

**Prevalence of Depression in Diabetes Mellitus: A hospital based Cross sectional study****K Sunil Kumar<sup>1</sup>, GV Ramana Rao<sup>2</sup>, Rudraraju Rama Krishnam Raju<sup>3</sup>, Naga Chaitanya Duggirala<sup>4</sup>**<sup>1</sup>*Postgraduate, Department of Psychiatry, ASRAM Medical College, Eluru, Eluru District, Andhra Pradesh, India*<sup>2</sup>*Associate Professor, Department of Psychiatry, ASRAM Medical College, Eluru, Eluru District, Andhra Pradesh, India*<sup>3</sup>*Professor & HOD, Department of Psychiatry, ASRAM Medical College, Eluru, Eluru District, Andhra Pradesh, India*<sup>4</sup>*Assistant Professor, Department of Psychiatry, ASRAM Medical College, Eluru, Eluru District, Andhra Pradesh, India***Received: 29-05-2023 / Revised: 27-12-2021 / Accepted: 30-01-2022****Abstract**

**Introduction:** Diabetes is a metabolic disorder that has life-changing consequences for individuals affected by it. Diabetes may be diagnosed and treated, but the depression in these patients often goes unnoticed. Most of the time depression is not considered as an important factor and often ignored and left untreated. Depression is associated with poor health behaviors (i.e., smoking, physical inactivity, caloric intake) that increase risk of type 2 diabetes. Depression is also associated to central obesity and potentially to impaired glucose tolerance and may worsen diabetes. **Objectives of the study:** The primary aim is to study the prevalence of depression in type 2 diabetes mellitus patients. **Materials & Methods:** A hospital based observational study was carried out on diabetic patients attending the general medicine OPD in a tertiary care hospital during the period June-October 2018. **Results:** The prevalence of depression in diabetic patients is 56% in the current study which is in par with earlier studies. In the present study, among depressed patients 38.39% had mild depression, 34.82% has moderate symptoms, 19.64% had moderately severe depression, 7.14% had very severe symptoms. On evaluation of various parameters of diabetes, the parameters that are significantly associated with depression are glycosylated hemoglobin (p=0.028), Fasting blood sugar (p=0.019), Body mass index (p=0.004), Duration of diabetes (p=0.002). Depression is mostly observed in patients with diabetes duration of 7-9 years. Among the parameters evaluated in the present study, number of complications and treatment regimen (p=0.000) have showed the most significant association with severity of depression. **Conclusion:** Higher glycosylated hemoglobin value, fasting blood sugar levels and duration of diabetes, higher BMI all are significantly associated with severity of depression. The number of complications and treatment regimen in diabetes are also significantly associated with depression. As the disease burden of depression increases in terms of duration of illness or poor control or complications, the severity of depression also seems to increase. Therefore adequate screening and intervention of depression is necessary for better outcome on both diabetes and depression especially in diabetic patients with higher morbidity and longstanding illness.

**Keywords:** Depression, Glycemic Control, Diabetes

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**Introduction**

Diabetes is a chronic illness that requires continuous medical care and ongoing patient education and self-management, and support to prevent complications and to reduce the risk of long-term complications, and ensure optimal outcomes. Current criteria for the diagnosis of diabetes includes HbA1C >6.5% or Fasting plasma glucose (FPG) >126 mg/dl (7.0 mmol/l) or 2-h plasma glucose >200 mg/dl (11.1 mmol/l) during an oral glucose tolerance test (OGTT).[1] In India, Diabetes is gaining the status of a potential epidemic at an alarming rate, with more than 62 million diabetic individuals currently diagnosed with the disease.[2] Indians have the phenotype characterized by low BMI and high upper body adiposity, high body fat, high level of Insulin resistance, increasing their proneness for Diabetes.[3]

Depression is a major condition characterized by disruptions in all

facets of life -social, psychological, behavioral, and biological. The association of depression with diabetes mellitus was first noted in the scientific literature more than 300 years ago when Willis made the surprising remark that diabetes was the result of sadness or prolonged sorrow.[4]

Depression is associated with poor health behaviors (i.e., smoking, physical inactivity, caloric intake) that increase risk of type 2 diabetes.[5]

Depression is also associated with central obesity and potentially impaired glucose tolerance.[6] Depression is associated with physiological abnormalities, including activation of the hypothalamic-pituitary-adrenal axis, pro-inflammatory cytokines, which can alter glucose transport function and lead to disturbance in glucose regulation mechanism causing hyperinsulinemia and insulin resistance and contribute to diabetes risk.[7] Late-life depression is associated with a history of vascular disease, including diabetes.[8] Most of the studies have shown that Quality of life in diabetes is decreased when compared to individuals without diabetes. Furthermore, the presence of diabetic complications has an additional negative impact on Quality of life.[9]

Most of the time depression is not considered as an important factor and often ignored and left untreated.[10]

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Diabetes care is complex and requires many issues, beyond glycemic control, to be addressed. Comorbidity of depression in diabetes compromises the care and complicates the illness. Furthermore, the presence of diabetic complications has an additional negative impact on Quality of life.[11]Hence there is a need to identify and manage depression effectively in diabetes patients.

**Aim of the Study**

To study the prevalence of Depression in patients with Diabetes mellitus and the influence of Depression on glycemic control.

**Material & Methods**

A hospital based study was carried out on diabetic patients attending the general medicine OPD in a tertiary care hospital in Eluru from JUNE 2018-OCTOBER 2018.

**Study Design**

A cross-sectional, open label, comparative study

**Sample Size**

200 patients selected through consecutive sampling

**Inclusion Criteria**

1. Male /Female patients aged 18 and above.
2. Those who are willing to sign the informed consent.
3. Diabetes mellitus patients as defined by American diabetic association criteria, 2010.

**Exclusion Criteria**

1. Presence of type 1 diabetes and gestational diabetes.
2. Those who are seriously ill and cannot comprehend information.
3. Those that are having medical co-morbidities, other than diabetic complications.
4. Those who refuse to give consent for the study

**Data Collection**

200 consecutive patients diagnosed as having type 2 diabetes mellitus were evaluated after obtaining informed and written consent.

**Materials & Methods**

Depression was assessed by administering the nine items PHQ-9; depression section of Patient Health Questionnaire, a self-report version of PRIME-MD [Primary care evaluation of mental disorders].

The PHQ-9, a tool specific to depression, simply scores each of the 9 DSM-IV criteria based on the mood module from the original PRIME-MD.

It is a dual instrument for screening as well as grading the severity of depression.

PHQ-9 Depression Severity: This is calculated by assigning scores of 0, 1, 2, and 3, to the response categories of —not at all, —several days, —more than half the days, and —nearly every day, respectively. PHQ-9 total score for the nine items ranges from 0 to 27. Scores of 5, 10, 15, and 20 represent cut points for mild, moderate, moderately severe and severe depression, respectively.

Telugu version of PHQ-9 was used.

Further social, demographical and clinical variables were recorded. Glycemic control was assessed by glycosylated hemoglobin value. Fasting and Postprandial blood glucose levels were also recorded.

Statistical analysis was done with statistical package for social sciences - SPSS 25 trial version.

Descriptive statistics: Frequency tables, Pie diagrams, Bar charts representing distribution of clinical and socio demographic variables.

Analytical statistics: Chi square test was used to analyse the data. p value less than 0.05 is taken as significant. Adjacent rows were added when the values were very low, wherever necessary.

Ethics committee approval: The study has been approved by the Institutional Ethical Committee of the ASRAM Medical College, Eluru, A.P.

**Results**

**Table 1:** Patient variables related to Diabetes vs. Depression

VARIABLES	FREQUENCY	PERCENTAGE	
FASTING BLOOD SUGAR LEVELS	<130	40	20.0
	130-150	28	14.0
	150-200	60	30.0
	>200	72	36.0
POST PRANDIAL BLOOD SUGAR LEVELS	<180	50	25.0
	180-200	18	9.0
	200-250	38	19.0
	>250	94	47.0
HbA1C	4-6	68	34.0
	6-7	44	22.0
	7-8	40	20.0
	>8	48	24.0
YEARS WITH DM	<1yr	42	21.0
	1-3yrs	40	20.0
	4-6yrs	40	20.0
	7-9yrs	30	15.0
	>10yrs	48	24.0
NO. OF COMPLICATIONS	0	96	48.0
	1	68	34.0
	2	22	11.0
	3	10	5.0
	>3	4	2.0
PHQ-9 SCORE (DEPRESSION)	0-5 NO	88	44.0
	6-10 MILD	43	21.5
	11-15 MODERATE	39	19.5
	16-20 MODERATE-SEVERE	22	11.0
21-27 VERY SEVERE	8	4.0	
TREATMENT REGIMEN	OHA	116	58.0
	INSULIN	24	12.0
	OHA+INSULIN	60	30.0

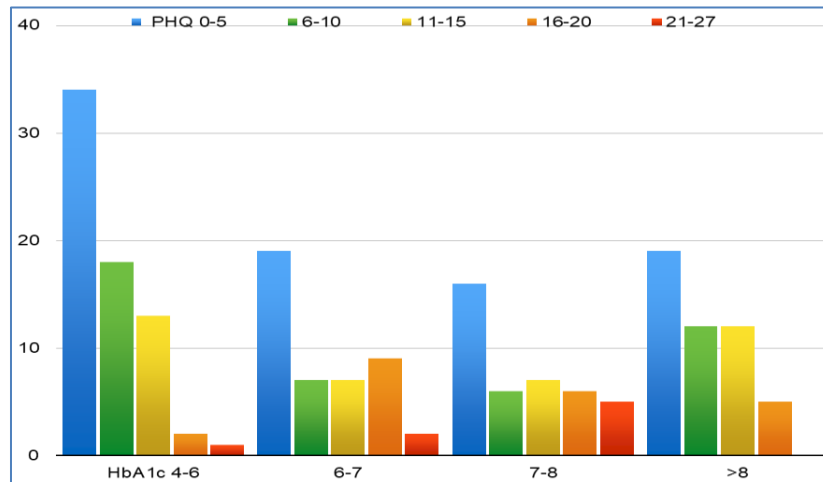
After assessment with Patient Health Questionnaire - Depression version(PHQ-D), 56% of the sample had depressive symptoms and

44% were free from depression. 19.5% had moderate depression, 11% had moderately severe depression and 4% had severe depression. Among the sample 21.5% had mild depressive symptomatology, 19.5% had moderate depression, 11% had moderately severe depression and 4% had severe depression.

**Table 2:** Glycated hemoglobin levels vs. depression

HbA1c	No Depression	Mild	Moderate	Moderate-Severe	Very Severe	Total (n)
4-6	34	18	13	2	1	68
6-7	19	7	7	9	2	44
7-8	16	6	7	6	5	40
>8	19	12	12	5	0	48
Total	88	43	39	22	8	200

Severity of depression given by PHQ 9 score (Chi-Square- 22.977; df-12; p-0.028)  
 There is significant association between HbA1c levels and depression



**Figure 1:** Severity of depression vs HbA1c values

In the above figure plotting depression levels vs HbA1C, no depression category is more common in the lower value range of HbA1c and as the HbA1c increases to >8, mild and moderate depression category contributed significantly.

**Table 3:** Fasting blood sugar levels vs. depression

FASTING BLOOD SUGAR LEVELS	PHQ-9 SCORE(DEPRESSION)					TOTAL(n)
	NO	MILD	MODERATE	MODERATE-SEVERE	VERY SEVERE	
<130	22	13	5	0	0	40
130-150	12	5	8	2	1	28
150-200	3	10	7	9	2	60
>200	22	15	19	11	5	72
TOTAL	88	43	39	22	8	200

Chi-Square- 24.261; df-12; p-0.019

**Table 4:** Duration of Diabetes vs Depression

Years with DM	No	Mild	Moderate	Moderate Severe	Very Severe	Total (n)
<1 year	24	13	5	0	0	42
1-3 years	18	5	8	7	2	40
4-6 years	21	7	7	4	1	40
7-9years	6	6	7	6	5	30
>10 years	19	12	12	5	0	48
Total	68	43	39	22	8	200

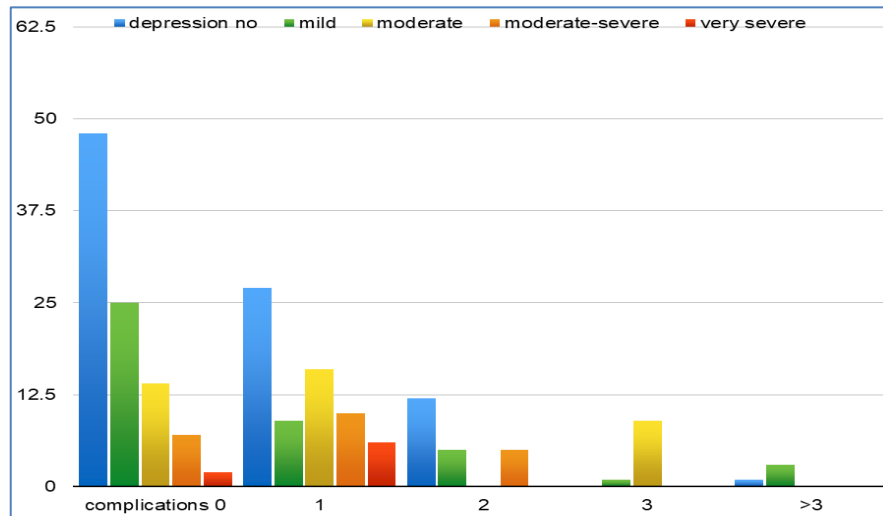
Chi - Square 36.98; df-16; p-0.002

Duration of diabetes is significantly associated with depression. 9 years.  
 Depression is mostly observed in patients with diabetes duration of 7-

**Table 5:** Number of Complications Vs Depression

No of Complications	No	Mild	Moderate	Moderate-Severe	Very Severe	Total
0	48	25	14	7	2	96
1	27	9	16	10	6	68
2	12	5	0	5	0	22
3	0	1	9	0	0	10
>3	1	3	0	0	0	4
Total	88	43	39	22	8	200

Chi-Square- 60.323; df-16; p-0.000



**Figure 2:** Distribution of subjects by Number of Complications

Number of complications a patient had was significant in association with depression. Depression was more in patients with diabetic complications when compared to diabetic patients without any complications

**Table 6:** Treatment regimen vs. Depression

Treatment Regimen	No Depression	Mild	Moderate	Moderate -Severe	Very Severe	Total
OHA	71	25	9	5	6	116
Insulin	7	9	5	0	3	24
Oha + Insulin	11	16	21	6	6	60
Total	89	50	35	11	15	200

Chi-Square- 42.8; df-8; p-0.000

Among patient factors, BMI (p=0.004) and smoking (p=0.017) are significantly associated with depression (p=0.004)

**Discussion**

The present study observed the prevalence of depression in diabetes mellitus and examined the association between diabetes and depression. The prevalence of depression in diabetic patients is 56% in the current study. In studies from the US, UK, Europe and other Asian countries, the range of clinically significant depression symptomatology in diabetic samples from tertiary care and teaching hospitals was 28%-72% .[12,13,14,15]

In accordance with the other studies, high prevalence of depression in patients with diabetes in teaching and tertiary care hospitals is replicated in our study.

Among the depressed subjects, 38.39% had mild depression, 34.82% has moderate symptoms, 19.64% had moderately severe depression, 7.14% had very severe symptoms. Depression may result in poor glycemic control and vice versa poor glycemic control may result in depression.

Association between depression and Hba1c showed a positive significant correlation p=0.028 in this study implicating that the

higher the HbA1C levels, the more severe is the depression. In the present study, Non depressed group is dominated by persons with good glycemic control, whereas depressed group shows very low number of persons with good glycemic control. In our study, the prevalence of depression in the group of HbA1C (4-6) was 50%, which has increased to 60% in the group of HbA1C > 7 implying a proportional increase in the prevalence of depression with poorer glycemic control. Among the patients with HbA1C more than 7, 2/3rds are having moderate - severe depression further showing that poor glycemic control is leading to both raise in the prevalence as well as severity of depression. BMI also had a statistically significant association with depression scores (p=0.004). Diabetes is associated with weight gain and obesity, which could be a risk factor in the development of depression and cardiac complications. In this study, Fasting blood sugar also had a statistically very significant association with depression score p=0.019. While postprandial blood sugar has no association with depression (p=0.324). It indicates that high fasting blood sugar is a better predictor of presence of depression. As the fasting glucose values increase, the risk of depression also increases. In our study the depressed people with FBS

< 130mg/dl was 45% which increased to 70% with FBS > 200mg/dl. Skaff et al evaluated 206 type 2 diabetic patients, showed that a daily negative mood correlated positively with the fasting glucose level of the next morning in men with Type 2 diabetes mellitus.[16]

A clinical variable that has shown a significant association with depression is the number of complications. This finding again is in agreement with most of the earlier studies in which presence of diabetes complications was the most significant factor which correlated with depression. The graded incremental relation with number of complications to depression, which was described in earlier studies was also replicated in our study. The percentage of depression in our sample with one complication was 60%, which increases to 88.5% with 3 or more than 3 complications. Diabetic complications include both microvascular (diabetic neuropathy, nephropathy, retinopathy, cardiomyopathy, erectile dysfunction) and macrovascular complications include coronary artery disease, peripheral vascular disease contributing to intermittent claudication, stroke. Regarding the association between diabetes drugs and depression, some studies reported increased incidence of depression in patients who were not treated with insulin, while some other studies reported more depression in patients who were treated with insulin. But the present study showed a statistically significant correlation between treatment regimen and depression in our study. ( $p=0.000$ ). Depression was more associated with the combined use of oral hypoglycemic drugs and insulin rather than use of insulin or oral hypoglycemic drugs alone. 70% of the patients who were only on insulin had depression and 81% of patients who are on combined insulin and oral hypoglycemic drugs were depressed in our study, whereas only 38.5% of patients using oral hypoglycemic drugs were depressed. Depression in combined use of insulin and oral hypoglycemic drugs may be related to painful injections of insulin in combination with pill burden. Strengths of the study: The association of depression and glycemic control in diabetes patients was studied, a subject in which Indian literature is sparse. Assessment of depression was done objectively with a valid, effective and easily administered instrument, Patient Health Questionnaire - 9. Glycemic control was assessed with HbA1c which is a good and reliable measure of glycemic control over the past weeks, which adds strength to the results even though study design is cross sectional.

#### Limitations of the study

The sample size is small and the study was done in a teaching hospital, so findings cannot be applied to general population. As it is a cross-sectional study, there is a possibility of missing depression in earlier days than the 2 weeks mentioned in the questionnaire

Most of the study subjects were from rural population, in whom there is a possibility of denying depressive symptoms due to stigma.

#### Conclusion

Diabetes is chronic and one of the commonest health problem in India. Persistent depressive symptomatology is present in more than half of the diabetic patients. There is a significant association between severity of depression and diabetes. This association could be partly explained by biological mechanisms. In addition, other factors such as stress can act as perpetuating factor for both the conditions worsening the prognosis. Hence screening for depression in diabetes should be done regularly. Life style modifications and systematic depression treatment should become routine components of diabetes care. The present study showed that more severe the diabetes, higher the depression and presence of diabetes complications was the most significant factor which correlated with depression. However we need further studies to evaluate more such parameters responsible for the association between diabetes and depression, to plan specific interventions.

**Conflict of Interest: Nil**

**Source of support: Nil**

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