Original Article

Prevalence and predictors of depression in type 2 diabetes mellitus

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Abstract:

BACKGROUND: Type 2 diabetes mellitus (DM) is a multifactorial disease and can be described as a noncommunicable disease of epidemic magnitude. Little is known about the predictors of depression in this population, especially among the Indian population. This study explores the predictors for depression in patients with type 2 DM.

MATERIALS AND METHODS: A cross-sectional study was performed for a period of 7 months during 2018–2019. The data were collected from 250 subjects at the diabetic clinic and psychiatry outpatient department of a tertiary care teaching hospital. T2DM with an age group of 18–60 years were included. Exclusion criteria were clinical evidence of any significant Axis I psychiatric disorder according to the International Classification of Diseases-10 Diagnostic Criteria for Research other than depression and substance use disorders. Data were analyzed with multiple linear regression analysis using SPSS-23 version.

RESULTS: Male and female patients were 127 (50.80%) and 123 (49.20%), respectively. The prevalence of depression was 49.20% among 250 patients with T2DM. Female patients had higher depression than male patients. We found age ($P = 0.013$), female gender ($P = 0.041$), locality of the patient ($P = 0.021$), body mass index (BMI) ($P = 0.018$), and fasting blood sugar (FBS) ($P = 0.045$) as significant predictors of depression among T2DM patients.

CONCLUSIONS: The study concludes that females and elderly patients were more affected by depression. The predictors of depression were age, gender, locality, BMI, and FBS among diabetic patients. The findings indicate to screen the patients of T2DM for depression, predominantly female and elderly patients, at regular intervals as per clinical demand.

Keywords:
Age, body mass index, depression, diabetes, gender, predictors, prevalence

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Introduction

Type 2 diabetes mellitus (DM) is viewed as a multifactorial disease and can be described well in the category of psychosomatic illness.[1] The earlier studies suggested a high prevalence of depressive illness in patients with type 2 DM.[2] However, little is known about the predictors of depression in this population, especially among the Indian population.[3] Sociodemographic and clinical factors such as age, gender, weight, duration of illness, glycemic control, type of antidiabetic medication, drug compliance, and many more predict depressive illness.[4] It has been observed that the duration of diabetes and its associated complications had a significant association with the psychosocial aspect of diabetes.[5] It is required to identify and educate diabetes patients with a practical approach toward disease self-management.[6] In the Indian diabetic population, the prevalence rate of depression varies widely between 7% and 84%.[3] This range varies widely from the data obtained in Western countries, as reported in controlled and uncontrolled studies. Possible reasons are using the different methodology in different studies,

besides the sociodemographic differences. A wide variety of questionnaires are available and used to measure depressive symptoms in DM patients, leading to varied results in these studies.[3,7] Based on the current evidence, the Center for Epidemiologic Studies Depression Scale (CES-D) is found to be the best supported for measuring depressive symptoms in diabetes patients.[8] In this study, we hypothesized a high prevalence of depression in patients with Type 2 DM. Additionally, several clinical and sociodemographic predictors, as mentioned above, are associated with depression and Type 2 DM. The results are expected to provide more precise measures of the prevalence of depression in Type 2 diabetics in Indian settings and help identify the risk factors for depression in these patients. To the best of our knowledge, two studies were conducted in India that used the CES-D, which is the best available tool, to determine depression among diabetics.[8,9] Additionally, these studies had inherent shortcomings concerning either sample size (*n* = 71) in one study[8] and another study Singh *et al*.[9] had a higher sample size (*n* = 200) but no supportive clinical study to support the findings. In the present study, we took a sample size higher than both to point to the similarities and differences between the present and earlier studies. The present study aims to estimate the prevalence and identify the predictors for depression in patients with type 2 DM.

Objectives

1. To estimate the prevalence of depression among patients with type 2 DM
2. To explore sociodemographic and clinical predictors of depression in patients with Type 2 DM.

Materials and Methods

A cross-sectional study was performed over 7 months during 2018–2019. Patients suffering from Type 2 DM, diagnosed as per the criteria laid down by the American Diabetes Association, attending the diabetes clinic on an outpatient basis, have been evaluated for depression symptoms using the CES-D by a psychiatrist and clinical psychologists at the psychiatry outpatient department. A purposive sampling technique was adopted, and those fulfilling the inclusion criteria were recruited for the study. The data were collected from 250 subjects [Figure 1].

Inclusion criteria

We included male and female patients of type 2 DM with 18–60 years of age. Informed written consent was also obtained from participants.

Exclusion criteria

- Clinical evidence of any significant Axis I psychiatric disorder according to International Classification of

Diseases-10 Diagnostic Criteria for Research other than depression and substance use disorders.

Ethical permission

Ethical permission was obtained from the Institutional Ethics Committee (01/AIIMS/IEC/IM/NF/2018).

Data collection procedure

Written informed consent of the patient for the study's participation was obtained, and then the sociodemographic and baseline clinical characteristics were collected using a semi-structured proforma). Then, they were applied on depression (score on the CES-D). The CES-D has twenty questions that assess the current level of depression. It has been validated several times over in Indians populations. Each question has four different frequencies of occurrence of symptoms from rarely (<1 day in the preceding week and a score of 0), sometimes (1–2 days and a score of 1), occasionally (3–4 days and a score of 2), and most of the time (5–7 days and a score of 3). Eight of the twenty questions are "positive" questions, for which the scoring is reversed. The score can range from 0 to 60, with higher scores indicating more symptoms.

Statistical analysis

The data were collected and recorded in Microsoft Excel. The analysis was done using SPSS version 23 (Statistical Package for the software program Social Sciences (SPSS), version 23.0, IBM 1911, Armonk, New York). A descriptive and inferential data analysis was done for continuous variables and categorical variables. The association between demographic and clinical variables with depression was analyzed with multiple linear regression analysis. Findings were expressed with regression coefficient, R square and R square adjusted for confounders, and two-tailed significance, *P* values set as < 0.05.

Results

A total of 315 patients attending diabetes clinics on an outpatient basis were identified. About 79.34% (250) patients were included as per the eligibility criteria of the study. Male and female patients were 127 (50.80%) and 123 (49.20%), respectively. The demographic profile of diabetic patients is shown in Table 1. Most patients were from Uttarakhand, and 126 (50.40%) patients were from an urban background. Most of the patients, 112 (44.80%), were graduate and above. The summary of the clinical profile of diabetic patients is shown in Table 2. The mean age of participants was 53.2 ± 11.23 years. The participants' mean body mass index (BMI) was 25.83 ± 5.08, and the mean duration of DM was 98.65 ± 75.41 months. It was also found that 175 (70%) patients had HbA1c >6%, and 45 (18%) patients were hypertensive. The majority of
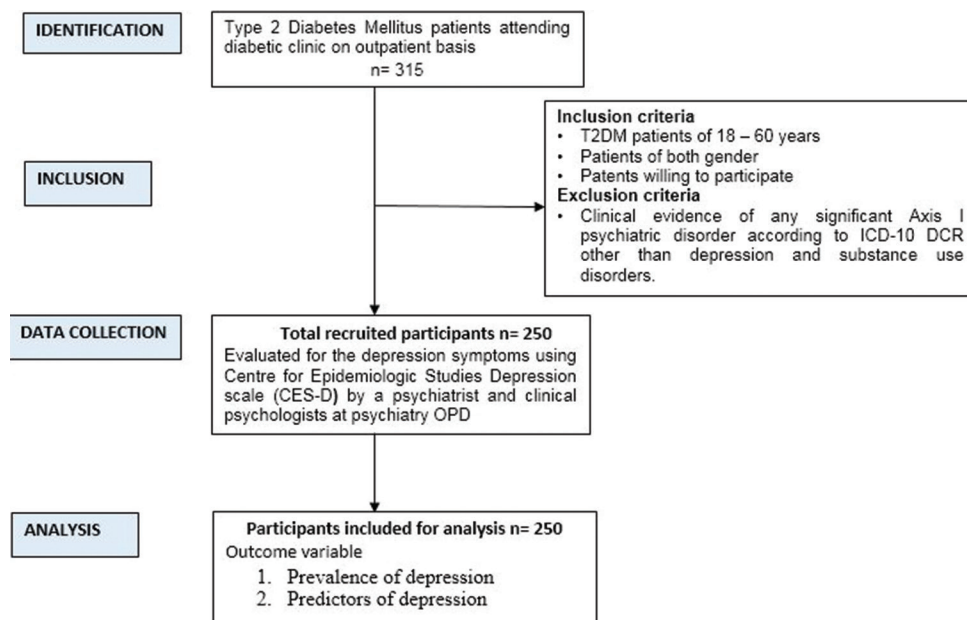
Figure 1: Flow chart

Table 1: Demographic profile of diabetic patients (*n*=250)

Variables	Frequency, *n* (%)
Age	
18-35	17 (6.8)
36-50	83 (33.20)
51-65	107 (42.80)
>65	43 (17.20)
Gender	
Male	127 (50.80)
Female	123 (49.20)
Locality	
Uttar Pradesh	68 (27.20)
Uttarakhand	170 (68)
Other	12 (4.80)
Habitat	
Rural	124 (49.60)
Urban	126 (50.40)
Marital status	
Married	195 (78)
Single	32 (12.80)
Separated	23 (9.20)
Educational status	
Up to 5th standard	60 (24)
5th-10th standard	43 (17.20)
10th-12th standard	35 (14)
Graduate and above	112 (44.80)

patients, 222 (89.16%), were taking oral hypoglycemic agents for the treatment of diabetes, and 133 (54.96%) of patients were taking treatment for <72 months. About 138 (73.02%) patients were suffering from complications <72 months, and 126 (63.31%) patients were suffering from vascular complications of diabetes. The prevalence of depression regarding age and gender has been described in [Figures 2 and 3]. In male patients, only 37.62% of patients had depression, and in female patients, 57% of patients had depression, which shows that female patients had higher depression than male patients [Figure 2]. In Figure 3, patients between the age group of 51–65 and >65 years had shown the prevalence of depression as 30.40% and 33.60%, respectively. Among the total 250 patients of T2DM, male and female patients were 50.8% and 49.20%. The CES-D score used to evaluate depression showed some depression in 123 (49.20%) and no depression in 127 (50.80%). It shows that the prevalence of depression was 49.20% among 250 patients with T2DM. Table 3 summarizes that only 6 (2.4%) patients were on antidepressant treatment; among them, 4 (66.8%) patients and 2 (33.2%) patients were taking treatment for ten years and >10 years, respectively. Table 4 describes the estimated regression coefficient for the CES-D by applying multiple linear regression analysis. We found age ($P = 0.013$), female gender ($P = 0.041$), locality of the patient (.021), BMI ($P = 0.018$), and fasting blood sugar (FBS) ($P = 0.045$) as predictors of depression among T2DM patients.

Discussion

The present study was conducted to ascertain the prevalence of comorbid depression in diabetes and identify the sociodemographic and clinical variables playing a part in its co-occurrence. The present study reported a prevalence of depression as 49.20% among T2DM patients. Females and elderly patients were more affected by depression. We found independent predictors of depression as age, female gender, locality, BMI, and FBS among type 2 diabetic patients. A previous
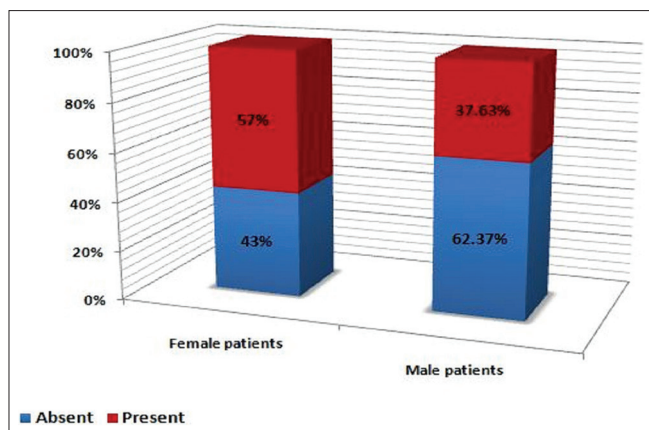
Figure 2: Gender distribution of depression among type 2 diabetes mellitus patients

Table 2: Clinical profile of diabetic patients

Variable	n	Mean±SD
Age (years)	250	53.2±11.23
BMI (kg/m²)	250	25.83±5.08
Duration of DM (months)	250	98.65±75.41
HbA1c (%)	250	7.50±1.16
Duration of DM treatment (months)	250	79.26±57.91
Duration of complication of DM (months)	189	58.51±44.64
Duration of antidepressant treatment (months)	6	116±80.55
CES-D group	250	17.98±12.36

BMI=Body mass index, DM=Diabetes mellitus, HbA1c (%)=Glycated hemoglobin, CES-D=Center for Epidemiologic Studies Depression Scale, SD=Standard deviation

Table 3: Prevalence of depression and clinical variables of depressed patients

Variables	Frequency (%)
Antidepressant treatment	
Yes	6 (2.4)
No	244 (97.6)
Duration of antidepressant treatment (years)	
1-5	2 (33.33)
5-10	2 (33.33)
10-15	1 (16.66)
>20	1 (16.66)
Depression (CES-D scale)	
Nondepressed	127 (50.80)
Depressed	123 (49.20)

CES-D=Center for Epidemiologic Studies Depression scale

study by Alzahrani *et al*. among 450 diabetic patients found the prevalence of depression (56.9%) in male patients and (43.1%) female patients, and predictors of depression were age, sex, HbA1c, comorbidities, and duration of T2DM. In contrast, our study reported higher depression in female patients, and predictors of depression were age, female gender, BMI, and FBS.[10] However, our findings go hand in hand with Rajput *et al*. so far as higher prevalence in the female sex is concerned; female patients had higher depression than male patients (17.1% vs. 9.3%); the overall prevalence of depression was however low (26.3%) in their study. The predictors
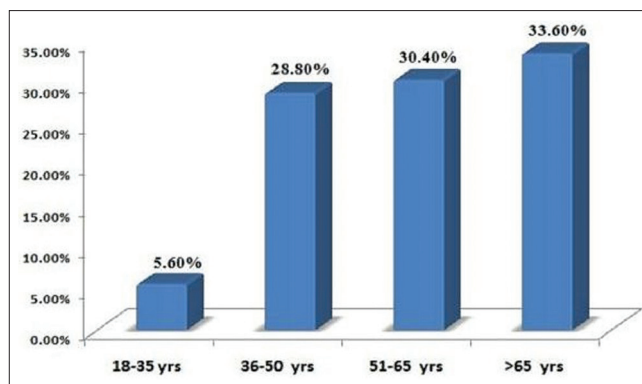

Figure 3: Prevalence of depression among the different age groups of type 2 diabetes mellitus patients

for depression among these patients were age, insulin therapy, female sex, ischemic heart disease, nephropathy, and retinopathy,[11] whereas Kamrul-Hasan *et al*. had found depression to the tune of 60.3% among 900 T2DM patients, predictors of depression were diabetic comorbidities and complications, duration of diabetes, use of insulin, and chronic kidney disease.[12] Gahlan *et al*. reported a lesser prevalence of depression (18.0%) and identified predictors of distress as lower education level and diabetes and hypertension complications,[13] whereas Khullar *et al*. also found a higher prevalence of depression (65.02%) in women than in men (49.87%), which is similar to the present study but reported female gender, duration of diabetes, and BMI as the independent risk factors for depression.[14] Another case–control study in 100 cases of T2DM found the prevalence of depression as high as 63% and reported duration of diabetes and complications of diabetes as the main risk factors for depression amongst them. The findings of the present study were also different concerning predictors of depression.[15] A cross-sectional study involving 300 patients with significant and moderate depression was found in 23% and 18%, respectively, and significant contributing risk factors were age, central obesity, and diabetic complications.[16] Madhu M *et al*. and Chowdhury *et al*. found a higher prevalence of depression and found female gender as the predictor of depression among T2DM patients current study.[17,18] Even Chen *et al*. reported that obesity, inadequate physical activity, and comorbidities were risk factors for depression in elderly T2DM patients.[19] It has been found that nearly 50% of diabetes patients had at least one associated complication, which was also related to their age, gender, and socioeconomic status.[4] Diet, exercise, and self-care practices were also related to age, gender, and duration of diabetes in type 2 diabetes patients.[20] Even in a study with 480 older people, it was noticed that they required a desirable healthy lifestyle.[21] Another meta-analysis suggested that female gender, diabetic complications, insulin use, and low education of the patients are risk factors for depression

Table 4: Estimated regression coefficient for the Center for Epidemiologic Studies Depression Scale

Variables	Regression coefficient	P
Constant	18.565	0.000**
Age	1.23	0.013*
Gender	4.492	0.041*
Locality	3.898	0.021*
BMI (kg/m²)	1.133	0.018*
FBS (mg/dl)	1.114	0.045*
Number of included variables	5	
R^2	0.058	
R^2 adjusted for confounders	0.049	-

Statistical test=Multiple linear regression analysis applied; *P* significant as *<0.05, **0.01. BMI=Body mass index, FBS=Fasting blood sugar

in this population.[22] There lies much confusion so far as gender diversity is concerned with depression among diabetes people. However, the systematic review and meta-analysis supported that female patients had higher depression than males (34% vs. 23%).[23] The current study has delineated that female and elderly patients are at a higher risk for depression. Depression is closely linked with poor glycemic control; it has been found that patients who are depressed with type 2 diabetes had poor self-care behavior[24,] and it affects nutrition management, blood glucose control, and adherence to the medication of patients with diabetes as well as their quality of life.[25,26] Additionally, it was also found in a study that patients with diabetes and depression have a higher frequency of cardiovascular risk factors.[27] The present study's findings indicate to screen the patients of T2DM for depression, predominantly female and elderly patients, to prevent further complications such as CVD and improve their quality of life. Simultaneously, the focus is required to manage their daily living with a healthy lifestyle.

Strength and limitations

It was a cross-sectional and hospital-based study. As little is known about the predictors of depression in the Indian diabetic population, this study, with a larger sample size than previous studies, contributed essential data to depression as an emergent need of diabetic patients.

Conclusions

Findings revealed a higher prevalence of depression among T2DM patients, and among these, females and elderly patients were more affected with depression. This study also concluded that patients' locality, BMI, and FBS were also significant predictors of depression. Further large-scale research is required to explore the predictors of depression among type 2 DM patients. It is needed to screen patients of type 2 DM, especially females and elderly patients, for depression, at regular intervals as per clinical demand. BMI and FBS of these patients should also be considered as predictors for

depression. It is also required to identify, motivate, and educate the diabetes patients with an effective approach toward disease self-care.

Conflicts of interest
There are no conflicts of interest.

References

1. van der Donk LJ, Fleer J, Sanderman R, Emmelkamp PM, Links TP, Tovote KA, *et al*. Is type of depressive symptoms associated with patient-perceived need for professional psychological care in depressed individuals with diabetes? PLoS One. 2019 Feb 14;14(2):e0212304.
2. Bădescu SV, Tătaru C, Kobylinska L, Georgescu EL, Zahiu DM, Zăgrean AM, *et al*. The association between diabetes mellitus and depression. J Med Life 2016;9:120-5.
3. Naskar S, Victor R, Nath K. Depression in diabetes mellitus – A comprehensive systematic review of literature from an Indian perspective. Asian J Psychiatr 2017;27:85-100.
4. Tol A, Baghbanian A, Mohebbi B, Shojaeizadeh D, Azam K, Shahmirzadi SE, *et al*. Empowerment assessment and influential factors among patients with type 2 diabetes. J Diabetes Metab Disord 2013;12:6.
5. Tol A, Pourreza A, Shojaeezadeh D, Mahmoodi M, Mohebbi B. The assessment of relations between socioeconomic status and number of complications among type 2 diabetic patients. Iran J Public Health 2012;41:66-72.
6. Mohebbi B, Tol A, Sadeghi R, Mohtarami SF, Shamshiri A. Self-management intervention program based on the Health Belief Model (HBM) among women with gestational diabetes mellitus: A quasi-experimental study. Arch Iran Med 2019;22:168-73.
7. van Dijk SE, Adriaanse MC, van der Zwaan L, Bosmans JE, van Marwijk HW, van Tulder MW, *et al*. Measurement properties of depression questionnaires in patients with diabetes: A systematic review. Qual Life Res 2018;27:1415-30.
8. Iype T, Shaji SK, Balakrishnan A, Charles D, Varghese AA, Antony TP. Cognition in type 2 diabetes: Association with vascular risk factors, complications of diabetes and depression. Ann Indian Acad Neurol 2009;12:25-7.
9. Singh H, Raju MS, Dubey V, Kurrey R, Bansal S, Malik M. A study of sociodemographic clinical and glycemic control factors associated with co-morbid depression in type 2 diabetes mellitus. Ind Psychiatry J 2014;23:134-42.
10. Alzahrani A, Alghamdi A, Alqarni T, Alshareef R, Alzahrani A. Prevalence and predictors of depression, anxiety, and stress symptoms among patients with type II diabetes attending primary healthcare centers in the western region of Saudi Arabia: A cross-sectional study. Int J Ment Health Syst 2019;13:48.
11. Rajput R, Gehlawat P, Gehlan D, Gupta R, Rajput M. Prevalence and predictors of depression and anxiety in patients of diabetes mellitus in a tertiary care center. Indian J Endocrinol Metab 2016;20:746-51.
12. Kamrul-Hasan AB, Palash-Molla M, Mainul-Ahsan M, Gaffar AJ, Asaduzzaman M, Saifuddin M, *et al*. Prevalence and predictors of depression among patients with type 2 diabetes: A multicenter

5

cross-sectional study from Bangladesh. Mymensingh Med J 2019;28:23-30.

13. Gahlan D, Rajput R, Gehlawat P, Gupta R. Prevalence and determinants of diabetes distress in patients of diabetes mellitus in a tertiary care centre. Diabetes Metab Syndr 2018;12:333-6.

14. Khullar S, Dhillon H, Kaur G, Sharma R, Mehta K, Aggarwal R, *et al*. The prevalence and predictors of depression in type 2 diabetic population of Punjab. Community Ment Health J 2016;52:479-83.

15. Bahety P, Agarwal G, Khandelwal D, Dutta D, Kalra S, Taparia P, *et al*. Occurrence and predictors of depression and poor quality of life among patients with type-2 diabetes: A northern India perspective. Indian J Endocrinol Metab 2017;21:564-9.

16. Dhanaraj E, Raval A, Yadav R, Bhansali A, Tiwari P. Prescription Pattern of Antihypertensive Agents in T2DM Patients Visiting Tertiary Care Centre in North India. Int J Hypertens. 2012;2012:520915.

17. Madhu M, Abish A, Anu K, Jophin RI, Kiran AM, Vijayakumar K. Predictors of depression among patients with diabetes mellitus in Southern India. Asian J Psychiatr 2013;6:313-7.

18. Chowdhury SH, Karim MN, Selim S, Ahmed F, Azad AK, Maksud SA, *et al*. Risk of depression among Bangladeshi type 2 diabetic patients. Diabetes Metab Syndr 2017;11 Suppl 2:S1009-12.

19. Chen F, Wei G, Wang Y, Liu T, Huang T, Wei Q, *et al*. Risk factors for depression in elderly diabetic patients and the effect of metformin on the condition. BMC Public Health 2019;19:1063.

20. Tol A, Shojaeezadeh D, Eslami A, Alhani F, Mohajeritehrani M, Baghbanian A, *et al*. Evaluation of self-care practices and relative components among type 2 diabetic patients. J Educ Health Promot 2012;1:19.

21. Zanjani S, Tol A, Mohebbi B, Sadeghi R, Jalyani KN, Moradi A. Determinants of healthy lifestyle and its related factors among elderly people. J Educ Health Promot 2015;4:103.

22. Simayi A, Mohemaiti P. Risk and protective factors of co-morbid depression in patients with type 2 diabetes mellitus: A meta analysis. Endocr J 2019;66:793-805.

23. Khaledi M, Haghighatdoost F, Feizi A, Aminorroaya A. The prevalence of comorbid depression in patients with type 2 diabetes: An updated systematic review and meta-analysis on huge number of observational studies. Acta Diabetol 2019;56:631-50.

24. Shrestha M, Al-Ghareeb A, Alenazi F, Gray R. Association between subthreshold depression and self-care behaviour in people with type 2 diabetes: A protocol for systematic review of observational studies. Syst Rev 2019;8:167.

25. Babazadeh T, Dianatinasab M, Daemi A, Nikbakht HA, Moradi F, Ghaffari-Fam S. Association of self-care behaviors and quality of life among patients with type 2 diabetes mellitus: Chaldoran county, Iran. Diabetes Metab J 2017;41:449-56.

26. Kant R, Yadav P, Kishore S. Gender diversity of insulin sensitivity markers among patients of type 2 diabetes mellitus in northern India: A cross-sectional analytical study. J Family Med Prim Care 2020;9:3315-20.

27. Katon WJ, Lin EH, Russo J, Von Korff M, Ciechanowski P, Simon G, *et al*. Cardiac risk factors in patients with diabetes mellitus and major depression. J Gen Intern Med 2004;19:1192-9.