

# Depression among patients with diabetes mellitus in North India evaluated using patient health questionnaire-9

Amit Thour, Subhash Das<sup>1</sup>, Tejasav Sehrawat, Yashdeep Gupta

Departments of Medicine and <sup>1</sup>Psychiatry, Government Medical College and Hospital, Chandigarh, India

### ABSTRACT

**Background:** Depression is common among diabetes, and is associated with poor outcomes. However, the data on this important relationship are limited from India. **Objective:** The aim was to estimate the prevalence of depression in patients with diabetes and to determine the association of depression with age, sex, and other related parameters. **Materials and Methods:** The study was cross-sectional carried out in endocrinology clinic of tertiary care hospital in North India. Cases were patients with type 2 diabetes mellitus (T2DM) above 30 years of age. Depression was assessed using the patient health questionnaire-9 (PHQ-9). The relationship with sociodemographic profile, duration of diabetes, hypertension and microvascular complications was also analyzed. **Results:** Seventy-three subjects (57.5% females) with mean age  $50.8 \pm 9.2$  years were evaluated. The prevalence of depression was 41%. Severe depression (PHQ score  $\geq 15$ ) was present in 3 (4%) subjects, moderate depression (PHQ score  $\geq 10$ ) in 7 (10%) subjects, and mild depression was present in 20 (27%) of subjects. Depression was significantly more prevalent in rural subjects (57%) when compared to urban ones (31%,  $P = 0.049$ ). Depression increased with presence of microvascular complications, fasting plasma glucose, hypertension, but the differences were not statistically significant. **Conclusions:** Our study demonstrates higher prevalence of depression in patients with type 2 diabetes. Apart from being belonging to the rural area, no other factor was significantly associated with depression. Therefore, depression should be assessed in each and every patient, irrespective of other factors.

**Key words:** Depression, diabetes, patient health questionnaire-9

## INTRODUCTION

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>[1]</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>[2]</sup> The recognition and addressal of this association can have profound implications for prevention and treatment of these disorders.<sup>[1]</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>[3]</sup> This study adds to the limited data available on the prevalence of depression in diabetes from India. It has special relevance for India (middle-income country), having high prevalence of both these disorders.<sup>[3,4]</sup>

## MATERIALS AND METHODS

This prospective case study was carried out in September 2014 at the Government Medical College and Hospital, Chandigarh (India). This is a tertiary care hospital serving patients from both urban and rural areas. The patients

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**Corresponding Author:** Dr. Yashdeep Gupta, Department of Medicine, Government Medical College and Hospital, Sector 32, Chandigarh - 160 030, India. E-mail: [dryashdeepgupta@gmail.com](mailto:dryashdeepgupta@gmail.com)

with a diagnosis of type 2 diabetes above age 30 years were recruited on voluntarily basis for this study. The Patient Health Questionnaire-9 (PHQ-9) was used for evaluation of depression, and relevant clinical details were obtained. No intervention was part of the study and the investigations that were available with the patient were used for analysis purpose. The cases were not receiving any psychiatric treatment which could have an effect on the result.

### Patient health questionnaire-9

Depression was assessed by administering the nine-item PHQ-9, a self-report version of Primary Care Evaluation of Mental Disorders that assesses the presence of major depressive disorder using modified Diagnostic and Statistical Manual, Fourth edition criteria. The PHQ-9 was filled in English by assistance of one of the authors. There is good agreement reported between the PHQ diagnosis and those of independent psychiatry health professionals (for the diagnosis of any one or more PHQ disorder,  $\kappa = 0.65$ ; overall accuracy, 85%; sensitivity, 75%; specificity, 90%).<sup>[5,6]</sup> It assesses the symptoms experienced by participants during the 2-week period before they take the survey. On the basis of participant response to the frequency of any particular symptom (0 = not at all, 1 = several days, 2 = more than 1/2 of the days, 3 = nearly every day), a total score ranging from 0 to 27 was obtained, with higher scores indicating patients' increased self-report of depression severity. The arbitrary division of PHQ-9 scores into ratings of minimal (0–4), mild (5–9), and moderate to severe depression ( $\geq 10$ ) suggested by Reddy *et al.* was used in this study.<sup>[7]</sup> Those who had moderate to severe depression based on cut-off points in PHQ  $9 \geq 10$  were referred to Psychiatry Department for further management.

### Clinical details

The variables included in the study were socio-demographic factors, the presence of hypertension, microvascular complications were also assessed. Since most of the patients were recruited as first-timers attending the endocrine clinic of the hospital, Glycated hemoglobin (HbA1c) was not available for all patients. The analysis is, therefore, with recent fasting blood glucose (FBG) value (within the last 7 days), which was available for all patients. Moreover, the value of FBG is more easily understood by the patient, rather than interpretation of HbA1c.

### Statistical analysis

Numerical data were presented as mean  $\pm$  standard deviation or percentages. Differences in characteristics between participants were tested with unpaired *t*-test for normally distributed variables, with the Wilcoxon

rank sum test for skewed variables, and with the Chi-square test or Fisher exact test for categorical variables. The significance level was set at 5%. All statistical analyses were carried out using Statistical Package for Social Sciences (Version 20.0, Chicago, IL, USA). A sample size of 73 was as per convenience. This sample size gave us power of 90% with an alpha error of 10%.

## RESULTS

### Baseline characteristics

We report data from 73 subjects. The mean age of the study population was  $50.8 \pm 9.2$  years. 57.5% of the subjects were females. 38.4% were from the rural area. 60% of them had coexistent hypertension. About 45% had at least one microvascular (retinopathy, nephropathy, and neuropathy) complication. The mean duration of diabetes was  $6.3 \pm 6.3$  years. Nearly 50% of the subjects had moderate to severe hyperglycemia as indicated by fasting plasma glucose values  $>150$  mg%.<sup>0</sup>.

### Prevalence of depression

Depression as defined by PHQ score  $\geq 5$  was present in 41% of the individuals. Severe depression (PHQ score  $\geq 15$ ) was present in 3 (4%) subjects, moderate depression (PHQ score  $\geq 10$ ) was present in 7 (10%) subjects, and mild depression was present in 20 (27%) of subjects.

### Characteristics of subjects with depression

Depression was significantly more prevalent in rural subjects (57%) as compared to urban ones (31%,  $P = 0.049$ ). The prevalence of depression increased with age and duration of diabetes though the difference was not significant. Men, subjects with hypertension, microvascular complications, and subjects with moderate to severe hyperglycemia had more depression [Table 1]. The differences were, however, nonsignificant. PHQ scores positively correlated with age, duration of diabetes and fasting plasma glucose. The correlations were statistically nonsignificant [Table 2].

### Risk factor analysis

In bivariate risk factor analysis [Table 3], rural subject was nearly three times more likely to have depression ( $P = 0.03$ ) as compared to urban. Presence of hypertension was associated with 60% more risk of having depression. The risk of depression nearly doubles after 3 years of diagnosis of diabetes. Absence of microvascular complication was associated with 18% less chances of having depression, and fasting plasma glucose  $\leq 150$  mg%<sup>0</sup> was associated with 26% lesser risk for depression. There was hardly any difference between men and women for depression.

**Table 1: Baseline characteristics of study population**

Variable	Number of subjects	Mean±SD/percentage	PHQ<5 (%)		P
			Normal	Depression	
Age	73	50.8±9.2	50.7±9.2 n=43	51.0±9.5 n=30	0.91
Duration of diabetes (years)	73	6.3±6.3	5.4±5.5	7.5±7.2	0.16
Sex					
Women	42	57.5	25 (59.5)	17 (40.5)	1.00
Men	31	42.5	18 (58.1)	13 (41.9)	
Place of residence					
Urban	45	61.6	31 (68.9)	14 (31.1)	0.049
Rural	28	38.4	12 (42.9)	16 (57.1)	
Hypertension					
Yes	44	60.3	24 (54.5)	20 (45.5)	0.47
No	29	39.7	19 (65.5)	10 (34.5)	
Any microvascular complication					
No	39	53.4	24 (61.5)	15 (38.5)	0.64
Yes	34	46.6	19 (55.9)	15 (44.1)	
FPG (%)					
≤150 mg	33	45.8	20 (60.6)	13 (39.4)	0.81
>150 mg	39	54.2	22 (56.4)	17 (43.6)	

SD: Standard deviation, FPG: Fasting plasma glucose, PHQ: Patient health questionnaire

**Table 2: Correlation of PHQ score with continuous variables**

Variable	Correlation coefficient	P
Age	0.09	0.46
FPG	0.22	0.07
Duration of diabetes	0.05	0.68

FPG: Fasting plasma glucose, PHQ: Patient health questionnaire

**Table 3: Risk factor analysis for depression**

Variable	n	Subjects with depression (%)	Bivariate OR (95% CI)	P
Hypertension				
No	29	10 (34.5)	1.00	0.39
Yes	44	20 (45.5)	1.59 (0.56, 4.55)	
Residence				
Urban	45	14 (31.1)	1.00	0.03
Rural	28	16 (57.1)	3.42 (1.16, 10.12)	
Microvascular complications				
Yes	34	15 (44.1)	1.00	0.73
No	39	15 (38.5)	0.82 (0.26, 2.59)	
Sex				
Men	31	13 (41.9)	1.00	0.96
Women	42	17 (40.5)	0.98 (0.36, 2.67)	
FPG (%)				
≤150 mg	39	17 (43.6)	1.00	0.60
>150 mg	33	13 (39.4)	0.74 (0.24, 2.30)	
Duration of diabetes				
≤3 years	32	11 (34)	1.00	0.17
>3 years	41	19 (46)	2.22 (0.72, 6.88)	
Age				
≥50 years	40	17 (42.5)	1.00	0.76
<50 years	33	13 (39)	0.84 (0.27, 2.64)	

FPG: Fasting plasma glucose, CI: Confidence interval, OR: Odds ratio

## DISCUSSION

The depression in our study was found in 41% of the patients. High prevalence of depression has been reported

from other studies also.<sup>[8-11]</sup> The eight studies in India from both urban and rural populations were recently summarized in a systematic review. Of the six urban clinic-based studies, between ¼ and ½ of the participants with diabetes were depressed; however, these studies demonstrated great variability (highest was 84%, and lowest was 16.9%).<sup>[3]</sup> We additionally found three more clinic-based studies from India. In total, four studies used (PHQ-9) questionnaire for the assessment of depression among diabetics in India.<sup>[9-12]</sup> The prevalence of depression in T2DM patients in our study (41%) was nearly similar to other studies (35–50%).<sup>[9-12]</sup>

There was no sex predilection for depression in our study. Similar findings have been reported by Raval *et al.* from Chandigarh. Better social fabric and support may be the reasons for same.<sup>[10]</sup> The interesting finding being higher prevalence of depression in a rural population, when compared to urban ones, and the difference was statistically significant. It may be related to socioeconomic status. The individuals with low earning power face the twin burdens of paying for health care, which is largely out-of-pocket expenditure in India and meeting the needs of their family.<sup>[12]</sup> The diagnosis of T2DM and its poor understanding in rural areas may be an additional stress causing depression in these people. We found no statistically significant association between depression and duration of diabetes, glycemic control and microvascular complications, the findings, also reported by Siddiqui *et al.*<sup>[11]</sup> These findings implicate that the depression should be assessed in all patients with diabetes, irrespective of gender, duration of diabetes, glycemic control or presence/absence of microvascular complications. American Diabetes Association also recommends screening and assessment of depression in patients with diabetes.<sup>[13]</sup>

A meta-analysis (16 studies), concluded that depression increases all-cause mortality, with the relative risk of dying being 2.5 times higher in depressed compared to nondepressed people. The mortality risk remained high even after additional adjustment for diabetes complications (hazard ratio = 1.76). The information presented, thus far, underscores the extensive adverse effects of untreated depression, including decreased capacity and functioning, increased risk of suicide, and increased medical morbidity and mortality from all causes.<sup>[14]</sup> However, much of the evidence for depression and type 2 diabetes, came from HICs, and few studies have systematically evaluated depression in diabetes in LMICs, which includes India.<sup>[3]</sup> Therefore, more understanding on this relationship is essential, and the present study will add to the limited literature available in India on relationship between diabetes and depression.

This study has some limitations. One of the limitations of this study is the small sample size. This study was cross-sectional, so inference about causality between depression and diabetes cannot be made. The study was conducted in tertiary care hospital, so a possible selection bias cannot be excluded, as more depressed/complicated patients might be seeking specialized diabetes care. A large sample from the community could throw more light on this relationship.

To summarize, the present study found a high prevalence of depression among patients with diabetes. Rural individuals are more depressed than the urban ones. Age, sex, duration of diabetes, microvascular complications, hypertension, were not significantly associated with depression. Universal screening for depression should be done in patients with diabetes. Future studies from India, should evaluate the effect of treatment of depression on glycemic control, and also the effect of glycemic control on depression.

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