

## **Original Research Article**

### **Study of Correlation Analysis and Prevalence of Anxiety and Depressive Disorder in Patients with Uncontrolled Diabetes Mellitus**

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**Abstract:** Diabetes is chronic illness in nature and patients are having difficulties in achieving optimal diabetes control. As there is no cure for diabetes the main aim of diabetes treatment is to optimise glycaemic control. People with diabetes are at higher risk of psychological problems such as depression and anxiety than the general population. This study was cross sectional study. We included person diagnosed with diabetes mellitus having uncontrolled diabetes status measured by one previous HbA1c between 8.2% and 15.0%. Existence of depression and anxiety disorder was evaluated by using PHQ-9 and GAD-7 questionnaire respectively. Socio-demographic data and duration of diabetes was obtained from semi structured questionnaires. We included total 200 patients in this study. Results suggest 36% had no depression, 37% had mild level of depression, 22 % moderate depression and severe depression was found in 5% of diabetic patients. The prevalence of anxiety disorder was 43% had no anxiety disorder, 53% had mild, 2% moderate and 2% severe anxiety disorder. There was positive correlation exist (p values <0.005) between Hb1Ac and PHQ-9 (0.241, P value 0.016), GAD-7 and diabetes mellitus duration (0.252, P value 0.011), Hb1Ac and height (0.197, P value 0.049). Very strong positive correlation exist between (P value <0.001) PHQ-9 and GAD-7 (0.702 P values 0.011), PHQ-9 and duration of diabetes mellitus (0.351 P value <0.001). We found higher levels depression and anxiety disorder among uncontrolled diabetes mellitus. Strong positive correlation exists between diabetes, depression and anxiety disorder.

**Keywords:** anxiety and depressive disorder, diabetes mellitus, Correlation analysis.

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#### **INTRODUCTION**

Diabetes is chronic illness in nature and patients are having difficulties in achieving optimal diabetes control. India has the largest number of diabetic population in the world and it is expected that

Despite the evidence for effective intensive insulin regimes and structured education programmes, between 25% and 50% of adults with type 1 diabetes have sub-optimal glycaemic control. Various parameters responsible for sub-optimal glycaemic control are smoking, younger age at onset of diabetes, less frequent self monitoring, lower socioeconomic status less diabetes-related knowledge and perceived abilities to cope, and being female, alcohol consumption and knowledge of diabetes.

People with diabetes are at higher risk of psychological problems than the general population such as depression, anxiety, Fear of injecting and self-testing, fear of hypoglycaemia and complication, burnout, eating disorder. These psychological problems

there will be 69.9 million diabetic populations in India by 2025 Chronic hyperglycaemia leads to micro- and macro vascular complications. As there is no cure for diabetes the main aim of diabetes treatment is to optimise glycaemic control [1].

leads to poor glycaemic control and its complication. Considering the limits of intensive medical interventions in these person there is an a priori role for psychological treatments as adjuncts in helping to improve glycaemic control[2, 3].

A bidirectional adverse interaction has been hypothesized in patients with comorbid depression, anxiety and diabetes [4]. In patients with diabetes, comorbid depression and anxiety disorder has been shown to be associated with increased medical symptom burden, additive functional impairment, poor self care (i.e. adherence to diet, exercise, disease control medication, and cessation of smoking recommendations), increased risk of macrovascular and microvascular complications, higher medical costs and greater mortality [5, 6, 7]. Incident diabetes

complications and resulting functional impairment may also provoke depressive episodes. Moreover, macrovascular complications such as stroke and heart attack may raise cytokine levels, thereby, increasing the risk of depressive illness [8].

The prevalence of generalised anxiety disorder, often comorbid with diabetes, is estimated to be around 14% for patients with diabetes compared with 3–4% in the general population, and is associated with sub-optimal glycaemic control. Behavioural mechanisms, such as neglect of diabetes self-care tasks, have been the preferred explanation for the association between depression and glycaemic control, but there is little prospective evidence to confirm this. In randomised controlled trials (RCTs) of interventions for depression in diabetes, mostly in type 2 diabetes, while depression scores tend to improve, glycaemic control does not always improve [9].

A meta-analysis of 27 studies found a significant association between depression and a wide variety of diabetes complications (neuropathy, retinopathy, nephropathy, macrovascular complications, and sexual dysfunction) [10]. The conclusions that can be drawn from individual studies are limited given their relatively small samples, which included patients with both type 1 and type 2 diabetes. While meta-analyses can combine information to overcome problems with small samples in individual studies, measurement problems remain a limitation of these studies. The diabetes complications considered included both mild and advanced pathophysiologic changes (e.g., both microalbuminuria and stroke) and both self-reported symptoms (e.g., pain severity or impotence) and objectively documented disorders (e.g., retinopathy glomerular filtration rate). In addition, depression assessment often used symptom-severity scales and lacked diagnostic measures.

In the only large-scale prospective study, Black *et al.* found in a sample of 2,830 elderly Mexican Americans with type 2 diabetes (aged  $\geq 65$  years) that comorbid depression at baseline was associated with an increased risk of macrovascular and microvascular complications over a 7-year period [8]. This study was limited to an elderly population from one ethnic group, and presence of diabetes and complications were based on patient self-report. The analyses also did not account for potential clinical confounders or mediators such as glycemic control, severity of medical comorbidity, or health habits. This prospective study investigates whether there is a link between depression and subsequent development of clinically significant diabetes complications in a large cohort of primary care patients.

Most of the previous studies have either focused only on depression or anxiety disorder but evaluation of both depression and anxiety disorder in diabetes are limited. Also evaluation of both these psychiatric disorder in Indian setting are very limited. The articles on patients with uncontrolled diabetes in Indian setting are very limited. So we tried to look into this matter and made our main aim of this study.

**Main aims and objectives:** 1) To study the prevalence of depressive disorder in diabetes mellitus 2). To study the prevalence of anxiety disorder in diabetes mellitus

**Methodology:** This study was a Cross sectional study. We included 200 patients who met the following inclusion and exclusion criteria as sample group

**Inclusion criteria:**

- 1) Diabetes mellitus was defined according to the World Health Organization criteria.
- 2) Either they are on oral hypoglycaemic agents and /or on insulin therapy
- 3) Age between 18–80 years
- 4) uncontrolled diabetes was measured by one previous HbA1c between 8.2% and 15.0%, identified by the treating physician

**Exclusion criteria:**

- 1) Pregnancy or attending a pre-pregnancy clinic
- 2) On antidepressant initiated less than 2 months ago to reduce the bias of recovery from depression
- 3) Acute or serious medical illness as defined by treating physician
- 4) Advanced diabetes complications (such as registered blind or serum creatinine values  $> 300$  mmol/l)
- 5) Known haemoglobinopathy or severe mental disorder.

**RESULTS**

**Socio-demographic data:**

Semi-structured questionnaire were used to look for socio-demographic data. The results suggest mean age of presentation was 57yrs, majority were males, and married, belongs to Hindu religion from urban background with mean educational status of 7 yrs. (Table 1)

To evaluate for diabetic status and its related complication we used clinician based evaluation and some bedside and laboratory test. The results are as shown in table 2. Mean duration of diabetes was 8 yrs with minimum new case to maximum 30 yrs duration. Mean Hb1Ac was 8.32.

**Table 1: Demographic profiles**

Demography	
Age minimum	30
Maximum	84
Mean ± SD	56.98± 12.0
Sex	
Male	61
Female	39
Marital status	
married	98%
Unmarried	2%
Education	
Minimum	0
maximum	18
Mean ± SD	7.94 ± 4.8
Religion	
Hindu	96%
Muslim	4%
Rural	42%
Urban	58%

**Table 2. Diabetic profile:**

Duration of diabetes	
Minimum	New case
maximum	30 years
Mean ± SD	7.9 ± 7.3
Hb1Ac	
Minimum	8.2
maximum	14.21
Mean ± SD	8.32 ± 1.8
Neuropathy	
Yes	33.3%
No	66.7%
Nephropathy	
Yes	10%
No	90%
Retinopathy	
Yes	21.7%
No	78.3%
Stroke/MI	
Yes	11.7%
No	88.3%
Diabetic foot	
Yes	13.3%
No	88.3%

**Prevalence of psychiatric disorder:**

To evaluate for psychiatric morbidity we used PHQ 9 which is clinician/self administered standardized questionnaire validated even from India also. In this maximum score was 27 and minimum score required to label it is an depression was 5. Subsequently severity depends on the score figure. Higher the score more the depression. These results suggest 36% had no depression, 37% had mild level of depression, 22 % moderate depression and severe depression was found in 5% of diabetic patients. Similarly the GAD-7 evaluates the existence of anxiety disorder and also quantifies the severity. The results were suggestive of 43% had no anxiety disorder, 53% had mild, 2% moderate and 2% severe anxiety disorder.

The prevalence of both anxiety and depressive disorder in uncontrolled diabetes mellitus was 43% and either anxiety or depression was present in 40% of the individual and no depression and anxiety in only 17 % of the individual. This suggests high prevalence of psychiatric disorder.

**Table 3: Prevalence of depression:**

Depression	Percentage (N=200)
None	35.9
Mild	36.6
Moderate	22.5
Severe	5.0

**Table 4: Prevalence of anxiety disorder**

Anxiety disorder	Percentage (N=200)
None	43.3
Mild	53.3
Moderate	1.7
Severe	1.7

**Table 5: Prevalence of depression and anxiety disorder**

Prevalence	Number in percentage
None	17%
Both	43%
Either	40%

**Correlation analysis**

We analysed the continuous data of Hb1Ac, diabetes mellitus duration, PHQ-9 score, GAD-7 score, height and weight with Pearson correlation. There was strong positive correlation (p values <0.005) between Hb1Ac and PHQ-9 (0.241, P value 0.016), GAD-7 and diabetes mellitus duration (0.252, P value 0.011), Hb1Ac and height (0.197, P value 0.049). This means higher the glycated hemoglobin (uncontrolled diabetes) higher is the severity of depression. Similarly more the generalized anxiety symptoms if the longer duration diabetes mellitus.

There is also positive correlation between higher the height higher levels of glycated hemoglobin. In another correlation very strong positive correlation exist between (P value <0.001) PHQ-9 and GAD-7 (0.702 P values 0.011), PHQ-9 and duration of diabetes mellitus ( 0.351 P value <0.001), height and weight (0.438 P value <0.001). This suggest higher the score of PHQ-9

(severe the depression) higher scores of anxiety disorder (severe the anxiety disorder). Similarly higher the duration of diabetes more severe will be the depression. Even positive correlation exists between height and weight means more the height higher the weight.

**Table 6: Correlation analysis**

		HB1AC	GAD-7	DM duration	PHQ-9 Score	Height	weight
HB1AC	Pearson Correlation	1	0.108	0.142	0.241(*)	0.197(*)	-0.120
	Sig. (2-tailed)		0.287	0.159	0.016	0.049	0.233
GAD-7	Pearson Correlation	0.108	1	0.252(*)	0.702(**)	-0.164	-0.155
	Sig. (2-tailed)	0.287		0.011	<0.001	0.102	0.124
DM duration	Pearson Correlation	0.142	0.252(*)	1	0.351(**)	0.098	-0.057
	Sig. (2-tailed)	0.159	0.011		<0.001	.331	.576
PHQ-9 Score	Pearson Correlation	0.241(*)	0.702(**)	0.351(**)	1	-0.077	0.089
	Sig. (2-tailed)	0.016	<0.001	<0.001		0.448	0.378
Height	Pearson Correlation	0.197(*)	-0.164	0.098	-0.077	1	0.438(**)
	Sig. (2-tailed)	0.049	0.102	0.331	0.448		<0.001
Weight	Pearson Correlation	-0.120	-0.155	-0.057	0.089	0.438(**)	1
	Sig. (2-tailed)	0.233	0.124	0.576	0.378	<0.001	

**DISCUSSION**

The socio demographic data of this study represents clinical profile of private sector institution. Majority of them were in the middle age group. Sixty percent were male and another 40% were female. The prevalence of type II DM was more common in the community and also treatment seeking is more in this population. The mean duration of diabetes was 8 yrs which suggest majority were suffering with diabetes for significant duration and stress and psychiatric disorder are more among longer duration suffering. Similar results have been found by Amit Raval et al study where the mean duration of study was 8 years [11] We have included minimum Hb1Ac should be more than 8 which suggest uncontrolled diabetes. The prevalence of various psychological phenomenon like burnout and depression are more common among these population. We found depression in 60% of the subject which suggest majority of the patients having uncontrolled diabetes are suffering from depressive disorder among 5% were suffering from major depressive disorder. The result was slightly higher than study from Amit raval et al study but comparable with other developed studies [12, 13]. The meta analysis by Anderson et al identified the prevalence of depression in diabetes ranging from 8 to 61 per cen [2].

The hypothesis for higher rate of depression in patients with both type 1 and type 2 diabetes results from chronic psychosocial stressors of having a chronic medical condition [14]. This hypothesis supported by atleast two important studies. First, 8870 participants from the first National Health and Nutrition Examination Survey Epidemiologic Follow-up Survey who were free of diabetes at baseline were assessed for depression and followed for 9 years [15]. Compared with those with no depressive symptoms at baseline, those with high or moderate depressive symptoms did not have significantly higher incidence of diabetes over the study period. Second, 1586 older adults from the Rancho Bernardo study were screened for type 2 diabetes with a 75 g oral glucose tolerance test and screened for depression with a modified Beck’s Depression Inventory [16]. There was no evidence that depression was associated with incident diabetes, instead, the study showed that there was a 3.7 fold increased odds of depression in those with a prior diagnosis of diabetes.

The DM complications strongly influence the outcome and both micro- and macrovascular complications were observed associated with higher prevalence of depression particularly neuropathy, retinopathy and diabetic foot disease. Association of diabetic foot disease showed a strong association with depression irrespective of aetiology, whether it was neuropathic or neuroischemic foot disease. This happens because patients become invalid because of foot disease, treatment cost, prolonged hospital stay and subsequently poor rehabilitation make it worst among all the diabetic complications.

The anxiety disorder was also quite common. The prevalence of anxiety disorder was 57% this is significantly higher compared to study from N. Hermanns *et al* in Germany where the prevalence of clinical anxiety disorders was 5.9%, subclinical anxiety disorder were 19.3% and elevated anxiety symptoms in 25.2%. Our results are comparable with these results correspond with elevated rates for anxiety symptoms reported from other studies [4].

Table 5 shows prevalence of both depression and anxiety disorder was present in 43% which suggest higher prevalence of these disorders in uncontrolled diabetes and another 40% were suffering from either depression or anxiety disorder. Only 17% were free from depression and anxiety disorder. These results are comparable with other international result but from India lower prevalence has been reported by Lee Ducat *et al* 2014.

Table 6 is very important table where most of the factors which influence the prevalence of depressive disorder and anxiety disorder can be predicted. There are good numbers of studies are available at national and international level about higher prevalence of depression in uncontrolled diabetes [2, 17, 18, 19, 20]. Our study has supported this finding where higher the glycated hemoglobin more severe will be depression. If more severe will be the depression person will have more anxiety disorder (because of strong correlation exist between PHQ-9 and GAD-7). This is one of the important new finding from our studies [21, 22, 23, 24]. Only few studies have supported our finding but dearth of literature from India is very limited. One more important finding where longer the duration of diabetes mellitus more severe will be the depression. This finding is also new finding and these results were supported by many studies. So the stronger predictor of depression and anxiety disorder are uncontrolled diabetes status (Hb1Ac) and longer the duration of diabetes mellitus. Our study did not support the correlation of higher glycated hemoglobin and anxiety disorder and there is no significant correlation for age, height and weight. This suggests all these three factors have no definite predictive values in depression and anxiety disorder. This is also important finding.

Both disorders require proper intervention. There are good numbers of study which support our finding specially the prevalence of psychiatric disorder very common among poorly controlled diabetes mellitus. The next step is to built up data on the diagnosing and treating psychiatric disorder and further evaluating the control over the diabetic status after treatment.

The limitations of this study were its being cross-sectional nature, hence, causal relationships between depression, anxiety and variables could not be assumed.

## CONCLUSION

In conclusion, the present study showed that individuals with Diabetes Mellitus are burdened with personal socio-demographic and behavioral factors, which contribute to the manifestation of anxiety and depression symptoms. Both men and Women with Diabetes Mellitus are presented with higher percentages of anxiety and depression. There was strong positive correlation between diabetes, depression, anxiety disorder and Hb1Ac.

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