



Cross-sectional Study

Factors affecting depression and anxiety in diabetic patients: A cross sectional study from a tertiary care hospital in Eastern India

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ABSTRACT

Background: Diabetes is one of the most common chronic disease in the world and its prevalence in India is rising day by day. Diabetic patients often suffer from depression and anxiety which has a negative impact on patients resulting in non-adherence to medication, rapid disease progression and overall poor prognosis. India is the land of diversity and so are the causes of depression and anxiety in the people from different parts of the country. The study done in the current population has revealed certain indicators of both depression and anxiety that were not significant in previous studies. These new findings point towards the changing scenario and the need for more precise steps for improving the quality of life of diabetics.

Aims: The study aims to determine the prevalence of depressive symptoms and anxiety among diabetic patients and the factors associated with them.

Methods: A prospective cohort study was conducted with 305 participants among which 152 were diabetic while 153 were non diabetic patients. Depression and anxiety of the patients was measured through PHQ-9 scale and GAD-7 scale respectively. Factors associated with prevalence of depression and anxiety in the diabetic population was analysed.

Results: The prevalence of depressive symptoms (39.5% versus 12.4%) and anxiety (36.2% versus 14.4%) were significantly higher in diabetic patients as compared to non-diabetic participants. Low-income, urban residence, unmarried status, insulin therapy, presence of retinopathy, and ischemic heart disease were significantly associated with depression among diabetic group of patients. Similarly the major predictors of anxiety were marital status, literacy and diabetic complications like neuropathy, retinopathy and ischemic heart disease.

Conclusion: Our study shows depression and anxiety are highly prevalent among diabetic patients. All diabetic patients while seeking clinical contact should be screened for depression and anxiety especially those patients with predisposing risk factors.

1. Introduction

India harbours the largest diabetic population in the world and the number of diabetic patients in India is estimated to reach 57.2 million by 2025 [1]. Major depressive disorder and diabetes mellitus both often chronically progress for years before getting diagnosed. Among diabetic patients, the rate of prevalence of depressive symptoms ranges from 17% to 44% and for anxiety the prevalence ranges from 4% to 10%

[2–6]. These are the most common mental illnesses in present times. A systematic review has revealed that both of these are very common in patients with chronic diseases in both developed and developing countries [7]. However they are hardly recognised and treated in timely fashion, hence creating the overall burden on top of the existing diabetic process. These have many negative health outcomes in patients with chronic illnesses like non adherence to medication, rapid disease progression and overall poor prognosis [8]. It is of paramount importance to

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recognise the symptoms of depression and anxiety early in these patients to start the management as early as possible.

Factors associated with depression and anxiety vary in different study populations and are not adequately studied in population of Eastern India. The current study aims to analyse the factors associated with these conditions at a tertiary care center of Eastern India. This will help in early intervention and diagnosis of depression and anxiety. Adequate treatment and counselling could be administered wherever necessary. This would lead to overall improvement of quality of life of the individual and the society at large.

2. Methodology

It is a cross sectional study conducted between April to July 2022 at a tertiary care facility in Kolkata (Eastern India). It has been approved by the institutional ethics committee (memo number- CMSDH/IEC/295/04–2022, dated 02/04/2022). The work has been reported in line with the STROCSS Criteria [9]. This study is registered at the Thai Clinical Trials Registry (TCTR20220616005).

2.1. Sample size

The required sample size calculated using confidence interval (z) as 95% and absolute precision (d) as 5%. The prevalence of anxiety among patients with diabetes in a study done by Ranjan et al. was found to be 10.6% [10]. It was calculated as follows:

$$N = \{(z)^2 (p) (1-p)\} / d^2$$

where N is the required sample size for diabetic and non-diabetic groups, $z = 1.96$ (standardized normal distribution curve value for 95% confidence interval), $p = 10.6$ (proportion of anxiety among diabetic patients), $d = 0.05$ (absolute precision).

$$N = \{(1.96)^2(0.106) (1-0.106)\} / (0.05)^2 = 145.6 \approx 147$$

Here we have taken the sample size for diabetic group as 152 and for non-diabetic group as 153. The total number of participants in our study was 305.

2.2. Study tool

Sociodemographic details of the patients were collected using a structured proforma in either of the three languages- English, Hindi or Bengali, according to the patient's convenience. Disease characteristics including clinical profile of diabetes was obtained from our prospectively maintained general medicine database.

PHQ-9 scale was used to determine the presence and to assess the severity of depression [11]. The patient had to answer 9 items. Each answer had to be selected from four options scored from 0 to 3. The total score ranges from 0 to 27 where 1–4 indicates minimal depression, 5–9 indicates mild depression, 10–14 indicates moderate depression, 15–19 indicates moderately severe depression and 20–27 indicates severe depression. Pre validated scales in Bengali (BPHQ) and Hindi languages were also used according to patient's preference [12].

GAD-7 scale was used to determine the presence and assess the severity of anxiety [13]. The patient had to answer 7 items. Each answer had to be selected from four options scored from 0 to 3. The total score ranges from 0 to 21, where 0–4 indicates minimal anxiety, 5–9 indicates mild anxiety, 10–14 indicates moderate anxiety and 15–21 indicates severe anxiety. Pre validated GAD-7 scale in Bengali and Hindi languages were used whenever necessary.

2.3. Procedure

Adult diabetic patients (>18 years of age) who attended the General Medicine out patient and in patient department of our hospital were

included in the present study. Diagnosis of diabetes was made according to the guidelines of the American Diabetes Association, where the patients were considered diabetic if they had HbA1c levels of 6.5% or higher, or fasting plasma glucose levels 126 mg/dl or higher in 2 separate tests [14]. A group of non-diabetic patients with similar socio-demographic and clinical profile were recruited as a comparator group. They were mostly the healthy family members of patients with unrelated disease. Informed, written patient consent was obtained from all study participants. Patients having known psychiatric illnesses, other long-standing chronic illnesses, terminally ill, or on corticosteroids were excluded from the study. The data were collected through a one on one interview with the participants of the study.

2.4. Statistical analysis

Data are represented as frequency with percentage for categorical variables and mean with standard deviation for numerical variables. Categorical data were analysed by chi-squared test or Fisher's exact test, and numerical data were analysed using independent sample t -test or Mann-Whitney U tests, as appropriate. Variables which were statistically significant or had a p value of <0.1 in the univariate analysis were analysed further by logistic regression (multivariate analysis). A p value of <0.05 was taken as significant. Statistical analysis was performed using commercially available SPSS version 21.

3. Result

In our study 305 participants were recruited among which 153 were non-diabetic (NDM) and 152 were diabetic (DM). The socio-demographic, clinical features and disease characteristics are shown in Table 1. Age and gender distribution among the 2 groups (NDM and DM) were similar ($p = 0.571$). Most of the study participants belonged to age

Table 1
Demographic and clinical profile of the study participants.

Variable	Non-diabetic group (n = 153)	Diabetic group (n = 152)	P-value
Age (years)	54.61 ± 6.04	55.13 ± 7.70	0.571
Sex (n,%)			0.530
Male	81 (52.9%)	75 (49.3%)	
Female	72 (47.1%)	77 (50.7%)	
Marital status (n,%)			0.009*
Married	142 (92.8%)	135 (88.8%)	
Unmarried	7 (4.6%)	2 (1.3%)	
Widowed	4 (2.6%)	15 (9.9%)	
Residential area (n,%)			0.098
Rural	40 (26.1%)	53 (34.9%)	
Urban	113 (73.9%)	99 (65.1%)	
Education (n,%)			0.518
Illiterate	38 (24.8%)	33 (21.7%)	
Literate	115 (75.2%)	119 (78.3%)	
Income (X 10 ³ rupees/month)	29.57 ± 20.93	31.10 ± 21.18	0.585
BMI (kg/m ²)	21.04 ± 1.64	24.51 ± 2.15	0.001*
FBS (mg/dL)	91.44 ± 10.89	166.37 ± 22.88	0.001*
PPBS (mg/dL)	126.61 ± 11.05	228.94 ± 27.68	0.001*
Duration of DM (years)		7.50 ± 3.57	
HbA1C (%)		9.29 ± 1.11	
OHA (%)		152 (100%)	
Insulin (%)		110 (72.4%)	
Retinopathy (%)		64 (42.1%)	
Nephropathy (%)		37 (24.3%)	
Neuropathy (%)		80 (52.6%)	
IHD (%)		32 (21.1%)	
HTN (%)	55 (35.9%)	98 (64.5%)	0.001*
Depression (n,%)	19 (12.4%)	60 (39.5%)	0.001*
Anxiety (n,%)	22 (14.4%)	55 (36.2%)	0.001*

(BMI: Body mass index, FBS: Fasting blood sugar, PPBS: Post-prandial blood sugar, HbA1C: Glycated hemoglobin, OHA: Oral hypoglycemic agent, IHD: Ischemic heart disease, HTN: hypertension, *: $p < 0.05$).

group 45–60 years. Number of widowed participants were significantly higher in the DM group ($p = 0.009$). There was no difference in place of residence, educational status, and income between these groups. Body mass index ($p = 0.001$), fasting blood sugar ($p = 0.001$), and post prandial blood sugar ($p = 0.001$) levels were significantly higher in the DM group compared to the NDM group. Hypertension was also more commonly seen in the DM group (35.9% versus 64.5%, $p = 0.001$).

There was a significant difference in depressive symptoms and anxiety in these groups. In the DM group, 60 (39.5%) and 55 (36.2%) patients had depressive symptoms (ranging from minimal to severe forms) and anxiety respectively. In contrast, 19 (12.4%) and 22 (14.4%) patients had depressive symptoms and anxiety respectively in the NDM group.

A subgroup analysis within the DM group (Tables 2 and 3) was done to analyse the predictors of depression and anxiety among the participants.

Educational status (OR:0.168, CI:0.050–0.563, $p = 0.004$), marital status (OR:7.334, CI:1.339–40.156, $p = 0.022$), insulin therapy (OR:3.596, CI:1.249–10.351, $p = 0.018$), retinopathy (OR:5.521, CI:2.193–13.903, $p = 0.001$), hypertension (OR:0.167, CI:0.065–0.431, $p = 0.001$) and ischemic heart disease (OR:5.646, CI:1.923–16.577, $p = 0.002$) were significantly associated with depressive symptoms. Marital status (OR:6.132, CI:1.214–30.996, $p = 0.028$), retinopathy (OR:7.668, CI:3.120–18.845, $p = 0.001$), neuropathy (OR:3.054, CI:1.239–7.527, $p = 0.015$) and ischemic heart disease (OR:5.356, CI:1.922–14.924, $p = 0.001$) were significantly associated with anxiety.

4. Discussion

The study aimed to determine the prevalence of depressive symptoms and anxiety, and the factors associated with them among diabetics.

4.1. Prevalence of depressive symptoms

We found that 39.4% ($N = 60$) diabetic patients met criteria for depression. This is more than 3 times the number of non diabetics with depression ($N = 19$, 12.4%, $p = 0.001$). Similar studies conducted at various other parts of India put the prevalence of depressive symptoms in diabetics at 16.9%–41% [4,15]. Studies from USA reported this rate at 30% [16]. These varying degrees of prevalence may be attributed to differences in methodology of the study, source population and socioeconomic difference. A similar trend of rising prevalence of depressive symptoms has been observed in all these studies.

Table 2

Univariate analysis of predictors of depression and anxiety among diabetic sub-group.

Predictors	Depression (P value)	Anxiety (P value)
Sex	0.594	0.771
Age	0.001*	0.138
Education	0.001*	0.013*
Marital status	0.001*	0.001*
Residence	0.005*	0.088
Income	0.001*	0.836
BMI	0.001*	0.001*
FBS	0.041*	0.001*
PPBS	0.019*	0.001*
HbA1C	0.025*	0.001*
Duration of DM	0.006*	0.001*
Insulin therapy	0.015*	0.050
Retinopathy	0.001*	0.001*
Nephropathy	0.013*	0.009*
Neuropathy	0.014*	0.001*
IHD	0.003*	0.001*
HTN	0.020*	0.370

(BMI: Body mass index, FBS: Fasting blood sugar, PPBS: Post-prandial blood sugar, HbA1C: Glycated hemoglobin, IHD: Ischemic heart disease, HTN: hypertension, *: $p < 0.05$).

Table 3

Multivariate analysis of predictors of depression and anxiety among diabetic sub-group.

Predictors	Odds ratio	95% CI for Odds ratio		B	P
		Lower	Upper		
Depression					
Education	0.168	0.050	0.563	−1.781	0.004*
Marital status	7.334	1.339	40.156	1.993	0.022*
Residence	0.673	0.268	1.689	−0.397	0.399
Insulin therapy	3.596	1.249	10.351	1.280	0.018*
Retinopathy	5.521	2.193	13.903	1.709	0.001*
Nephropathy	2.165	0.802	5.841	0.772	0.127
Neuropathy	1.801	0.727	4.458	0.588	0.203
IHD	5.646	1.923	16.577	1.731	0.002*
HTN	0.167	0.065	0.431	−1.788	0.001*
Anxiety					
Education	0.525	0.171	1.618	−0.644	0.262
Marital status	6.132	1.214	30.996	1.814	0.028*
Insulin therapy	2.888	0.952	8.761	1.061	0.061
Retinopathy	7.668	3.120	18.845	2.037	0.001*
Nephropathy	2.400	0.922	6.248	0.875	0.073
Neuropathy	3.054	1.239	7.527	1.117	0.015*
IHD	5.356	1.922	14.924	1.678	0.001*

(IHD: Ischemic heart disease, HTN: hypertension, *: $p < 0.05$).

Diabetic patients in our study belonged to age group of 55.13 ± 7.70 years and had a higher prevalence of depressive symptoms as compared to NDM group. This may be due to multiple factors such as daily insulin injections, maintaining strict diet, regular medical check-ups and constant blood glucose monitoring [17]. Similar results were observed in previous studies where prevalence of depression was higher in the age group of 31–59 years and >54 years respectively as compared to younger groups [4].

Depressive symptoms were found to be equally prevalent in both males and females. This result is in contrast to previous studies where it showed that female diabetics had higher prevalence of depression [17, 18]. This stark contrast may be due to recent rise of depression in males as compared to earlier times. Increasing poverty, lack of jobs and inflation are some of the main reasons for rising depression in men [19]. Women were found to have a wider and more flexible range of coping strategies to deal with depression compared to men [20].

Among the DM group, prevalence of depressive symptoms was higher in low-income families residing in urban area. Several factors including increasing cost of diabetic treatments and management, increase in pollution and hectic lifestyle in urban areas point towards these results. This increases the psychological stress which in turn results in depression. Studies done by Rajput et al. and Katon et al. shows similar findings [17,21]. Lack of jobs and increasing unemployment increases stress manifold and leads to depression [19].

Unmarried diabetics were found to have a higher prevalence of depressive symptoms (OR: 7.334, CI:1.339–40.156, $p = 0.022$). Katon et al. showed similar findings in their study [21]. Marriage introduces people to new social networks, reduces stress from life and provides a personal security and purpose. However, this study is in contrast to a study where it was seen that prevalence was higher in married patients where the subjects attributed it to the added responsibility on married people such as managing both career and family responsibilities together, maintaining their household and managing their own chronic illness [17]. These increase their financial and emotional burden.

This study revealed that depressive symptoms were significantly associated with diabetic retinopathy (DR) (OR:5.521, CI:2.193–13.903, $p = 0.001$), neuropathy (OR:0.325, CI:0.122–0.865, $p = 0.024$) and ischemic heart disease (IHD) (OR:5.646, CI: 1.923–16.577, $p = 0.002$). Several factors such as suboptimal diabetic selfcare, poor compliance with prescribed medications, not maintaining a strict diet or exercise is responsible for such findings. Depression itself leads to progression of both macrovascular and microvascular complications such as DR, peripheral vascular disease and atherosclerosis. Moreover, depression can

in turn lead to negative attitude towards medication and surgical treatment, thus worsening DR and IHD in a relatively indirect way [22]. The results of this study correlates with earlier studies which showed prevalence of depression was significantly higher in diabetics with associated comorbidities like retinopathy and IHD [23]. However, some studies found significant association of neuropathy as well as nephropathy with prevalence of depression in diabetics [3,4].

Hildrum et al., in his study, established an epidemiological evidence for an association of hypotension with anxiety and depression [24]. He found low BP in depressed individuals. Carmilla MM Licht et al. hypothesized several possible mechanisms for low BP in depression [25]. First, low BP may be seen due to usage of additional antihypertensive drugs in depressed patients. Second, chronic low BP may itself be present comorbidity with DM leading to increased prevalence of depression in such patients. Finally, altered levels of neuropeptide Y, an important modulator of norepinephrine signalling causes depression as well as may suppress sympathetic activity and decrease BP [26–28]. Our study showed similar findings where prevalence of depression was inversely proportional to hypertension (OR:0.246, CI: 0.101–0.603, $p = 0.002$).

Insulin therapy was found to significantly affect the rate of prevalence in diabetics [OR:3.596, CI:1.249–10.351, $p = 0.018$]. This is due to the fact that patients on insulin therapy have to take multiple injections, regularly visit hospitals and chances of complications, such as lipodystrophy at the site of injection are higher. This is significantly less in diabetics on oral therapy. Previous studies also show that prevalence of depression was higher in insulin dependent diabetics than noninsulin dependent diabetics [29].

We also found depressive symptoms to be associated with many other clinical factors such as Body mass index (BMI), fasting blood sugar (FBS), post prandial blood sugar (PPBS) and HbA1c assay. This correlates with similar studies done in the past [15].

4.2. Prevalence of anxiety

Anxiety was found to be about 2.5 times more common in diabetics than in non-diabetics (36.2% versus 14.4%). This is consistent with previous study showing prevalence of anxiety to be 35.3% [6]. However, another study showed prevalence of anxiety to be as high as 57.9% [5]. INTERPRET-DD, a study done based on data collected from 3170 diabetic patients from 15 countries in different continents estimated the prevalence of anxiety to be as low as 18% [30]. The differences in prevalence rates can be explained by the different methods, instruments and scales used for calculating the prevalence of anxiety. While we used the GAD-7, which is designed to assess for generalized anxiety disorder (GAD), the INTERPRET-DD study used the Mini International Neuropsychiatric Interview.

Age and sex were not statistically significant in determining the predictors of anxiety. This is in contrast to previous studies which showed females had higher incidence of anxiety [5,31]. They reasoned that women had more gender specific roles which included increased work demand and responsibilities. The contrast in this study can be attributed to increasing unemployment and poverty where both men and women are equally affected [32].

Married people had a higher prevalence of anxiety (OR: 6.132, CI:1.214–30.996, $p = 0.028$). This can be due to increase in responsibilities including both career and household problems. Moreover, widowed individuals were also found to face social discrimination which adds to their psychological burden [33].

Literate individuals were twice more associated with anxiety than illiterate people. This can again be associated to the lack of jobs and unemployment, where even literate people are not able to get a decent job [32].

Microvascular (retinopathy) and macrovascular (IHD) complications were significantly associated with anxiety prevalence. Neuropathy was also found to be a prevalent factor for anxiety in diabetics. This correlates with previous studies done by Rajput et al. and Khuwaja et al. [5,17].

Rajput et al. also found nephropathy to be a significant factor. However our study found no such association.

BMI, FBS, PPBS and HbA1c are significantly associated with prevalence of anxiety in diabetics. This result is in contrast to previous studies done by Rajput et al. [17].

4.3. Comorbid depression and anxiety with diabetes mellitus

Comorbid depressive symptoms and anxiety were present in 33 (21.6%) diabetic patients. This result is similar to a previous study [17]. However, Thomas et al. found comorbid depression and anxiety to have a much higher prevalence rate in diabetics (36.0%) [34]. Sahoo et al. found that clinical depression was present in 12.1% patients and generalized anxiety disorder was present in 19.0% patients [35]. The occurrence of depression greatly increased the odds of anxiety as well with 87% of depression patients also suffering from anxiety [36]. Patients who were diagnosed with anxiety disorder also had high rates of comorbid depression [36]. Gerontoukou et al. documented the positive correlation between depression and anxiety in chronic illness, and the occurrence of depression can increase the risk of anxiety symptoms in patients with chronic illness [37,38]. The clinical symptoms of depression and anxiety were subsyndromal to make a primary diagnosis of either depression or anxiety indicating new regulations should be introduced to manage and prevent more serious diseases [39]. Evidences have shown that patients having comorbid depression and anxiety suffered from more serious illness and were more resistant to different treatments than those having one only disorder [40].

In spite of having various clinical implications, our study also has certain limitations. Firstly, being a cross sectional study, we cannot draw long term conclusions from the result of this study. Secondly, our study is based on a relatively small sample size of a tertiary care center. Hence the results cannot be generalized. Further multicentral, longitudinal studies carried out in different geographical locations have to be taken into account for establishing diabetes as a cause of depression.

5. Conclusion

Our study shows depression and anxiety are highly prevalent among diabetic patients. Factors like marital status, insulin therapy, retinopathy and ischemic heart disease are important predictors of depression and anxiety among diabetic patients which require clinical attention. All diabetic patients while seeking clinical contact should be screened for depression and anxiety especially those patients with predisposing factors.

Ethical approval

This study was approved by the institutional ethics committee (Memo number- CMSDH/IEC/295/04-2022, dated 02/04/2022).

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Nil.

Author contribution

K.K. and J.B. wrote the manuscript. A.D. and S.N. conceptualized the research. K.K., A.D., J.B., and S.N. performed the data collection and review of the literature. S.S. and G.K.D. revised the manuscript. All the authors have gone through the final version of the manuscript.

Consent

Informed written consent was taken from all the participants.

Registration of research studies

This study is registered at Thai Clinical Trials Registry (TCTR20220616005).

Guarantor

Kankana Karpha acts as guarantor for the report and accepts responsibility for the work.

Declaration of consent

Informed written consent was taken from all the participants.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

Nil.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104945>.

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