80 (16.7%) |
| Moderate (21–30) | 150 (31.3%) |
| Severe (≥31) | 33 (6.9%) |

## Correlation Between Depression and Patient Characteristics

The following table shows associations between various socio-demographic and disease-related variables with depression. Depression was most prevalent in individuals aged 51-60 years (46.8%), married patients (79.7%), those with a history of diabetes in the family (80.5%), as well as individuals with a greater BMI (63.9%). Depression was not found to be associated with fasting blood sugar levels, while it was found to be highly significant with the duration of diabetes. Patients having diabetes for 5-10 years showed the highest prevalence (54.7%) (Table 4).

**Table 4: Association of Demographic and Disease-Related Variables with Depression: total Depression Present**

| Variable | Category | Total (n=480) | Patients with Depression (n=312) | Percentage (%) | p-value |
|---|---|---|---|---|---|
| **Age (years)** | < 30 | 24 | 1 | 0.3% | <0.001 |
| | 30–40 | 48 | 7 | 2.2% | |
| | 41–50 | 129 | 94 | 30.3% | |
| | 51–60 | 192 | 146 | 46.8% | |
| | >60 | 87 | 64 | 20.4% | |
| **Marital Status** | Married | 374 | 249 | 79.7% | 0.069 |
| | Unmarried | 19 | 7 | 2.4% | |
| | Divorced | 24 | 15 | 4.9% | |
| | Widow/Widower | 63 | 41 | 13% | |
| **Family History** | Yes | 374 | 251 | 80.5% | 0.068 |
| | No | 106 | 61 | 19.5% | |
| **BMI (kg/m²)** | ≤25 | 100 | 52 | 16.8% | <0.001 |
| | 25–30 | 130 | 60 | 19.2% | |
| | >30 | 250 | 200 | 63.9% | |
| **Fasting Blood Sugar (mg/dl)** | ≤110 | 58 | 38 | 12.2% | 0.081 |
| | 110–125 | 86 | 47 | 15.2% | |
| | >125 | 336 | 227 | 72.7% | |
| **Duration of Diabetes (years)** | ≤5 | 163 | 82 | 26.3% | <0.001 |
| | 5–10 | 240 | 171 | 54.7% | |
| | >10 | 77 | 59 | 19.0% | |

The distribution of patients across the four categories of depression based on their socio-demographic and disease-related characteristics has been shown in Table 5. Significant associations were found across all variables, with the majority of severe depression cases occurring in patients with BMI >30 and duration of diabetes 5-10 years.

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**Table 5: Association of Socio-Demographic and Disease-Related Variables with Types of Depression (BDI-II)**

| Variable | Category | Mild Depression (11-16) | Borderline Depression (17-20) | Moderate Depression (21-30) | Severe Depression (31 and above) | p-value |
|---|---|---|---|---|---|---|
| **Age (years)** | ≤30 | 0 (0%) | 0 (0%) | 1 (100%) | 0 (0%) | <0.001 |
| | 31–40 | 2 (28.6%) | 2 (28.6%) | 2 (28.6%) | 1 (14.3%) | |
| | 41–50 | 25 (26.6%) | 40 (42.6%) | 18 (19.1%) | 11 (11.7%) | |
| | 51–60 | 18 (12.3%) | 31 (21.2%) | 92 (62.6%) | 5 (3.4%) | |
| | >60 | 4 (6.3%) | 7 (10.9%) | 37 (57.8%) | 16 (25%) | |
| **BMI (kg/m²)** | ≤25 | 24 (46.2%) | 14 (26.9%) | 8 (15.4%) | 6 (11.5%) | <0.001 |
| | 25–30 | 13 (21.7%) | 25 (41.7%) | 9 (15%) | 13 (21.7%) | |
| | >30 | 12 (6%) | 41 (20.5%) | 133 (66.5%) | 14 (7%) | |
| **Duration of Diabetes** | ≤5 | 9 (11%) | 45 (54.9%) | 19 (23.2%) | 9 (11%) | <0.001 |
| | 5–10 | 26 (15.2%) | 24 (14%) | 105 (61.4%) | 16 (9.4%) | |
| | >10 | 14 (23.7%) | 11 (18.6%) | 26 (44.1%) | 8 (13.6%) | |

## Discussion

The majority of participants in this study were males (61.9%), with females comprising 38.1%. Most participants in our research were older than 50 years, particularly within the 51–60-year age range, consistent with earlier findings where the majority of participants were aged 65 years or younger [24].

In this investigation, 65% of participants scored 11 or higher on the BDI-II, indicating a high prevalence of depressive symptoms. Depression was significantly observed among individuals with a longer duration of diabetes, corroborating findings from other studies. For example, research conducted at Shahid Rahimi Hospital in Iran identified a 76.9% prevalence of depression among diabetes patients [3]. The rates observed in our study exceeded those found by Raval et al., who reported that 23% of participants had major depression and 59% had no clinically significant depression [25]. Additionally, prior research has highlighted a 24% increased risk of depression among individuals with T2DM, emphasizing the link between these conditions [26].

In the Indian context, a study by AIIMS New Delhi identified depressive episodes in 16.9% of diabetic patients [27], while another investigation involving 80 participants reported depressive symptoms in 38.8% of individuals [28]. Similarly, research conducted in Palestine revealed that 40% of T2DM patients were potential cases of depression [24]. These findings underscore the significant prevalence of depressive disorders among individuals with T2DM, highlighting the critical need to integrate mental health considerations into diabetes care strategies.

T2DM and depressive disorders are significant global public health issues, with over 365 million individuals estimated to have T2DM and nearly 300 million experiencing major depressive episodes [2]. By 2030, these conditions are predicted to rank among the top five contributors to the global disease burden, with India hosting the largest population of individuals with diabetes worldwide [21]. Depression is acknowledged as a modifiable and independent risk factor for the onset of T2DM and its associated complications [22]. The simultaneous occurrence of these disorders substantially increases the likelihood of developing additional co-existing conditions, further complications, and heightened healthcare expenditures [23].

Although numerous investigations have been conducted in India to determine the prevalence of depressive symptoms among T2DM patients, there is a scarcity of research specifically focusing on Northern India, particularly the Jammu region, where such studies are infrequent. This study evaluated 480 participants using the Beck Depression Inventory-II (BDI-II) to measure depressive symptoms. Demographic and clinical variables such as age, gender, marital status, body mass index (BMI), educational attainment, smoking habits, duration of diabetes, glycated hemoglobin (HbA1c) levels, use of insulin, and presence of additional health conditions were collected. Our results align with prior research in this domain.

## Conclusion

This study identifies a significant occurrence of depressive symptoms among individuals with diabetes, with 31.3% experiencing moderate levels of depression as assessed by the Beck Depression Inventory-II. Key determinants linked to greater severity of depression include advanced age, increased body mass index (BMI), and prolonged duration of diabetes. These results emphasize the critical need to integrate mental health support into diabetes management. Developing customized strategies that address both psychological well-being and effective diabetes care will greatly

improve patient health outcomes and overall quality of life.
Limitations: The study is limited by its short duration and small sample size.

## Recommendation
Proper screening for depression among diabetic patients with neuropathy and early screening for neuropathy in type 2 diabetic patients to prevent depression is recommended.

## Acknowledgment
To all the participants for their cooperation and patience.

## Data Availability
Data is available upon request.

## Author contributions
All authors contributed to the design of the research. EY collected and analyzed the data. KF wrote the manuscript. PK and EY edited the paper. All authors read and approved the paper.

## List of Abbreviations
T2DM- Type 2 diabetes mellitus
BDI- Beck Depression Inventory
BMI- Body Mass Index
HbA1c- glycated hemoglobin
OPD- outpatient department
MMAS- Morisky Medication Adherence Scale

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## Conflict of interest
The authors declare no conflicts of interest.

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