

## Original Research Article

# Prevalence of depression among patients with type 2 diabetes mellitus: a cross-sectional study

Sanjay Parihar<sup>1</sup>, Rajesh Singh<sup>2\*</sup>

<sup>1</sup>Consultant Physician, Government District Hospital, Kishtwar, Jammu and Kashmir, India

<sup>2</sup>Consultant Physician, Community Health Centre, Gundoh, Doda, Jammu and Kashmir, India

**Received:** 02 August 2019

**Accepted:** 07 August 2019

### \*Correspondence:

Dr. Rajesh Singh,

E-mail: [rajesh.mbbs.gmc@gmail.com](mailto:rajesh.mbbs.gmc@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Depression can be viewed as a modifiable independent risk factor for the development of T2DM and for progression of complications from either type 1 or type 2 diabetes. The recognition and addressal of this association can have profound implications for prevention and treatment of these disorders. Objectives of this study the prevalence of depression among patients with diabetes mellitus type 2.

**Methods:** A semi-structured questionnaire was used to collect the sociodemographic profile and the details of the diabetes and its treatment and history of other chronic diseases. Beck depression inventory (BDS-II) was used for evaluation of depression and 8 item Morisky medication adherence scale (MMAS-8) was used for measurement of patient's adherence to medication.

**Results:** Majority of the potential cases of depression (33%) were in the age group of 51-60 years. 62% of the patients were male. Majority of the patients (40%) were in the age group of 51-60 years. 73.4% of the married patients were potential cases of depression. 78% of the patients were having family history of type 2 diabetes mellitus. Majority of the patients (72%) were overweight or obese (BMI > 25kg/m<sup>2</sup>).

**Conclusion:** Duration of diabetes and duration of treatment was 5-10 years in majority of the patients and were significantly associated with prevalence of depression. Prevalence of depression was associated with sex, religion, and family history but was not statistically significant.

**Keywords:** Beck depression inventory, Depression, Prevalence, Type 2 diabetes mellitus

## INTRODUCTION

Diabetes mellitus is a chronic metabolic disease, characterized by a disorder in the metabolism of carbohydrates, lipids, and amino acids, either as a result of decreased insulin secretion or due to a reduction to insulin sensitivity of the cells of the body cells. It is a disease that acquires epidemic form and constitutes one of the major threats to human health in the 21<sup>st</sup> century.<sup>1</sup> The prevalence of Type 2 diabetes mellitus has been estimated to vary from 8 to 15% among the urban

population in India, with a significantly increasing trend over the years.<sup>2</sup>

Depression is a common illness worldwide, with an estimated 350 million people affected. Especially when long-lasting and with moderate or severe intensity, depression may become a serious health condition. It can cause the affected person to suffer greatly and function poorly at work, at school and in the family.<sup>3</sup> Depression is a common problem among those suffering from diabetes mellitus.<sup>4</sup> Depression and severe psychological

distress are frequently comorbid with diabetes and are associated with reduced adherence to medication and healthy lifestyle regimens, poorer glycemic control, and increased complications.<sup>5</sup>

Type 2 diabetes mellitus (T2DM) and depression are major public health issues. Worldwide, more than 365 million people are estimated to have T2DM, and almost 300 million people have major depression. Both these disorders are projected to be among the five leading causes of disease burden by 2030.<sup>6</sup> Depression can be viewed as a modifiable independent risk factor for the development of T2DM and for progression of complications from either type 1 or type 2 diabetes.<sup>7</sup> The recognition and addressal of this association can have profound implications for prevention and treatment of these disorders.<sup>6</sup> Eighty percent of people with T2DM reside in low- and middle-income countries (LMICs). Yet much of the research around depression among people with diabetes has been conducted in high-income countries (HICs).<sup>8</sup> Depression is common among diabetes, and is associated with poor outcomes. However, the data on this important relationship are limited from India.<sup>9</sup> Studies on prevalence of depression among patients with diabetes has special relevance for India a middle-income country, having high prevalence of both these disorders.<sup>8,10</sup>

Research has established the relation between diabetes and depression. There is ample evidence that diabetes and depression are associated. According to a large meta-analysis incorporating data from 42 studies concluded that the prevalence of depression is doubled in individuals with type 2 diabetes compared with those without diabetes.<sup>11</sup> However, the temporal or causal relationship between depression and type-2 diabetes remains unclear. Depression is often regarded as a comorbid condition that results from the daily burden of having diabetes and/or its complications. Interestingly, there are also indications that depression in turn is an independent risk factor for the development of type-2 diabetes.<sup>12</sup>

In addition to the morbidity associated with the disease itself, the presence of depression complicates outcomes in the management of diabetes mellitus. Patients with comorbid depression are more likely to have poor control of hyperglycemia in both type 1 and 2 diabetes mellitus.<sup>13</sup> Depression is also associated with poor adherence to diabetic medications and dietary regimes. There is also lesser physical activity, reduced quality of life, and increased health care expenditure in patients with diabetes and depression.<sup>14-16</sup>

The increased prevalence of depressive symptoms among patients with diagnosed DM2 suggests that depressive symptoms might be a consequence of the burden of diabetes. The number of chronic diseases seems to explain part of the association between DM2 and depressive symptoms. More research is needed to

confirm the association between Type 2 diabetes and depressive symptoms. Instead of cross-sectional studies, longitudinal studies should be performed to investigate if diabetes is an independent risk factor for the onset of depressive symptoms. In these studies, the influence of a history of depression and the influence of comorbid chronic diseases should be taken into account.<sup>17</sup>

Therefore, this research was conducted with the objective of studying the prevalence of depression among patients with diabetes mellitus type 2 in Government Medical College, Jammu - a tertiary care institute, catering to a huge population of North India.

## METHODS

The present study was conducted in the post graduate department of Medicine, Government Medical College, Jammu for a period of one year from November 01, 2016 to October 31, 2017. Subjects were selected from those attending the outpatient department, emergency and wards of medicine department.

The patients of both gender and of all ages with type-2 diabetes mellitus were included in the study. The patients with physical and/or mental conditions that interfere with participation and inability to obtain venous blood sample were excluded. The study was approved from Institutional Ethics Committee. The subjects for this study was enrolled after taking informed written consent.

A semi-structured questionnaire was used to collect the sociodemographic profile and the details of the diabetes and its treatment and history of other chronic diseases. The details regarding diabetes was included the duration of the condition, duration of treatment, type of treatment being received, complication due to diabetes, family history of diabetes and Body Mass Index (BMI). The level of diabetes control was assessed by using the HbA<sub>1c</sub> levels, fasting blood glucose and postprandial blood glucose.

Beck depression inventory (BDS-II)<sup>[18]</sup> was used for evaluation of depression and 8 item Morisky medication adherence scale (MMAS-8)<sup>[19]</sup> was used for measurement of patient's adherence to medication. Subjects was evaluated on the following lines – history, clinical examination and investigations. Details of clinical history, physical examination (general physical examination and systematic examination) and laboratory investigations was recorded as per proforma.

## RESULTS

Majority of the patients in our study were >40 years (n=85; 85%). Out of this maximum patients were in the age group of 51-60 years (n=40; 40%). Eldest and youngest patient observed in our study were 70 years old and 25 years old respectively. Out of 100 patients

observed in this study, 62 (62%) are male and 38 (38%) were female (Table 1).

**Table 1: Distribution of cases according to socio-demographic variables.**

| Socio-demographic variables | Frequency, n | Percentage |
|-----------------------------|--------------|------------|
| Age groups (years)          |              |            |
| ≤30                         | 5            | 5.0        |
| 31-40                       | 10           | 10.0       |
| 41-50                       | 27           | 27.0       |
| 51-60                       | 40           | 40.0       |
| >60                         | 18           | 18.0       |
| Sex                         |              |            |
| Male                        | 62           | 62.0       |
| Female                      | 38           | 38.0       |
| Marital status              |              |            |
| Married                     | 78           | 78.0       |
| Unmarried                   | 4            | 4.0        |
| Divorced                    | 5            | 5.0        |
| Widow                       | 13           | 13.0       |
| Religion                    |              |            |
| Hindu                       | 53           | 53.0       |
| Muslim                      | 30           | 30.0       |
| Sikh                        | 12           | 12.0       |
| Others                      | 5            | 5.0        |

Majority of the patients (n=78; 78%) in our study were having family history of type-2 diabetes. Most of the patients (n=72;72%) were observed to be overweight having BMI >25.

Fasting blood sugar was observed to be >125 mg/dl in majority of the patients (70; 70%). Duration of diabetes and treatment was 5-10 years in majority of the patients (n=52; 52%) and (n=55; 55%) respectively.

Majority of the patients (n=60; 60%) were on oral medication (Table 2). Distribution of cases according to Beck's Depression Inventory was described in Table 3.

Majority of the potential cases of depression (n=33; 33%) were in the age group 51-60 years. Out of 62 males 42 were potential cases of depression whereas out of 38 females 25 were potential cases of depression. Majority of the married patients (58 out of 79) were potential cases of depression. Majority of patients belonging to Hindu community (36 out of 53) were found to be potential cases of depression (Table 4).

According to table 5, 55 out of 80 (68%) patients having family history of diabetes type 2 and 12 out of 20 (60%) patients having no family history were observed to be potential cases of depression. 22 out of 29 (75.8%) patients having BMI ≤25; 34 out of 50 (68%) patients having BMI in the range 25-30; and 11 out of 21(52.3%) patients having BMI ≥30 were observed to be potential

cases of depression.

**Table 2: Distribution of cases according to Disease related variables.**

| Disease related variables            | Frequency, n | Percentage |
|--------------------------------------|--------------|------------|
| Family history of diabetes           |              |            |
| Yes                                  | 78           | 78.0       |
| No                                   | 22           | 22.0       |
| Body Mass Index (kg/m <sup>2</sup> ) |              |            |
| ≤25                                  | 28           | 28.0       |
| 25-30                                | 50           | 50.0       |
| >30                                  | 22           | 22.0       |
| Fasting Blood Sugar (mg/dl)          |              |            |
| ≤110                                 | 12           | 12.0       |
| 110-125                              | 18           | 18.0       |
| >125                                 | 70           | 70.0       |
| HbA <sub>1c</sub> (%)                |              |            |
| <7                                   | 37           | 37.0       |
| ≥7                                   | 63           | 63.0       |
| Duration of diabetes (years)         |              |            |
| >5                                   | 38           | 38.0       |
| 5-10                                 | 52           | 52.0       |
| >10                                  | 10           | 10.0       |
| Duration of treatment (years)        |              |            |
| >5                                   | 42           | 42.0       |
| 5-10                                 | 55           | 55.0       |
| >10                                  | 3            | 3.0        |
| Medication                           |              |            |
| Oral                                 | 60           | 60.00      |
| Injection                            | 28           | 28.0       |
| Oral + Injection                     | 12           | 12.0       |

**Table 3: Distribution of cases according to Beck's Depression Inventory.**

| Beck's depression inventory | Score | Frequency, n (100) | Percentage |
|-----------------------------|-------|--------------------|------------|
| Minimal                     | 1-10  | 23                 | 23         |
| Mild                        | 11-16 | 10                 | 10.00      |
| Borderline                  | 17-20 | 20                 | 20         |
| Moderate                    | 21-30 | 40                 | 40         |
| Severe                      | ≥31   | 7                  | 7          |

All of 9 out of 12 (75%) patients having fasting blood sugar (FBS) ≤110; 12 out of 18 (66.6%) patients having fasting blood sugar (FBS) in the range 110-125; 46 out of 70 (65.7%) patients having fasting blood sugar (FBS) ≥125 were observed to be potential cases of depression. 17 out of 38 (44.7%) patients having duration of diabetes less than 5 years; 41 out of 52 (78.8%) patients having duration of diabetes in the range 5-10 years; and 9 out of 10 (90%) patients having duration of diabetes more than 10 years were observed potential cases of depression.

**Table 4: Association between socio-demographic variables and depression.**

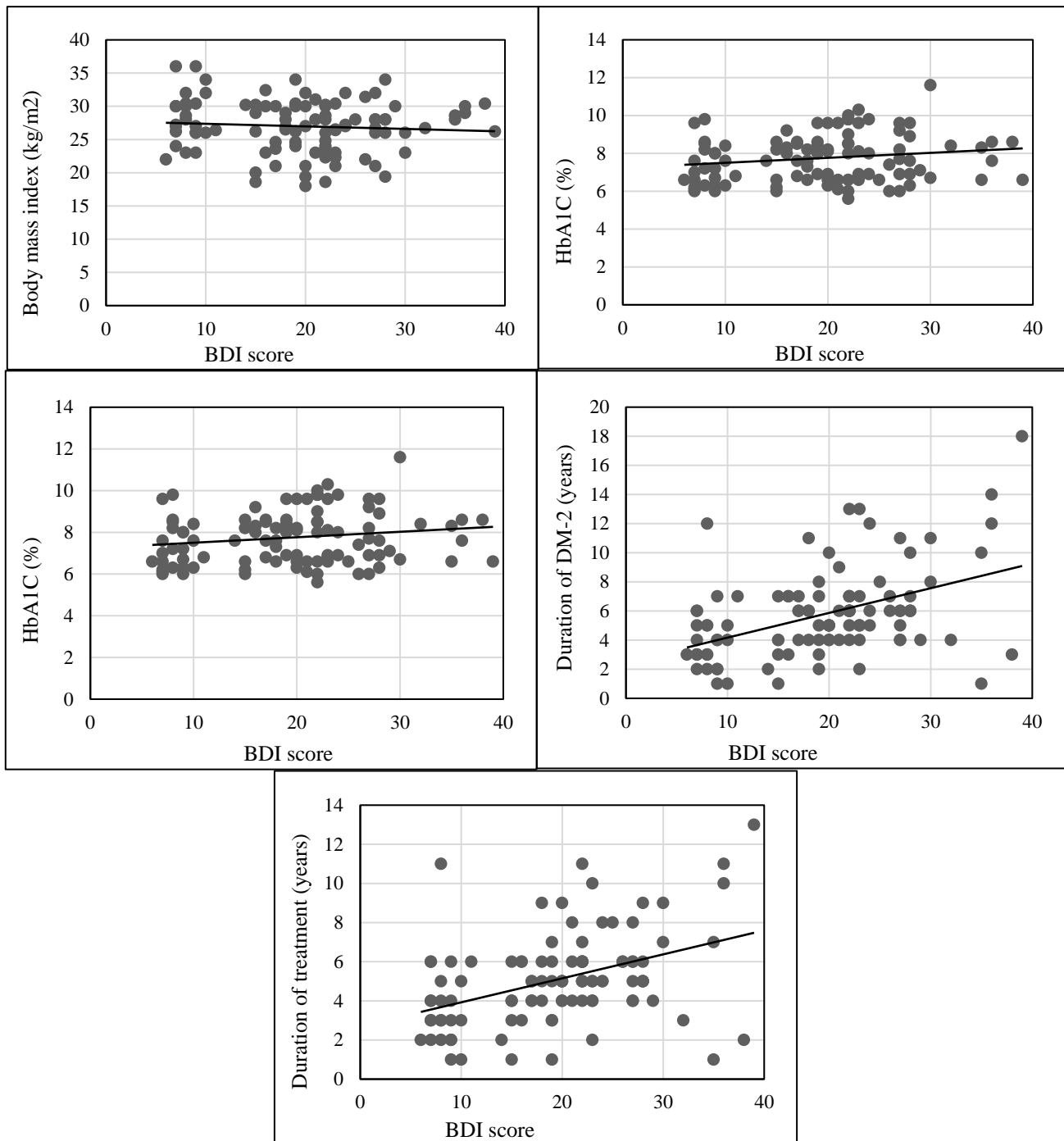
| Variables      |    | Number of patients (%) |                 |                       |                     |                   | p-value |
|----------------|----|------------------------|-----------------|-----------------------|---------------------|-------------------|---------|
|                |    | Minimal Depression     | Mild Depression | Borderline Depression | Moderate Depression | Severe Depression |         |
| Age (years)    | N  |                        |                 |                       |                     |                   |         |
| ≤30            | 5  | 2 (40.00)              | 0 (0.00)        | 2 (40.00)             | 1 (20.00)           | 0 (0.00)          | <0.001  |
| 31-40          | 10 | 3 (33.33)              | 1 (10.00)       | 1 (10.00)             | 3 (33.34)           | 2 (20.00)         | <0.001  |
| 41-50          | 27 | 9 (33.34)              | 4 (14.82)       | 4 (14.82)             | 8 (29.63)           | 2 (7.41)          | <0.001  |
| 51-60          | 41 | 5 (12.20)              | 3 (7.32)        | 11 (26.83)            | 20 (48.78)          | 2 (4.88)          | <0.001  |
| >60            | 17 | 4 (23.53)              | 2 (11.77)       | 2 (11.77)             | 8 (47.06)           | 1 (5.89)          | <0.001  |
| Sex            |    |                        |                 |                       |                     |                   |         |
| Male           | 62 | 14 (22.58)             | 6 (9.68)        | 11 (17.75)            | 27 (43.55)          | 4 (6.46)          | 0.701   |
| Female         | 38 | 9 (23.69)              | 4 (10.53)       | 9 (23.69)             | 13 (34.21)          | 3 (7.90)          |         |
| Marital status |    |                        |                 |                       |                     |                   |         |
| Married        | 79 | 14 (17.73)             | 7 (8.86)        | 17 (21.52)            | 35 (44.31)          | 6 (7.60)          | <0.001  |
| Unmarried      | 3  | 2 (66.67)              | 0 (0.00)        | 0 (0.00)              | 1 (33.33)           | 0 (0.00)          | <0.001  |
| Divorced       | 5  | 1 (20.00)              | 2 (40.00)       | 0 (0.00)              | 2 (40.00)           | 0 (0.00)          | <0.001  |
| Widow          | 13 | 6 (46.16)              | 1 (7.70)        | 3 (23.08)             | 2 (15.39)           | 1 (7.70)          | <0.001  |
| Religion       |    |                        |                 |                       |                     |                   |         |
| Hindu          | 53 | 12 (22.65)             | 5 (9.44)        | 10 (18.87)            | 23 (43.40)          | 3 (5.66)          | <0.001  |
| Muslim         | 30 | 9 (30.00)              | 2 (6.67)        | 4 (13.34)             | 11 (36.67)          | 4 (13.34)         | <0.001  |
| Sikh           | 12 | 1 (8.34)               | 1 (8.34)        | 6 (50.00)             | 4 (33.34)           | 0 (0.00)          | <0.001  |
| Others         | 5  | 1 (20.00)              | 2 (40.00)       | 0 (0.00)              | 2 (40.00)           | 0 (0.00)          | <0.001  |

**Table 5: Association between diseases related variables and Depression.**

| Variables                |    | Number of patients (%) |                 |                       |                     |                   | p-value |
|--------------------------|----|------------------------|-----------------|-----------------------|---------------------|-------------------|---------|
|                          |    | Minimal Depression     | Mild Depression | Borderline Depression | Moderate Depression | Severe Depression |         |
| Family history           | N  |                        |                 |                       |                     |                   |         |
| Yes                      | 80 | 19 (23.75)             | 6 (7.50)        | 16 (20.00)            | 33 (41.25)          | 6 (7.50)          | <0.001  |
| No                       | 20 | 4 (20.00)              | 4 (20.00)       | 4 (20.00)             | 7 (35.00)           | 1 (5.00)          | <0.001  |
| BMI (kg/m <sup>2</sup> ) |    |                        |                 |                       |                     |                   |         |
| ≤25                      | 29 | 4 (13.79)              | 3 (10.34)       | 8 (27.59)             | 14 (48.28)          | 0 (0.00)          | <0.001  |
| 25-30                    | 50 | 12 (24.00)             | 4 (8.00)        | 9 (18.00)             | 19 (38.00)          | 6 (12.00)         | <0.001  |
| >30                      | 21 | 7 (33.34)              | 3 (9.09)        | 3 (9.09)              | 7 (33.34)           | 1 (3.04)          | <0.001  |
| FBS (mg/dl)              |    |                        |                 |                       |                     |                   |         |
| ≤110                     | 12 | 3 (25.00)              | 0 (0.00)        | 0 (0.00)              | 8 (66.67)           | 1 (8.34)          | <0.001  |
| 110-125                  | 18 | 5 (27.78)              | 1 (5.56)        | 3 (16.65)             | 7 (38.89)           | 2 (11.12)         | <0.001  |
| >125                     | 70 | 15 (21.41)             | 9 (12.86)       | 17 (24.29)            | 25 (35.72)          | 4 (5.72)          | <0.001  |
| HbA <sub>1c</sub> (%)    |    |                        |                 |                       |                     |                   |         |
| <7                       | 38 | 10 (26.32)             | 4 (10.53)       | 6 (5.77)              | 16 (42.11)          | 2 (5.27)          | 0.032   |
| ≥7                       | 62 | 13 (20.97)             | 6 (9.68)        | 14 (22.58)            | 24 (38.71)          | 5 (8.06)          |         |
| DoD (years)              |    |                        |                 |                       |                     |                   |         |
| >5                       | 38 | 15 (39.48)             | 6 (15.78)       | 7 (18.42)             | 7 (18.42)           | 3 (7.90)          | <0.001  |
| 5-10                     | 52 | 7 (13.47)              | 4 (7.70)        | 12 (23.08)            | 28 (53.82)          | 1 (1.93)          | <0.001  |
| >10                      | 10 | 1 (10.00)              | 0 (0.00)        | 1 (10.00)             | 5 (50.00)           | 3 (30.00)         | <0.001  |
| DoT (years)              |    |                        |                 |                       |                     |                   |         |
| >5                       | 42 | 17 (40.48)             | 6 (14.29)       | 8 (19.04)             | 8 (19.04)           | 3 (7.14)          | <0.001  |
| 5-10                     | 54 | 5 (9.24)               | 4 (7.41)        | 12 (22.23)            | 31 (57.41)          | 2 (3.71)          | <0.001  |
| >10                      | 4  | 1 (25.00)              | 0 (0.00)        | 0 (0.00)              | 1 (25.00)           | 2 (50.00)         | <0.001  |
| Medication               |    |                        |                 |                       |                     |                   |         |
| Oral                     | 60 | 16 (26.67)             | 8 (13.33)       | 11 (18.33)            | 22 (36.67)          | 3 (5.00)          | <0.001  |
| Injection                | 28 | 5 (17.86)              | 1 (3.57)        | 8 (29.57)             | 13 (46.43)          | 1 (3.57)          | <0.001  |
| Oral + Injection         | 12 | 2 (16.67)              | 1 (8.33)        | 1 (8.33)              | 5 (41.67)           | 3 (25.00)         | <0.001  |

In this study 19 out of 42 (45.2%) patients having duration of treatment less than 5 years; 45 out of 54 (83.3%) patients having duration of treatment in the

range 5-10 years; 3 out of 4 (75%) patients having duration of treatment more than 10 years were observed to be potential cases of depression.



**Figure 1: Pearson's correlation between depression and different parameters (A) Body mass index; (B) HbA1C; (C) Fasting blood sugar; (D) Duration of DM-2; and (E) Duration of treatment.**

In our study 36 out of 60 (60%) patients undergoing oral treatment; 22 out of 28 (78.57%) patients undergoing injectables treatment; and 9 out of 12 (75%) patients undergoing combination of oral and injectables treatment were observed to be potential cases of depression.

Based on the Pearson's correlation between depression and demographic parameters it is observed that only age and marital status are found to be significantly associated with high BDI-II scores (Figure 1).



## DISCUSSION

Type 2 diabetes and depression are among major public health issues. Worldwide, more than 365 million people are estimated to have type 2 diabetes mellitus and almost 300 million people have major depression.<sup>20</sup> Both these disorders are projected to be among the five leading causes of burden by 2030.<sup>20</sup> Moreover, India has the largest number of diabetic populations in the world.<sup>21</sup>

Depression can be viewed as a modifiable independent risk factor for the development of type 2 diabetes mellitus and for progression of complication from type 2 diabetes.<sup>22</sup> Both diabetes and depression are associated with premature morbidity and mortality, and when these conditions co-exist the risk of developing co-morbidities, complications, patient suffering and associate cost escalates.<sup>23</sup>

Few studies have been conducted in India to study the prevalence of depression among type 2 diabetes in the past. However, limited data is available as far as Northern India is concerned and rarely such study has been carried out for Jammu region thereby absence of any existence of such data. In our study a total of one hundred patients were surveyed for the presence of depression symptoms using Beck Depression Inventory (BDI-II) scale. Patient's records were reviewed to obtain data pertaining to age, sex, marital status, Body Mass Index, level of education, smoking status, duration of diabetes mellitus, glycemic control using HbA1c test, use of insulin and presence of additional illness. The demographic pattern in our study is consistent with the available relevant literature.

Majority of the patients in our study were males (62%) and rest (38%) were females. Out of 169 cases 73 were males and 69 were females.<sup>3</sup> In our study majority of the patients were above 50 years of age, of which maximum number of patients were in the age group of 51-60 years. Study included 40 patients with age  $\geq 50$  years and 33 patients with age  $< 50$  years.<sup>9</sup> Investigated 294 patients out of which majority of patients were  $\leq 65$  years ( $n=216$ ; 73.5%).<sup>24</sup> All consecutive patients with mean age of 54.2 years in their study.<sup>25</sup>

Our study revealed that out of all the surveyed patients 70 patients (70%) scored  $\geq 16$  on BDI-II scale which were potential cases of depression. Depression was observed to be very common among patients in our study based on BDI-II scores. In our study HbA1c, duration of disease and duration of treatment were observed to be significantly associated with high BDI-II scores. Obesity ( $BMI > 30 \text{ kg/m}^2$ ) was also observed to be significantly associated with high BDI-II scores. Depression has high prevalence among diabetic patients. They reported 76.9% patients to be depressed in a study conducted in Shahid Rahimi Hospital of Khorramabad, Iran.<sup>3</sup>

Prevalence of depression among diabetic patients in other

studies has been observed to be less than observed noticeably more in our study. According to 23% of the studied patients met the criteria of major depression and 18% for moderate depression and 59% had no clinically significant depression.<sup>25</sup>

Their study examined the association of diabetes and the onset of depression by reviewing the literature and conducting a meta-analysis of longitudinal studies on this topic and found that people with type 2 diabetes have a 24% increased risk of developing depression.<sup>26</sup> AIIMS, New Delhi studied 77 patients with type 2 diabetes visiting Endocrinology out-patient department and found that depressive episode was found in 16.9% cases.<sup>27</sup> India interviewed 80 patients and found that 38.8% had depressive symptoms.<sup>28</sup> In a study conducted Palestine they reported that 40% of the screened type 2 diabetes patients were potential cases of depression.<sup>24</sup> India found that depression is common among diabetic patients and reported 41% of the studied patients to be depressed.<sup>25</sup>

Limitations of the study include; sample size was small. The study was conducted among patients visiting GMC Jammu, a tertiary care centre, therefore results cannot be generalised and extended to general population. There is a possible selection bias of the sample as more depressed patients might be seeking more specialised diabetic care in other centres instead of visiting GMC, Jammu.

## CONCLUSION

Majority of the potential cases of depression (33%) were in the age group of 51-60 years. 62% of the patients were male. Majority of the patients (40%) were in the age group of 51-60 years. 73.4% of the married patients were potential cases of depression. 78% of the patients were having family history of type 2 diabetes mellitus. Majority of the patients (72%) were overweight or obese ( $BMI > 25 \text{ kg/m}^2$ ). Duration of diabetes and duration of treatment was 5-10 years in majority of the patients and were significantly associated with prevalence of depression. Prevalence of depression was associated with sex, religion, and family history but was not statistically significant. Authors would suggest that more such studies should be carried out in detail for patients to screen type 2 diabetic patients for depressive symptoms.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Roupia Z, Koulouri A, Sotiropoulou P, Makrinika E, Marnaras X, Lahana I, et al. Anxiety and depression in patients with type 2 diabetes mellitus, depending on sex and body mass index. *Health Sci J*. 2009;3(1):32-40.

2. Gupta R, Misra A. Type 2 Diabetes in India: Regional Disparities. *Br J Diab Vasc Dis*. 2007;7(1):12-6.
3. Norouzi Z, Kaviani M, Tarrahi M, Jariani M, Abdollahian M, Almasian M, et al. The Prevalence of Depression in Patients with Diabetes Mellitus Type II in the Shahid Rahimi Hospital of Khorramabad, Iran. *Epidemiol. (Sunnyvale)* 2016;6(3):249.
4. Frederick FT, Maharajh HD. Prevalence of Depression in Type 2 Diabetic Patients in Trinidad and Tobago. *West Indian Med J*. 2013;62(7):628-31.
5. Friis AM, Consedine NS, Johnson MH. Does Kindness Matter? Diabetes, Depression, and Self-Compassion: A Selective Review and Research Agenda. *Diabetes Spectrum*. 2015;28(4):252-7.
6. Tabák AG, Akbaraly TN, Batty GD, Kivimäki M. Depression and type 2 diabetes: A causal association? *Lancet Diabetes Endocrinol*. 2014;2:236-45.
7. Williams MM, Clouse RE, Lustman PJ. Treating depression to prevent diabetes and its complications: Understanding depression as a medical risk factor. *Clin Diabetes*. 2006;24(2):79-86.
8. Mendenhall E, Norris SA, Shidhaye R, Prabhakaran D. Depression and type 2 diabetes in low- and middle-income countries: A systematic review. *Diabetes Res Clin Pract*. 2014;103(2):276-85.
9. Thour A, Das S, Sehrawat T, Gupta Y. Depression among patients with diabetes mellitus in North India evaluated using patient health questionnaire-9. *Indian J Endocr Metab*. 2015;19(2):252-5.
10. Ramachandran A, Snehalatha C, Ma RC. Diabetes in South-East Asia: An update. *Diabetes Res Clin Pract*. 2014;103(2):231-7.
11. Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. The prevalence of co-morbid depression in adults with diabetes: A meta-analysis. *Diabetes Care*. 2001;24:1069-78.
12. Talbot F, Nouwen A. A review of the relationship between depression and diabetes in adults. *Diabetes care*. 2000;23:1556-62.
13. Lustman PJ, Anderson RJ, Freedland KE, de Groot M, Carney RM, Clouse RE. Depression and poor glycemic control: A meta-analytic review of the literature. *Diabetes Care*. 2000;23(7):934-42.
14. Schram MT, Baan CA, Pouwer F. Depression and quality of life in patients with diabetes: A systematic review from the European depression in diabetes (EDID) research consortium. *Curr Diabetes Rev*. 2009;5(2):112-9.
15. Shaban MC, Fosbury J, Kerr D, Cavan DA. The prevalence of depression and anxiety in adults with Type 1 diabetes. *Diabet Med*. 2006;23:1381-4.
16. Simon GE, Katon WJ, Lin EH, Rutter C, Manning WG, Von Korff M, et al. Cost-effectiveness of systematic depression treatment among people with diabetes mellitus. *Arch Gen Psychiatr*. 2007;64(1):65-72.
17. Knol MJ, Twisk JW, Beekman AT, Heine RJ, Snoek FJ, Pouwer F. Depression as a risk factor for the onset of type 2 diabetes mellitus. A meta-analysis. *Diabetologia*. 2006;49(5):837-45.
18. Beck A, Steer R, Brown G. Beck Depression Inventory. Second ed San Antonio, TX, E.U.: Psychological Corporation; 1996.
19. Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. *Clin Hypertens. (Greenwich)* 2008;10(5):348-54.
20. e Silva L, de Menezes N, Lam M, Soares CN, Munoz D, Milev R, et al. Insulin Resistance as a Shared Pathogenic Mechanism Between Depression and Type 2 Diabetes. *Front Psychiatry*. 2019;10:57.
21. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. *Australas Med J*. 2014;7(1):45-8.
22. Wu Y, Ding Y, Tanaka Y, Zhang W. Risk factors contributing to type 2 diabetes and recent advances in the treatment and prevention. *Int J Med Sci*. 2014;11(11):1185-200.
23. Tovilla-Zarate C, Juarez-Rojop I, Jimenez YP, Jiménez MA, Vázquez S, Bermúdez-Ocaña, et al. Prevalence of anxiety and depression among outpatients with type 2 diabetes in the Mexican population. *PLoS One*. 2012;7(5):e36887.
24. Sweileh WM, Abu-Hadeed HM, Al-Jabi SW, Zyoud SH. Prevalence of depression among people with type 2 diabetes mellitus: a cross-sectional study in Palestine. *BMC Public Health*. 2014;14(1):163.
25. Raval A, Dhanaraj E, Bhansali A, Grover S, Tiwari P. Prevalence and determinants of depression in type 2 diabetes patients in a tertiary care centre. *Indian J Med Res*. 2010;132(2):195-200.
26. Nouwen A, Winkley K, Twisk J, Lloyd CE, Peyrot M, Ismail K, et al; European Depression in Diabetes (EDID) Research Consortium. Type 2 diabetes mellitus as a risk factor for the onset of depression: a systematic review and metaanalysis. *Diabetologia*. 2010;53(12):2480-6.
27. Balhara YP, Sagar R. Correlates of anxiety and depression among patients with type 2 diabetes mellitus. *Indian J Endocr Metab*. 2011;15(1):S50-4.
28. Mathew CS, Dominic M, Isaac R, Jacob JJ. Prevalence of depression in consecutive patients with type 2 diabetes mellitus of 5-year duration and its impact on glycemic control. *Indian J Endocr Metab*. 2012;16(5):764-8.

**Cite this article as:** Parihar S, Singh R. Prevalence of depression among patients with type 2 diabetes mellitus: a cross-sectional study. *Int J Adv Med* 2019;6:1372-8.