

# Depression and diabetes: A tendency or demon of darkness among diabetics? A cross-sectional study among type 2 diabetes mellitus patients attending an “integrated diabetes and gestational diabetes clinic” of Eastern India

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## ABSTRACT

**Background:** Depression is a common comorbid condition found in chronic medical illnesses in general and diabetes mellitus (DM) in particular. Worldwide, more than 365 million people are estimated to have Type 2 DM (T2DM), and almost 300 million people have major depression. 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 T2DM. **Objectives:** The aim of the study was to find out the distribution and determinants of depression among T2DM patients attending an integrated diabetes and gestational diabetes clinic (IDGDC) of a tertiary care hospital of West Bengal, East India. **Materials and Methods:** This cross-sectional, observational study was conducted among T2DM patients who attended IDGDC during May 2017–June 2017. Public Health Questionnaire-9 was used to assess depression and its severity. A total of 196 study subjects participated in the study. **Results:** The prevalence of depression was found to be 54.6%. About 28.1% of the study subjects had mild depression, 17.9%, 6.1%, and 2.6% subjects had moderate, moderately severe, and severe depression, respectively. Women gender, increasing age, rural residence, low literacy, longer duration of diabetes, and overweight/obesity were significantly associated with high frequency of depression. Addiction was significantly higher among depressed T2DM patients. Mean hemoglobin A1c level was significantly lower among non-depressed T2DM patients. **Conclusion:** More than half of the T2DM patients are suffering from depression of varying severity. There should be a dedicated counselor in diabetes clinics for routine screening of depression among all T2DM patients to identify the high-risk patients requiring urgent psychiatrist consultation.

**KEY WORDS:** Type 2 Diabetes Mellitus; Depression; Public Health Questionnaire-9; Hemoglobin A1c; Integrated Diabetes Care

## INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder resulting from either insulin resistance and/or relative or absolute insulin deficiency.<sup>[1]</sup> Globally, about 425 million people are suffering from diabetes which is projected to rise to 629 million by 2045. India is home of about 72.9 million DM patients, and if corrective steps are not taken, the number

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will rise to 134 million by 2045.<sup>[2]</sup> Depression is a disease, which is one of the leading causes of disability, workplace absenteeism, decreased productivity, and high suicide rates.<sup>[3,4]</sup> It is the most common mental morbidity in general practice, which is diagnosed in about 10% of patients in primary health-care setting.<sup>[5,6]</sup>

Depression is a common comorbid condition found in chronic medical illnesses in general and DM in particular. Type 2 diabetes mellitus (T2DM) and depression are both major public health issues. Both these disorders are projected to be among the five leading causes of disease burden by 2030.<sup>[7]</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>[8]</sup> The prevalence of depression among T2DM patients ranges from 24–30% globally.<sup>[9–11]</sup> Few Indian studies reported a prevalence of depression among T2DM from 16.9–84%.<sup>[12–17]</sup> Many epidemiological studies have shown a strong association between T2DM and depression.<sup>[9]</sup> While T2DM doubles the probability of depression,<sup>[10,12]</sup> depression itself is a barrier to the effective management of T2DM. Early identification of depression among T2DM can have profound implications on management of T2DM patients.

Public Health Questionnaire-9 (PHQ-9) is depression and its severity measurement scale, which has been used extensively by many researchers globally. PHQ-9 consists of nine items, each of which is scored 0–3, providing a 0–27 severity score.<sup>[18]</sup>

Integrated diabetes and gestational diabetes clinic (IDGDC) is a “Chronic Care Model”<sup>[19]</sup> based specialty clinic of a tertiary health care facility of West Bengal in the Eastern part of India. This study aims to find out the burden of depression and its determinants among T2DM patients attending IDGDC of Eastern India.

## MATERIALS AND METHODS

An institution-based, observational, and cross-sectional study was conducted among T2DM patients who attended IDGDC of a tertiary health care facility of West Bengal, Eastern India from May 2017 to June 2017. A total of 196 study subjects participated in the study.

### Ethical Clearance

The study was approved by the Institutional Ethics Committee of IQ City Medical College and Multispeciality Hospital.

### Study Design

This was a cross-sectional study.

### Study Setting

This study was conducted at IDGDC of a tertiary health care facility of Eastern India.

### Study Duration

The study duration was 2 months (May 2017–June 2017).

### Sampling Procedure

Sample size was calculated using the World Health Organization (WHO) formula “4PQ/d” for cross-sectional studies.<sup>[20]</sup> Considering the prevalence (P) of depression among T2DM = 38.8%,<sup>[14]</sup> Q = 1–P, absolute precision of 20 with 95% confidence interval (d = 20% of P<sup>2</sup>), and 20% nonresponse rate, minimum sample size came to be 180. We used “systematic random sampling (SRS)” for the recruitment of study subjects. Sample interval of SRS was predefined, based on the patient attendance record of previous month. Data collection was continued throughout data collection period without deploying any extra resources, and the final sample size was 196.

### Sample Size

The sample size was 196.

### Study Population

Type 2 Diabetes Patients who attended Integrated Diabetes and Gestational Diabetes Clinic (IDGDC) during data collection period (May- June 2017).

### Inclusion Criteria

The following criteria were included in the study:

1. Age  $\geq 18$  years
2. Duration of T2DM  $\geq 6$  months.

### Exclusion Criteria

The following criteria were excluded from the study:

1. Steroid-induced diabetes
2. Known case of neurological disorder
3. Refusal to give consent
4. Critically ill.

### Study Tool

1. Pre-designed, pre-tested, and semi-structured schedule developed with the help of PHQ-9.<sup>[18]</sup> A validated Bengali version of PHQ-9 which is available online free of cost was used in this study
2. Relevant medical records.

### Study Technique

Written informed consent was taken from all study subjects. A pre-designed, pre-tested, and semi-structured schedule was used to collect clinic-social data. Relevant medical records were also reviewed for data collection. A total of 196 study subjects consented to participate in study. Depression was classified as PHQ-9 scores, i.e., none –minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19),

and severe (20–27).<sup>[18]</sup> Diabetes was defined and classified as per the American Diabetes Association.<sup>[21,22]</sup> Anthropometric measurements were taken as per standard WHO protocols,<sup>[23]</sup> and body mass index (BMI) was classified as per the WHO recommendation for Southeast Asian population.<sup>[24]</sup>

### Statistical Analysis

Data were codified and analyzed using SPSS (Statistical Package for the Social Sciences) version 20.0 for Windows. Frequency of depression and other clinic-social variables was calculated. Pie chart and simple bar diagrams were used to show frequency of depression and severity of depression, respectively. Chi-square test was used to show association between categorical variables. Unpaired *t*-test was performed to show mean difference for continuous variables. All statistical tests were two-tailed and  $P < 0.05$  was considered significant.

### RESULTS

Clinico-social characteristics are tabulated in Table 1. About 62.8% of study subjects were male and 37.2% were female. About 50.0% of the study subjects were in the age group of 50–64 years followed by 28.1%, 13.7%, and 8.2% in the age group of 35–49 years,  $\geq 65$  years, and 20–34 years, respectively. About 179 (91.3%) of them were Hindu and rest 17 (8.7%) were Muslim. About 3/4<sup>th</sup> and 1/4<sup>th</sup> of the study subjects had urban and rural residence, respectively. About 69 (35.2%) had education up to Class X–XII, followed by 29.6%, 12.7%, and 9.2% who had education  $\geq$  Graduation, Class VI–IX and up to Class V, respectively. About 13.3% of the study subjects were illiterate. About two-third of the study subjects had either tobacco or alcohol addictions and 50.0% of the study subjects had history of T2DM among first degree relatives. Mean duration of the T2DM was  $8.74 \pm 7.49$  (standard deviation) years, minimum duration was 0.5 years, and maximum duration was 36 years. Duration of diabetes was more than 10 years in 43.4% of study subjects followed by 37.2% and 19.4% study subjects who had diabetes from 0 to 5 years and 6 to 10 years, respectively. As per the WHO BMI classification for Southeast Asian population, 30.6% of the study subjects were obese and 29.3% were overweight. About 26.5% had normal BMI and 3.6% were underweight. About 4/5<sup>th</sup> of the study subjects were treated with oral antidiabetic (OAD) medicines, and 1/5<sup>th</sup> received both insulin and OADs. About 124 (63.3%) of the study subjects had at least one comorbidity such as hypertension, dyslipidemia, kidney disease, peripheral arterial disease, and ischemic heart disease. About 54.6% of the study subjects had some form of depression [Table 1 and Figure 1]. About 45.4% had non-minimal depression, followed by mild depression, moderate depression, moderately severe depression, and severe depression which was present in 28.1%, 17.8%, 6.1%, and 2.6% of study subjects, respectively [Table 1 and Figure 2]. Female gender, increasing age, rural residence, addiction, poor educational status, longer duration of diabetes, and overweight/obesity and were significantly associated with more depression burden

**Table 1:** Distribution of clinico-social characteristics of study subjects ( $n=196$ )

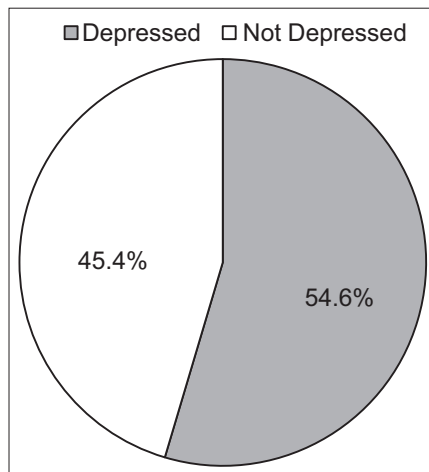
Clinico-social characteristics	<i>n</i> (%)
Gender	
Male	123 (62.8)
Female	73 (37.2)
Age groups (year)	
20–34	16 (8.2)
35–49	55 (28.1)
50–64	98 (50.0)
$\geq 65$	27 (13.7)
Religion	
Hindu	179 (91.3)
Muslim	17 (8.7)
Residence	
Urban	147 (75.0)
Rural	49 (25.0)
Education	
Illiterate	26 (13.3)
Up to V	18 (9.2)
VI–IX	25 (12.7)
X–XII	69 (35.2)
$\geq$ graduation	58 (29.6)
Addiction	
Yes	128 (65.3)
No	68 (34.7)
F/H of T2DM	
Yes	98 (50.0)
No	98 (50.0)
Duration of diabetes (years)	
0–5	73 (37.2)
6–10	38 (19.4)
$> 10$	85 (43.4)
Body mass index (kg/m <sup>2</sup> )	
Under weight (<18.5)	7 (3.6)
Normal (18.5–22.99)	52 (26.5)
Overweight (23–27.49)	77 (29.3)
Obese ( $\geq 27.5$ )	60 (30.6)
Treatment type	
OHA	153 (78.0)
OHA+Insulin	43 (22.0)
Comorbidities	
Yes	124 (63.3)
No	72 (36.7)
Depression	
Yes	107 (54.6)
No	89 (45.4)
Severity of depression	
No depression	89 (45.4)

(Contd...)

**Table 1:** (Continued)

Clinico-social characteristics	n (%)
Mild depression	55 (28.1)
Moderate depression	35 (17.8)
Moderately severe depression	12 (6.1)
Severe depression	5 (2.6)

HbA1C: Hemoglobin A1c, OHA: Oral hypoglycemic agents, T2DM: Type 2 diabetes mellitus, BMI: Body mass index

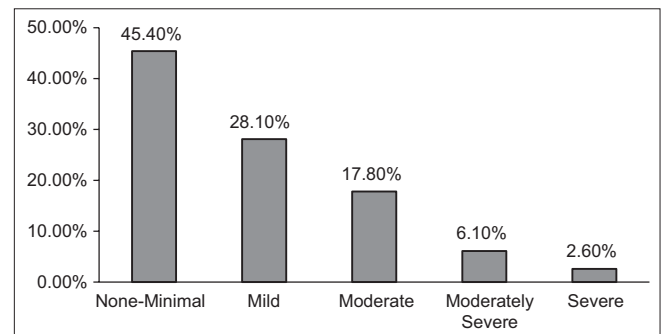


**Figure 1:** Pie chart showing frequency of depressed and non-depressed study subjects (n=196)

among study population [Table 2]. A non-significant numerical predominance of depression has been observed among Muslim and who had family history of diabetes. Study subjects having comorbidities and had treatment with insulin also showed a non-significant predominance of depression [Table 2]. Mean hemoglobin A1c (HbA1c) level was significantly higher among depressed study subjects [Table 3].

## DISCUSSION

This cross-sectional study was conducted to find out the burden of depression among T2DM patients. A total of 196 study subjects participated in study. The prevalence of depression was found to be 54.6%, which is quite higher than the prevalence of depression among non-diabetic patients. About 28.1% of the study subjects had mild depression followed by 17.8%, 6.1%, and 2.6% who had moderate depression, moderately severe depression, and severe depression, respectively. Female gender, increasing age, rural residence, addiction, poor educational status, longer duration of diabetes, overweight/obesity, and higher mean HbA1C were significantly associated with more depression burden among study population. A non-significant numerical predominance of depression has been observed among Muslim and who had family history of diabetes. Study subjects having comorbidities and had treatment with insulin also showed a non-significant predominance of depression.



**Figure 2:** Simple bar diagram showing the severity of depression

Various other studies also reported a high prevalence of depression among diabetes patients than nondiabetic.<sup>[9-12]</sup> A study from South India reported a 70% prevalence of depression among T2DM patients.<sup>[25]</sup> In this study, female gender was found to be a significant risk factor for depression as 72.6% of the females were depressed as compared to only 49.3% of male study subjects. Although significant female preponderance of depression was reported by many other researchers,<sup>[10,26]</sup> few studies<sup>[13,15]</sup> reported otherwise. There was linear increase in the frequency of depression with increasing age. Increasing age was significantly associated with higher frequency of depression. Similar results were reported by Stordal *et al.*,<sup>[27]</sup> however, a study from the USA reported the lowest prevalence of depression in middle age followed by sharp rise after 80 years.<sup>[28]</sup> About 67.3% of the study subjects who resided in rural were depressed while only 50.3% of their urban counterparts were depressed. In this study, rural residence has emerged as significant risk factors for depression, which might be due to the limited job opportunity and limited access to the health-care infrastructures. Similar results were reported by a North Indian study by Thour *et al.*<sup>[18]</sup> Almost two-third of those who had alcohol and/or smoking addiction were depressed. Tobacco and/or alcohol use is proven risk factors for depression which might be due to the fact that they use it as a coping strategy against depression. High prevalence of depression and smoking was also reported by many other researchers across globe.<sup>[29,30]</sup> Poor education was found to be a significant risk factor for depression which is in agreement with the findings of various other epidemiological studies.<sup>[31,32]</sup> In this study, longer duration of diabetes emerged as a significant risk factor for depression. However, the relationship between duration of diabetes and prevalence of depression is still debatable. While few studies have reported a significant association between diabetes duration and depression,<sup>[13,26]</sup> there are many studies which reported a null association between them.<sup>[15]</sup> There are evidence which suggest the role of chronic complications of diabetes in the development of depression,<sup>[32,33]</sup> but we found a non-significant numerical preponderance of depression among study subjects having comorbidities. Non-significant role of diabetes complications and depression was also reported by Lin *et al.*<sup>[34]</sup> and Raval *et al.*<sup>[15]</sup> Overweight and obesity were found to be significant risk factors for depression



**Table 2:** Chi-square test showing determinants of depression among study subjects ( $n = 196$ )

Clinico-Social Variables	Depression		Total (%)	Y <sup>2</sup>	df	P value
	Yes (%)	No (%)				
Gender						
Male	54 (43.9)	69 (56.1)	123 (100.0)	15.2	1	0.000
Female	53 (72.6)	20 (17.4)	73 (100.0)			
Age group (year)						
20–34	5 (31.2)	11 (68.8)	16 (100.0)	9.9	1	0.002
35–49	25 (45.5)	30 (54.5)	55 (100.0)			
50–64	57 (58.2)	41 (41.8)	98 (100.0)			
≥65	20 (74.1)	7 (25.9)	27 (100.0)			
Religion						
Hindu	95 (53.1)	84 (46.9)	179 (100.0)	1.9	1	0.207
Muslim	12 (70.6)	5 (29.4)	17 (100.0)			
Residence						
Urban	74 (50.3)	73 (49.7)	147 (100.0)	4.3	1	0.047
Rural	33 (67.3)	16 (32.7)	49 (100.0)			
Addiction						
Yes	84 (65.6)	44 (34.4)	128 (100.0)	18.1	1	0.000
No	23 (33.8)	45 (66.2)	68 (100.0)			
Education						
Illiterate	20 (76.9)	6 (23.1)	26 (100.0)	9.3	1	0.002
Up to V	12 (66.7)	6 (33.3)	18 (100.0)			
VI–IX	15 (60.0)	10 (40.0)	25 (100.0)			
X–XII	34 (49.3)	35 (50.7)	69 (100.0)			
≥graduation	26 (44.8)	32 (55.2)	58 (100.0)			
Duration of diabetes (year)						
0–5	36 (49.3)	37 (50.7)	73 (100.0)	6.3	2	0.041
6–10	20 (52.6)	18 (47.4)	38 (100.0)			
>10	58 (68.2)	27 (31.8)	85 (100.0)			
BMI (Kg/m <sup>2</sup> )						
Under weight	2 (28.6)	5 (71.4)	7 (100.0)	6.3	2	0.043
Normal	25 (48.1)	27 (51.9)	52 (100.0)			
Overweight/Obese	87 (63.5)	50 (36.5)	137 (100.0)			
F/H of T2DM						
Yes	56 (57.1)	42 (42.9)	98 (100.0)	0.5	1	0.283
No	51 (52.0)	47 (48.0)	98 (100.0)			
Comorbidities						
Yes	71 (57.3)	53 (42.7)	124 (100.0)	0.9	1	0.373
No	36 (50.0)	36 (50.0)	72 (100.0)			
Treatment						
OHA	79 (51.6)	74 (48.4)	153 (100.0)	2.5	1	0.123
OHA+Insulin	28 (65.1)	15 (34.9)	43 (100.0)			

HbA1c: Hemoglobin A1c, OHA: Oral hypoglycemic agents, T2DM: Type 2 diabetes mellitus, BMI: Body mass index

among diabetes patients as 63.5% of the overweight/obese study subjects were depressed as compared to only 48.1% and 28.6% who were normal and underweight, respectively. Takeuchi *et al.*<sup>[35]</sup> also reported a significantly high prevalence of depression among obese people. We found a significantly higher mean HbA1c among depressed than non-depressed

study subjects. This may be due to the fact that poor glycemic control itself is risk factors for many diabetes-related complications which might be influencing the occurrence of depression among poorly controlled diabetes patients. Most of the other studies<sup>[36]</sup> reported a positive role of high fasting blood sugar on depression, but there are very few studies<sup>[37-39]</sup>

**Table 3:** Independent *t*-test showing mean HbA1C levels among depressed and non-depressed study subjects (*n*=196)

Depression difference	<i>n</i> =196	Mean±SD	Mean	<i>t</i> -test	<i>P</i>
No	89	7.45±2.07	1.07	-3.44	0.001
Yes	107	8.52±2.25			

SD: Standard deviation, HbA1C: Hemoglobin A1c

globally who studied and reported a role of higher HbA1c in the development of depression among diabetes patients. HbA1c is the gold standard for the monitoring of long-term glycemic control should be preferred in diabetes-related research.

Being a novel study on this topic in this part of West Bengal, our study may act as a catalyst to promote further research on depression and diabetes. This is a hospital based study, and the results of this study cannot be generalized. Further being a specialist clinic of tertiary health-care facility, there might have been selective bias in terms of preferential attendance of more complicated cases which might have resulted in high prevalence of depression in this study.

## CONCLUSION

More than half of the T2DM patients are suffering from depression of varying severity. Poor education, tobacco/alcohol addiction, poor glycemic control, and high BMI are some of the modifiable risk factors for depression. Routine screening of depression among all T2DM patients should be done to identify the high-risk patients requiring urgent psychiatrist consultation. There should be a dedicated counselor in every diabetes clinic.

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