Original Research Article

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Prevalence of depression in patients with type 2 diabetes mellitus and its association with fasting blood sugar levels, in an urban area of Kancheepuram district, Tamil Nadu

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) and depressive disorders are among the major health problems in our community. Chronic medical conditions, like diabetes are affectively stressful for patients and may influence pathophysiologic mechanisms as well as mood. This can lead to depression and poor prognosis of T2DM. This study was done to assess the prevalence of depression among T2DM patients and its association with glycemic control.

Methods: This descriptive cross sectional study was carried out among 300 T2DM patients attending Urban Health Training Center (UHTC), Anakaputhur, which belongs to the urban field practice area of our institution. Fasting Blood Sugar levels (FBS) were assessed retrospectively from their medical records; and they were screened for depression by administering the nine items, "Patient Health Questionnaire - 9".

Results: Of the 300 T2DM patients, 54% were females. The mean age of the participants was 53±9.7 years. 31% of the study participants had fasting blood sugar (FBS) levels above 125 mg/dl. Depression was present in 39.7% of the individuals, among which, 17.3% had mild depression, 13% had moderate depression, 6.7% had moderately severe depression and 2.7% had severe depression. Depression was found to be significantly associated with increasing fasting blood sugar levels, diabetic complications, female gender and diabetic treatment.

Conclusions: This study shows that depression is highly prevalent among T2DM patients and is associated with poor prognosis, as reflected by poor glycemic control (FBS) and the occurrence of diabetic complications. So screening and counselling for depression among T2DM patients have to be carried out for optimum control and treatment of T2DM.

Keywords: Psychosocial, Stress, Glycemic control, Hyperglycemia

INTRODUCTION

Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemia associated with disturbances of carbohydrate, fat and protein metabolism due to absolute or relative deficiency in insulin secretion and/or action. It is categorized into type 1 and type 2 diabetes mellitus. Type 1 Diabetes mellitus usually manifests before adulthood and accounts for about 5% of

the cases. It arises through the autoimmune destruction of pancreatic beta cells, which leaves the patient with severe insulinopenia and extreme hyperglycemia. Type 2 diabetes mellitus (T2DM usually manifests in later adult life and accounts for about 95% of all cases. It develops mainly through a combination of insulin resistance and defective beta cell function. T2DM if not treated adequately, can lead to micro-vascular complications affecting the retina, renal glomerulus and the peripheral

nervous system and macro-vascular complications like coronary artery disease.² It is one of the leading causes of mortality and morbidity in our country. In India, Diabetes is gaining the status of a potential epidemic at an alarming rate, with more than 62 million diabetic individuals currently diagnosed with the disease.³ According to a study published by Lancet, half of the adults with diabetes in 2014 live in- India, China, Indonesia, Brazil and USA.⁴

Depression (major or minor depressive disorder) is a common mental disorder, characterized by sadness, loss of interest, low self-esteem, feelings of guilt, disturbed sleep, feelings of tiredness and poor concentration. It can become difficult to cope up with daily activities. Depression can even lead to suicide at its more severe form.⁵ It is a disorder of major public health importance, in terms of its prevalence, suffering, dysfunction, morbidity and economic burden. The report on global burden of disease estimates the point prevalence of unipolar depressive episodes to be 1.9% for men and 3.2% for women, and the one-year prevalence has been estimated to be 5.8% for men and 9.5% for women. One of the largest population based study done in South India among 25,400 residents residing at Chennai, found the prevalence rate of depression to be 15.1%.

Depression can be considered as a modifiable risk factor for the development of T2DM and its prognosis. When diabetes and depression co-exist; the risk of developing complications, comorbidities, patient suffering and associated cost increases.⁸ Depression is associated with increased levels of catecholamine, glucocorticoids and growth hormone. Because of this, glucose transport function gets altered; and there is secretion of inflammatory cytokines, all of which could lead to insulin resistance and, ultimately, be causal factors in the development and complications of diabetes mellitus. ⁹ The disease burden or the diagnosis of T2DM can lead to symptoms of depression among T2DM patients. 10 People with diabetes are almost twice as likely to suffer from anxiety and depression compared to population. 11,12

Recent evidence has shown that, mortality is high among persons who have co-existing diabetes and depression. ¹³ Having comorbid diabetes and depression, may also be associated with higher risk of suicide, with some reports indicating a 10 times increase of suicidal ideation and suicide. ^{14,15} This association can have a major impact on the prevention, effective treatment and control of T2DM. Depression early in life can lead to increased risk for type 2 diabetes, due to increased likelihood that patients with depression may practice unhealthy behaviors such as smoking, sedentary lifestyle etc. ¹⁶

Based on this background, this study was planned to find out the association of depression among T2DM patients in the urban field practice area of our institution with the following objectives,

- To find out the prevalence of depression among type
 Diabetes mellitus patients attending urban health training center area of Anakaputhur in Kancheepuram district.
- To find out if there is an association between depression and fasting blood sugar levels among the T2DM Patients.

METHODS

Study design

This is a community based cross sectional descriptive study carried out in Anakaputhur, an urban area of Kancheepuram District of Tamil Nadu.

Study area and population

The study was done among Type 2 diabetes mellitus patients attending urban health training center (UHTC), Anakaputhur that belongs to the urban field practice area of Community Medicine Department, Sree Balaji Medical College and Hospital in Kancheepuram district of Tamil Nadu.

Study period

The study was carried out between December 2015 and June 2016.

Sample size and sampling technique

A study done by Thour et al in Chandigarh in the year 2015, found that the prevalence of depression among type 2 diabetes mellitus patients to be about 41%.¹⁷ So, taking the prevalence of depression (P) as 41% with a precision of 14% of P at 95% confidence Interval, the sample size calculated using the formula [4PQ/L²], was found to be 293, which were rounded off to 300.

Purposive sampling method was used to carry out the study among T2DM patients attending the UHTC based on the following inclusion and exclusion criteria. The inclusion criteria were patients who have been diagnosed as having T2DM for a minimum period of 6 month, having reports of fasting blood sugar (FBS) done in the past 3 months and age group of above 18 years. Exclusion criteria were patients who have clinical evidence of any other psychiatric illness excluding depression, not having blood test reports (FBS) done in past 3 months and patients who didn't give informed consent.

Ethical approval and informed consent

Ethical approval was obtained from Institutional ethical Committee, Sree Balaji Medical College and Hospital. The study purpose and confidentiality was explained to each participant and the informed consent was obtained from all willing participant in the local language.

Data collection method

The data for this study was collected using a pre-tested structured interview schedule consisting of socio-demographic details of the participants, history of hypertension, presence of diabetic complications, glycemic status of the participants, the type of treatment they are undertaking for T2DM and presence of comorbid depression.

Clinical variables

Assessment of T2DM

The glycemic control of a diabetic patient can ideally be assessed by their glycated hemoglobin (HbA1c) values. HbA1c gives the average of the glycemic values over the past 2 to 3 months. 18 As per the target ranges for control of diabetes as recommended by the Indian Council of Medical Research (ICMR), HbA1c levels above 8% is deemed to be unsatisfactory.¹⁹ Fasting blood sugars represent the current glycemic levels of the individual and not a reliable indicator of glycemic control and chronic complications due to T2DM, while HbA1c is better associated with chronic complications.²⁰ But in a study done by Musenge et al in Zambia, they proved that FBS can be used as an alternative to assess the glycemic control In absence of HbA1c.²¹ So in our study, we used FBS to assess the glycemic control instead of HbA1c, as this test result was not available with most of the patients.

The fasting blood sugar levels done in the past 3 months were obtained retrospectively from their medical reports for our study purpose. As per the target ranges for control of diabetes as recommended by the Indian Council of Medical research (ICMR), fasting blood sugar levels above 125 mg/dl are deemed to be unsatisfactory. So the participants were divided into those having a FBS of 70-125 mg/dl and those above 125 mg/dl. Presence of complications related to T2DM like Diabetic Retinopathy, Diabetic Nephropathy, Diabetic Neuropathy and Coronary Artery Disease were enquired and also looked into the medical records and were recorded.

Assessment of depression

Presence of depression among the study group was assessed using the Patient Health Questionnaire-9 (PHQ-9). It is a self-administered version of PRIME- MD diagnostic instrument for common mental disorders. It is a depression module, which scores each of the 9 DSM-IV criteria (Diagnostic and Statistical Manual of Mental Disorders, 4th edition) as 0- (not at all) to 3- (nearly every day). Depression severity is calculated by assigning scores of 0, 1, 2, and 3, to the response categories of 0not at all, 1 - several days 2 - more than half the days and 3 - nearly every day, respectively. PHQ-9 total score for the nine items ranges from 0 to 27. Scores of 5, 10, 15, and 20 represent cut points for mild, moderate, moderately severe and severe depression, respectively. 22 It is a valid and reliable measure of severity of depression.²³

RESULTS

Socio-demographic characteristics of study population

A total of 300 subjects participated in the study. Table 1 shows the socio-demographic characteristics of the study participants. Participants involved in this study were in the age group of 30-80 years. The mean age of the participants was 53±9.7 years. Highest percentage of the participants belonged to the age group of 51-60 years (39%), followed by 33.3% in 41-50 years group. Female participants were predominantly higher (54%), when compared with males (46%). As for the education status, 26% of the participants have studied up to high school, 19.7% had diploma and 23.7% were illiterate. About 71% of them were married and 27% were widowed. Majority belonged to Hindu religion [84.3%]. About 45% were unemployed, which could be attributed to the housewife status among the female participants. Majority of the study population belonged to Class I (41.3%) and class II (36.7%) socio-economic status. Current status of tobacco and alcohol consumption was found to be about 6.3% and 10% respectively.

Table 1: Socio-demographic characteristics of the study participants and depressed patients.

S.No	Characteristic	Depressed T2DM patients [n=119]		Not depressed T2DM patients [n=181]		Total study participants [N=300]	
		No.	%	No.	%	No.	%
1.	Age group (years)						
	31 - 40	9	7.6	13	7.2	22	7.3
	41 - 50	42	35.3	57	31.5	100	33.3
	51 - 60	46	38.7	72	39.8	117	39.0
	61 - 70	13	10.9	34	18.8	47	15.7
	71 - 80	9	7.6	5	2.8	14	4.7
2.	Gender						
	Male	46	38.7	92	50.8	138	46
	Female	73	61.3	89	49.2	162	54

	Education							
3.	Illiterate	31	26.1	40	22.1	71	23.7	
	Primary school	4	3.4	4	2.2	8	2.7	
	Intermediate	21	17.6	30	16.6	51	17.0	
	High school	33	27.7	45	24.9	78	26.0	
	Diploma	18	15.1	41	22.7	59	19.7	
	Graduate or Post graduate	12	10.1	21	11.6	33	11.0	
	Occupation							
	Unemployed	57	41.6	80	44.2	137	45.7	
	Unskilled	7	5.9	2	1.1	9	3	
4.	Semiskilled	17	14.3	19	10.5	36	12	
4.	Skilled	13	10.9	29	16.0	42	14	
	Clerical/Shopkeeper	16	13.4	37	20.4	53	17.7	
	Semi professional	7	5.9	11	6.1	18	6	
	Professional	2	1.7	3	1.7	5	1.7	
	Socio-economic status (BG Prasad scale)							
	Class – I	39	32.8	85	47.0	124	41.3	
5.	Class – II	52	43.7	58	32.0	110	36.7	
5.	Class – III	22	18.5	28	15.5	50	16.7	
	Class – IV	5	4.2	9	5.0	14	4.7	
	Class – V	1	0.8	1	0.6	2	0.7	
	Marital status							
	Married	80	67.2	133	73.5	213	213	
6.	Unmarried	3	2.5	2	1.1	5	5	
	Widower	36	30.3	45	24.9	81	81	
	Divorce	0	0	1	0.6	1	1	
	Religion							
7.	Hindu	96	80.7	157	86.7	253	84.3	
/•	Muslim	13	10.9	18	9.9	31	10.3	
	Christian	10	8.4	6	3.3	16	5.3	
	Consumption of tobacco							
8.	Yes	10	8.4	9	5.0	19	6.3	
	No	109	91.6	172	95.0	281	93.7	
	Consumption of alcohol							
9.	Yes No	12 107	10.1 89.9	18 163	9.9 90.1	30 270	10 90	

Socio-demographic characteristics of depressed patients.

From Table 1, depression was found to be more common among participants belonging to age group of 40–60 years. Depression was more among the females (61.3%) when compared with the males (38.7%). It was more among the illiterate (26.1%) and the unemployed (41.6%). Participants belonging to higher socio-economic class were found to be more depressed. The last part of the Public Health Questionnaire - 9, asks the participants how far the problems caused due to depression, affects their everyday life – both personal and social life, over the past 2 weeks (difficulty check). So among those who were depressed, 10.92% did not feel difficult at all, 48.73% felt somewhat difficult, 38.65% felt very difficult and 1.68% felt extremely difficult (Table 2).

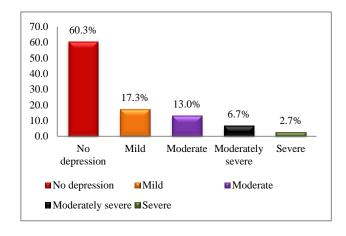


Figure 1: Distribution of depression severity (PHQ – 9) among the study participants.

Prevalence of depression

As per the scoring in PHQ-9, a person with a score of ≥ 5 is considered as having depression. So depression as per PHQ score of ≥ 5 was present in 39.7% of the participants. Among which 17.3% had mild depression

with PHQ score of 5 to 9, while 13% had moderate depression with a PHQ score of 11 to 14 and 6.7% had moderately severe depression with a PHQ score of 15 to 19 and 2.7% had severe depression with PHQ score ≥20 (Table 2). Figure 1 shows the distribution of depression severity (as per PHQ−9) among the study participants.

Table 2: Clinical characteristics of the study participants.

S. No	Clinical variables	No	%			
	Depression status					
	a). Depression scale (PHQ – 9) [N=300]					
	No depression	181	60.3			
	Mild depression	52	17.3			
	Moderate depression	39	13			
1	Moderately severe depression	20	6.7			
1	Severe depression	8	2.7			
	b). Difficulty check (PHQ-9) [n=119]					
	Not Difficult	26	10.92			
	Somewhat difficult	51	48.73			
	Very difficult	38	38.65			
	Extremely difficult	4	1.68			
	Diabetic status					
	a). Fasting blood sugar [N=300]					
	>125 mg/dl	93	31			
2	70-125 mg/dl	207	69			
	b). Diabetic complications [N=300]					
	Yes	63	21			
	No	237	79			

Clinical characteristics of study population

The study participants having Fasting Blood Sugar levels between 70-125 mg/dl were 69% and those having a FBS

of above 125 mg/dl were 31%. The participants who had at least any one of the diabetic complications (neuropathy, nephropathy, retinopathy and coronary artery diseases) was 21% (Table 2).

Table 3: Clinical characteristics of depressed and non-depressed patients.

		Depression (PHQ score >5)							
S.No	Clinical Characteristic	Present n=119	Absent n=181	OR, 95% CI	Chi-square	P value			
	Fasting blood sugar levels								
1.	>125 mg/dl	50 (42.0)	49 (27.1)	1.952	7.252	0.007*			
	70-125 mg/dl	69 (58.0)	132 (72.9)	(1.196 - 3.186)	7.253	0.007*			
	Hypertension								
2.	Yes	21 (17.6)	27 (14.9)	1.222	0.398	0.528			
	No	98 (82.4)	154 (85.1)	(0.655-2.291)					
	Diabetic complications								
3.	Yes	34 (28.6)	33 (18.2)	1.794	4.425	0.035*			
	No	85 (71.4)	148 (81.8)	(1.037 - 3.104)					
	Diabetic treatment								
4.	OHA	91 (76.5)	159 (87.8)	2.2238					
7.	Insulin & Both Insulin and OHA	28 (23.5)	22 (12.2)	(1.2023-4.1131)	6.69	0.015			

^{*}P value<0.05, statistically significant at 95% confidence interval.

Table 3 compares the clinical characteristics of depressed and non-depressed patients. FBS values of more than 125 mg/dl were higher among depressed patient's (42%),

when compared with non-depressed patients (27.1%). Significant association was found between FBS levels and presence of depression (p<0.05) Persons with

depression were twice more likely to have FBS levels above 125mg/dl (OR=1.952). Depressed diabetic patients had higher rate of complications (28.6%) and were more prone to get insulin treatment (23.5%) when compared with non-depressed diabetic patients (18.2%). Hypertension had a slightly higher prevalence among

depressed patients (17.6%) when compared with nondepressed patients (14.9). From Table 4, it can be seen that depression severity as defined by the PHQ-9 questionnaire and diabetic complications were found to be having a strong statistical association with FBS (p<0.01).

Table 4: Association of clinical variables with fasting blood sugar.

		Fasting blood sug	gar (mg/dl)		
S.No	Clinical Variable	>125 mg/dl 70–125 mg/dl [n=93] [n=207]		Chi– square	P value
	Depression scale (PHQ-9)				
	No depression	49	132		0.002*
	mild	14	38		
	moderate	20	19	17.168	
1.	moderately severe	11	9		
	Severe	5	3		
	Diabetic complications				
2.	Yes	53	10	105.228	0.000*
4.	No	40	197	103.220	0.000

^{*}P value<0.05, statistically significant at 95% confidence interval.

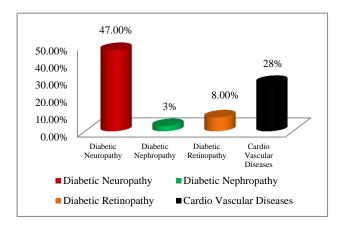


Figure 2: Diabetic complications among T2DM patients.

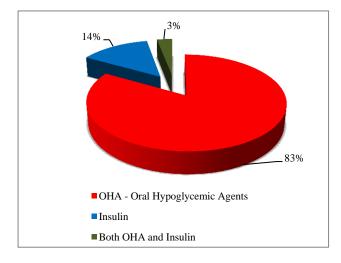


Figure 3: Type of medication taken by the T2DM patients.

Figure 2 shows the diabetic complications among the T2DM patients. Diabetic neuropathy was found to be most common diabetic complication (47%), followed by cardio vascular diseases (28%). Figure 3 shows the type of medication taken by the T2DM patients. 83% of them take only oral hypoglycemic drugs (OHA). 14% of them take Insulin and 3% of them take both Oral Hypoglycemic drugs and Insulin.

DISCUSSION

Though National and State programs are implemented to create awareness and screen Non Communicable Diseases like diabetes, screening for depression among diabetic patients is not carried out. T2DM patients are unaware of the fact that their mental health could play a role in the prognosis and outcome of their disease. The study carried out among T2DM patients attending the UHTC in Anakaputhur, shows that depression is highly prevalent among T2DM patients.

In this study, the prevalence of depression among T2DM patients was found to be 39.7%. These results were comparable to several other studies conducted elsewhere. In UK and USA the prevalence of depression among T2DM patients were found to be between 30 to 83%. ^{24,25} A study done by Thour et al in Chandigarh, found the prevalence to be 41%. 17 A study done in a tertiary care hospital in Southern India by Madhu et al found the prevalence to be 49%.²⁶ In both these studies, depression was associated with poor glycemic control.

This study shows that depression was more common among female diabetic patients. Similar findings were observed in study done by Sahota et al, where women were twice likely to have depression compared with

males.²⁷ Depression was found to be higher among unemployed and illiterate patients. It might have been due to insecurity and dependence on family members for their sustenance and survival.

In our study statistically significant association was found between fasting blood sugar levels and depression severity. Increasing FBS levels were observed in depressed individuals when compared with non-depressed individuals. This could have led to diabetic complications, which was again associated with increasing FBS levels. Similar findings were observed in a study done by Bajaj et al in Uttar Pradesh. About 43.5% of the study participants experienced somewhat difficulty in carrying out daily activities as per the PHQ-9 questionnaire. This could have led to poor compliance to medication which could have led to poor outcome of the disease. Similar findings were observed in study done by Habtewold et al in Ethiopia. 29

Diabetic complications were found to be strongly associated with increasing depression severity. Similar findings were observed in a study done by Joseph et al in Mangalore. Increasing Depression Severity was in turn associated with fasting blood sugar levels. So increasing depression severity among T2DM could lead to worse Fasting Blood Sugar levels, which could cause diabetic complications, which could increase the morbidity from the disease. Most commonly occurring diabetic complication reported was diabetic neuropathy. Similar finding was observed in study done by Thour et al in Chandigarh. 17

One limitation of this study was that the glycated hemoglobin levels (HbA1C) of the diabetic patients were not available, as most of the patients who reported to our Health Center did not have their glycated hemoglobin levels (HbA1C) checked.

CONCLUSION

The biological mechanism by which T2DM and depression are associated still remains unclear. However, our study has shown that depression is highly prevalent among T2DM patients (39.7%). Also, increasing depression severity is found to be associated with worsening glycemic control which was represented by the increasing fasting blood sugar levels. This was in turn associated with diabetic complications. So it can be concluded from this study that, when T2DM and Depression co-exist in an individual, he/she is more prone to develop worse glycemic control which could lead to diabetic complications and associated morbidity.

Through periodic and intense health education and awareness creation programs, all the healthcare professionals have to be made aware of the bidirectional relationship between Type 2 diabetes mellitus and depression. Persons having co-morbid depression and T2DM can be offered counseling, medication or a

psychiatrist referral so that, depression won't worsen the glycemic control. By doing so, diabetic complications can be reduced leading to a better prognosis of the disease.

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Ethical approval: The study was approved by the Institutional Ethics Committee, Sree Balaji Medical College and Hospital

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