



## Association Of Depression In Patients Of Type 2 Diabetes Melitus

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### Abstract

**Background:** Diabetes is a chronic, progressive disease often associated with numerous neuropsychiatric co morbidities, particularly depression. The prevalence of depression is 2–3 times higher in patients with diabetes than in the general population. Depression is considered one of the most overlooked symptoms in diabetics and is directly associated with a poor quality of life. **Objective:** To study the profile of depression in subjects with type 2 DM. To establish possible co-relation between glycemic parameter (FBS, PPBS & HbA1c) and depression. **Methods:** This cross- sectional study was conducted among our patient's cohort comprised of the OPD (out-patient department) and IPD (in-patient department) patients of Internal Medicine in Rohilkhand Medical College and Hospital Bareilly, It comprises of 100 patients, who fulfill the Inclusion and Exclusion criteria were selected. **Result:** This study shows that depression is highly prevalent in the middle-aged population (particularly in females), as reflected by poor glycemic control (FBS, PPBS & HbA1c level) and the occurrence of diabetic complications. I Screening and counseling for depression among T2DM patients have to be carried out for control and treatment. Thus, proper lifestyle interventions like physical activity are recommended to lower the risk of both conditions. Its specific association with elevated risk of depression warrants further scrutiny.

**Keywords:** Depression, Type 2 DM, co-relation, glycemic parameter.



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### INTRODUCTION

Diabetes mellitus is characterized by persistent hyperglycemia with resultant morbidity and mortality [1]. In 1985, the world prevalence of DM was approximately 30 million cases, increasing to 177 million (2.8%) in 2000. Based on current tendencies, more than 360 million (4.4%) individuals will have the disease by 2030 [2].

International diabetes federation reveals that the total number of diabetes subjects in India is 50.8 million. The CPR (Crude prevalence rate) in the urban areas is estimated to be 9% and in rural area prevalence rate is around 3%. India has the second largest number of diabetic population in the world and it is expected that there will be 69.9 million diabetic populations in India by 2025 [3]. The International Diabetes Federation (IDF) estimated that, there will be increase in the people living with diabetes in India up to 87.0 million by 2030 from 50.8 million (2010), making it the 'Diabetes Capital' of the world [4].

Co morbid depression is common in chronic medical conditions including diabetes. Depression and diabetes are highly prevalent conditions and have significant impact on health outcomes [5]. Further, the prognoses of both depression and diabetes with respect to disease severity, complications, treatment resistance, and cost is worse for either disease than when they occur together. Given that co morbidity of disorders adds to treatment complexity and is frequently associated with chronicity, it is not surprising that diabetes mellitus negatively affects the course of psychiatric disorder [6]. The aim of our review on depression and diabetes was to emphasize the association of two in this part of the world, because of modern day epidemics of diabetes and obesity that is emerging in developing countries.

Approximately 340 million people worldwide suffer from depression at any given time. 10 to 25% of women and 5 to 12% of men have lifetime risk of developing major depressive disorder in community samples as per American Psychiatric Association, 2000 [7]. Prevalence rates appear to be unrelated to marital status, education, income, or ethnicity.

Major depression is commonly occurring, serious recurrent disorder linked to diminished functioning & guiding of life, medical morbidity & mortality [8]. The world health organization (WHO) has ranked depression the 4th leading cause of disability worldwide and project that by 2020, it will be 2nd leading cause [9]. According to world mental health survey, around one in 20 people having one episode of depression in previous year worldwide around 350 million people are suffering from depression [10]. Worldwide prevalence of major depression is ranging from 1.1% - 28% [25].

Psychological disturbances are commonly observed during the course of endocrine disorders. In recent years there has been an increased interest in the psychological wellbeing of patients suffering with endocrinological disorder. The relationship between endocrinological disorders particularly thyroid and diabetes continues to generate considerable interest in research. Psychological distress is frequently seen in diabetes mellitus and usually occurs after the diagnosis. The quality of life of patient is adversely affected, due to the course of the illness, restriction of diet and activity, management schedules and its complications.

There is lack of data on depression in diabetic patients in Uttarakhand, and it is hilly and geographically difficult state. We have taken an important step towards exploring the relationship between depression and type 2 diabetes mellitus patient in Dehradun region through our study.

## **MATERIALS AND METHODS**

Our patient's cohort comprised of the OPD (out-patient department) and IPD (in-patient department) patients of Internal Medicine in Rohilkhand Medical College and Hospital Bareilly, UP, India. Our study is cross-sectional study. It comprises of 100 patients, who fulfill the Inclusion and Exclusion criteria were selected.

### **Inclusion criteria:**

- 1: Any patient who has been diagnosed to have diabetes mellitus.
- 2: Type 2 diabetic patients with age >18yr.

### **Exclusion criteria:**

- Bipolar disorder.
- Having any psychiatric illness other than depression.
- Major cognitive impairment
- Occurrence of a severe life event in 2 months.
- Substance use disorder except nicotine and caffeine.
- Hypothyroidism.
- Pt with H/O limb amputation.

## **METHOD OF COLLECTION OF DATA**

### **Sample size:**

- Data was collected for a period of two years (Oct. 2024 to Sept. 2025) with the minimum sample size of 100 type 2 diabetics.

### **Study Procedure:**

All the patients meeting inclusion and exclusion criteria were evaluated thoroughly. History collection, clinical examination, laboratory investigations such as complete blood count, lipid profile, blood sugar level, HbA1c, and other routine investigations were performed as a part of routine diagnosis and treatment for all the patients.

We diagnose and classify depression Beck's Depression Inventory scale was used. Scores greater than 10 were considered positive to determine prevalence of depression.

A correlation analysis to assess a relationship between HbA1c scores in the last 6 months with BDI scores will be done. Patient screening positive on BDI were referred to psychiatrist for ruling out other disorder and confirmation of MDD. Patients will be evaluated for diagnosis MDD according to DSM 5.

Fasting blood glucose and lipids were measured within 24 hours of admission of the case subjects. Blood samples of all participants were sent to the laboratory of our medical college.

All the patients were given necessary treatment and they were followed up in medicine OPD.

The results of glycemic control and depression in type 2 Diabetes Mellitus were compared. Association with renal dysfunction, chronic disease, and stroke were also investigated.

Data was entered in Microsoft excel and was analyzed using SPSS software version 18. Qualitative data was expressed as frequencies and quantitative data was expressed as mean with standard deviation. Chi Square test was used to compare the frequencies while mean was compared using independent sample T test among two groups and ANOVA among three groups. P-value of <0.05 was taken as statistically significant.

## RESULTS

Our patient's cohort comprised of 100 diabetic patients. Most of the cases were from age group of <60 years (69%) followed by patients >60 years (31%). Mean age of all participants was 56.65±11.15 years.

In our study, both mild to borderline (40.625% Vs 18.75%) and moderate to severe (28.125% Vs 12.5%) forms of depression was more common in younger age groups (<60 years) compared to older age groups (>60 years). Though, it was not statistically significant. Because of the chronic nature of the disease and its complications, younger age group populations were unable to cope up. This may limit lifestyle of the patients.

Depression was more common among females (78.125%) diabetes patients as compared to males (21.875%) patients. Both mild to borderline (50% Vs 9.374%) and moderate to severe depression (28.125% Vs 12.5%) was more common in females compared to males. Though, it was not statistically significant. It might have been due to family burden, insecurity and dependence on family members for their sustenance and survival.

**Table-1: Baseline characteristics of the study participants**

| Variable       |            | No. | Percentage |
|----------------|------------|-----|------------|
| Age Group      | ≤60years   | 69  | 69.0       |
|                | >60years   | 31  | 31.0       |
| Sex            | Female     | 71  | 71.0       |
|                | Male       | 29  | 29.0       |
| Duration of DM | 0 – 2years | 35  | 35.0       |
|                | 2 – 5years | 20  | 20.0       |
|                | >5years    | 45  | 45.0       |
| Co morbidities | Present    | 46  | 46.0       |
|                | None       | 54  | 54.0       |

Our study showed that as per BDI scoring system almost similar proportion of patients in both the age groups had depression. Higher proportion of females had depression as compared to males, however this was not statistically significant.

**Table-2: proportion of depression among diabetics.**

| Depression  |                       | No. | %    |
|-------------|-----------------------|-----|------|
| BDI Scoring | Normal                | 68  | 68.0 |
|             | Mild Mood Disturbance | 17  | 17.0 |
|             | Borderline Depression | 2   | 2.0  |
|             | Moderate Depression   | 8   | 8.0  |
|             | Severe Depression     | 5   | 5.0  |
|             | Extreme Depression    | 0   | 0.0  |
| Clinically  | Normal                | 69  | 69.0 |
|             | Borderline depression | 3   | 3.0  |
|             | Mild depression       | 16  | 16.0 |
|             | Moderate Depression   | 7   | 7.0  |
|             | Severe Depression     | 5   | 5.0  |

The increase in duration of diabetes the number of patients with depression increased and this was found to be statistically significant. The increase in duration of diabetes the number of patients with depression increased and this was found to be statistically significant. The depression increased with poor glycemic control, although this association was not found to be statistically significant. We observed direct correlation of HbA1c value with depression. Depression was more common (75% Vs 25%) in patients with poor glycemic control (HbA1c level >7), and severity of depression also increase (12.5% Vs 3.125%) with poor glycemic control (HbA1c level >7). Although this association was not statistically significant. Poor glycemic control could have lead to diabetic complications. Diabetic complications were found to be strongly associated with increasing depression severity.

**Table 3:- Association of depression on the basis of Clinical examination with glycemic control.**

| Variable |       | n  | Depression |                               |                               | p Value |
|----------|-------|----|------------|-------------------------------|-------------------------------|---------|
|          |       |    | Normal     | borderline to mild depression | Moderate to severe depression |         |
|          |       |    | No.(%)     | No.(%)                        | No.(%)                        |         |
| HbA1c    | <7    | 23 | 15(65.2)   | 6(26.1)                       | 2(8.7)                        | 0.86    |
|          | 7 – 8 | 19 | 14(73.7)   | 3(15.8)                       | 2(10.5)                       |         |
|          | >8    | 58 | 40(69.0)   | 10(17.2)                      | 8(13.8)                       |         |

That depression increased with poor glycemic control, although this association was not found to be statistically significant.

**Table-4: Comparison of Glycemic control parameter with depression as per BDI scores.**

| Variable |           | n  | Depression (BDI) |           | p Value |
|----------|-----------|----|------------------|-----------|---------|
|          |           |    | Present          | Absent    |         |
|          |           |    | No.(%)           | No.(%)    |         |
| FBS      | <126      | 12 | 5 (41.7)         | 7 (58.3)  | 0.74    |
|          | 127 – 160 | 48 | 15 (31.3)        | 33 (68.8) |         |
|          | >160      | 40 | 12 (30.0)        | 28 (70.0) |         |
| FBS      | <126      | 12 | 5 (41.7)         | 7 (58.3)  | 0.44    |
|          | >126      | 88 | 27 (30.7)        | 61 (69.3) |         |
| PPBS     | <200      | 10 | 2 (20.0)         | 8 (80.0)  | 0.41    |
|          | 201 – 250 | 24 | 10 (41.7)        | 14 (58.3) |         |
|          | >250      | 66 | 20 (30.3)        | 46 (69.7) |         |
| PPBS     | <200      | 10 | 2 (20.0)         | 8 (80.0)  | 0.39    |
|          | >200      | 90 | 30 (33.3)        | 60 (66.7) |         |

Poor glycemic control was higher in patients with depression, although this association was not statistically significant.

**Table-5: Comparison of mean of Glycemic control parameter with severity of depression as per BDI score.**

| Variable |           | n  | Depression (BDI) |                                                |                               | p Value |
|----------|-----------|----|------------------|------------------------------------------------|-------------------------------|---------|
|          |           |    | Normal           | Mild mood disturbance to borderline depression | Moderate to severe depression |         |
|          |           |    | No.(%)           | No.(%)                                         | No.(%)                        |         |
| FBS      | <126      | 12 | 7 (58.3)         | 4 (33.3)                                       | 1 (8.3)                       | 0.19    |
|          | 127 – 160 | 48 | 33 (68.8)        | 11 (22.9)                                      | 4 (8.3)                       |         |
|          | >160      | 40 | 28 (70.0)        | 4 (10.0)                                       | 8 (20.0)                      |         |
| FBS      | <126      | 12 | 7 (58.3)         | 4 (33.3)                                       | 1 (8.3)                       | 0.39    |
|          | >126      | 88 | 61 (69.3)        | 15 (17.0)                                      | 12 (13.6)                     |         |
| PPBS     | <200      | 10 | 8 (80.0)         | 2 (20.0)                                       | 0 (0.0)                       | 0.16    |
|          | 201 – 250 | 24 | 14 (58.3)        | 8 (33.3)                                       | 2 (8.3)                       |         |
|          | >250      | 66 | 46 (69.7)        | 9 (13.6)                                       | 11 (16.7)                     |         |
| PPBS     | <200      | 10 | 8 (80.0)         | 2 (20.0)                                       | 0 (0.0)                       | 0.43    |
|          | >200      | 90 | 60 (66.7)        | 17 (18.9)                                      | 13 (14.4)                     |         |

Poor glycemic control was higher in patients with depression, although this association was not statistically significant.

**Table-6: Association of severity of depression on the basis of BDI score and Clinical examination with different variables.**

| Variable     |          | n  | Depression |            | p Value |
|--------------|----------|----|------------|------------|---------|
|              |          |    | Severe     | Others     |         |
|              |          |    | No.(%)     | No.(%)     |         |
| Age group    | ≤60years | 69 | 4(5.8)     | 65(94.2)   | 0.58    |
|              | >60years | 31 | 1(3.2)     | 30(96.8)   |         |
| Sex          | Female   | 71 | 3(4.2)     | 68(95.8)   | 0.58    |
|              | Male     | 29 | 2(6.9)     | 27(93.1)   |         |
| Hypertension | Present  | 31 | 2(6.5)     | 29(93.5)   | 0.66    |
|              | Absent   | 69 | 3(4.3)     | 66(95.7)   |         |
| COPD         | Present  | 6  | 0(0.0)     | 6(100.0)   | 0.56    |
|              | Absent   | 94 | 5(5.3)     | 89(94.7)   |         |
| UTI          | Present  | 8  | 0(0.0)     | 8(100.0)   | 0.49    |
|              | Absent   | 92 | 5(5.4)     | 87(94.6)   |         |
| HbA1c Range  | ≤7       | 23 | 1(4.3)     | 22(95.7)   | 0.87    |
|              | >7       | 77 | 4(5.2)     | 73(94.8)   |         |
| T2DM Range   | 0-2yrs   | 35 | 1(2.9)     | 34(97.1)   | 0.74    |
|              | 3-5yrs   | 20 | 1(5.0)     | 19(95.0)   |         |
|              | >5yrs    | 45 | 3(6.7)     | 42(93.3)   |         |
| Hb           | <9       | 17 | 0 (0.0)    | 17 (100.0) | -       |
|              | >9       | 83 | 5 (6.0)    | 78 (94.0)  |         |

Table-6 shows that association was not found to be statistically significant.

## DISCUSSION

Gopalakrishnan S et al, also found similar distribution of the age. They found mean age of patients was 53±9.7 years old [11]. Another study Joseph et al, mean age was 53.61±10.7 years old [141]. Mean age of our patients is also in same range. Our study found that 32% diabetics suffered from depression. Other studies (also found incidence of depression in range of 14-41% [11,13].

A similar Nicolau J et al, conducted in Spain, involving 320 interviews with type 2 diabetes mellitus patients, found that 27.2% had depressive symptoms (as measured by the Spanish version of the Beck Depression Inventory). These symptoms predominantly affected women. It might have been due to single and the unemployed [14].

Another cross-sectional study Mushtaque A et al, evaluating the prevalence of depression in 80 patients with type 2 diabetes hospitalized in the south India found that 38.75% of subjects with type 2 diabetes were diagnosed with depression (based on the Diagnostic and Statistical Manual of Mental Disorders). Whose severity was higher in females, It might have been due to indigenous, separated / divorced and widowed individuals with incomplete primary education and obese status [15].

A study by Gopalakrishnan S et al, the prevalence of depression among T2DM patients was found to be 39.7%. Also, shows that depression was more common among female diabetic patients. It might have been due to insecurity and dependence on family members for their sustenance and survival. Similar findings were observed in study done by Sahota et al, where women were twice likely to have depression compared with males [16].

Many studies, including systematic reviews, have found that people at risk of having diabetes and diabetics have more depressive symptoms compared with non-diabetics [160-161], and the literature has shown depression is a risk factor for developing diabetes. A systematic review observed that depressed individuals have a 41% greater risk for developing diabetes mellitus and a 32% greater risk for developing type 2 diabetes. However, the authors noted that the mechanisms underlying this relationship remain unclear and warrant further research [17].

In our study depression was directly encountered with increase the duration of diabetes, shows the association of depression as BDI scoring with different variables. It was seen that majority of the participants in both the age groups were mild mood disturbance to borderline depression and moderate to severe depression. For females it was seen that maximum were mild mood disturbance to borderline depression and moderate to severe depression, whereas for male majority were in moderate to severe depression followed by mild mood disturbance to borderline disturbance but this difference was non-significant. With the increase in duration of diabetes the number of patients with depression increased

and this was found to be statistically significant. Because of increase duration of disease, its complications, economical burden on family, and disturbance in work, it compromises the lifestyle of the patients.

Musavi's study [18] found no significant relationship between the duration of diabetes and depression. This is in contrast with other studies reporting significant relationship between depression and duration of diabetes [19-20].

We also found significant relationship between duration of diabetes and depression. This study also evaluated by psychiatrist independently, and shows similar results as BDI scores.

In contrast, Engum et al., found that hyperglycemia was not associated with depression in type 2 diabetes and there was actually an inverse relationship between HbA1c and level of depression in both types of diabetes, although the associations were not significant [156]. These findings are observed by other author also.

A study Kruse et al., [21] did not find positive associations between depression and HbA1c in a community sample. In addition, they concluded that individuals with diabetes and HbA1c level <7% more often had affective disorders than those with poor glycemic control. In the general population, patients with high HbA1c levels reported slightly but significantly higher levels of well being than patients with low HbA1c levels [22].

We observed Depression was more in patients with poor control PPBS (>200mg/dl) level. But moderate to severe depression was more common in patients with poor control FBS (>126mg/dl) and PPBS (>200mg/dl) level, although this association was not statistically significant (Table 9, 11). Similar results were also evaluated by Psychiatrist. Increasing blood sugar levels (FBS & PPBS) could have lead to diabetic complications. Diabetic complications were found to be strongly associated with increasing depression severity.

A study by Gopalakrishnan S et al., statistically significant association was found between fasting blood sugar levels and depression severity. Increasing FBS levels could have lead to diabetic complications. Diabetic complications were found to be strongly associated with increasing depression severity.

Diabetic patients with co morbidities were found to no association with depression, although this association was not statistically significant in our study.

A study by Joseph et al., also found the presence of other co morbidities like hypertension to be associated with depression [12], which was also observed by Jose et al., in their study [23]. But in the study by Thomas lype et al., done in Trivandrum no association was reported between the presence of co morbidities or complications and the presence of depression among DM patients [24]. It has further been suggested that proinflammatory cytokines can contribute to development of insulin resistance directly by modulation of the insulin receptor in periphery tissues. For example, Grimbale proposes in a review in 2002 over inflammatory status and insulin resistance that TNF- $\alpha$ , via reduced phosphorylation of a subunit of the insulin receptor, contribute to development of insulin resistance [25]. In summary, this hypothesis on chronic and unintentional stress response can be contribute to the development of both type 2 diabetes and depression.

A study by Gopalakrishnan S et al., shows about 43.5% of the study participants experienced somewhat difficulty in carrying out daily activities as per the PHQ-9 questionnaire. This could have lead to poor compliance to medication, which could have lead to poor outcome of the disease. Similar findings were observed in study done by Habtewold et al., in Ethiopia [26].

## CONCLUSION

Thus depression was found to be most common associated with duration of diabetes, and associated with elderly age, female gender and poor glycemic control (FBS, PPBS & HbA1c level). But association of duration of diabetes was statistically significant.

Depression could be a barrier in the effective treatment of diabetes as it could lead to non-adherence to treatment by the patients. It is important that patients with Diabetes should be screened for depression and treated if necessary. It may improve treatment adherence and could result in better outcome of patients.

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