International Journal of Advances in Medicine
Rajkumar A et al. Int J Adv Med. 2019 Feb;6(1):110-117
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20190115

Original Research Article

Prevalence and implications of depression in type-2 diabetes mellitus: a follow up study

Amirthalakshmi Rajkumar[1], Lokesh S.[2], Sivaprakash B.[3], Arun Kumar R.[4]*

[1]Senior Resident, [2]Professor and HOD, Department of General Medicine, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth University, Puducherry, India
[3]Professor and HOD, Department of Psychiatry, Mahatma Gandhi Medical College and research Institute, Sri Balaji Vidyapeeth University, Puducherry, India
[4]Assistant Professor, Department of General Medicine, Mahatma Gandhi Medical College and research Institute, Sri Balaji Vidyapeeth University, Puducherry, India

Received: 12 January 2019
Accepted: 19 January 2019

***Correspondence:**
Dr. Arun Kumar R.,
E-mail: arunkumarr@mgmcri.ac.in

ABSTRACT

Background: There are not many longitudinal or prospective studies to determine the association between Diabetes Mellitus (DM) and depression in Indian scenario. Present study was mainly intended to find out the prevalence of depression in diabetic individuals and its impact on diabetes. The aim of the present endeavour was to study the prevalence of depression in diabetic patients, its impact on the clinical course of diabetes and to study the association between clinical courses of depression and diabetes.
Methods: It is a prospective analytical study done in MGMCRI. All diabetic patients, aged 30years and above were taken up. Those who screened positive for depression were further assessed using PHQ9 questionnaire and were subjected to antidepression management. From the total number of diabetic patients screened, the prevalence of depression was calculated. Equal number of T2DM patients who screened negative for psychiatric disorders were taken as control. PHQ-9, FBS, PPBS, HbA1c were measured at baseline and repeated at 3rd month of follow-up.
Results: In our study the prevalence of depression among diabetic individuals was found to be 15%. The difference in improvement of HbA1c from baseline to follow up was statistically significant when compared between groups having mild, moderate and severe depression, with maximum fall of HbA1c in the group with severe depression. This implies the positive effect of treating depression on glycemic control.
Conclusions: This study shows that when diabetes and depression were addressed together it has a positive effect on the glycemic control and the depressive symptoms emphasizing the need for a collaborative management and need for screening diabetes patients for depression for a better care.

Keywords: Diabetes Mellitus, Depression, HbA1c, PHQ 9

INTRODUCTION

Diabetes Mellitus (DM) is characterized by hyperglycemia due to defects in insulin secretion, action or both. It can lead to long term tissue damage, dysfunction, failure of vital organs and blood vessels.

Depression among Type 2 Diabetes Mellitus (T2DM) patients is a scarcely researched topic in India. A study from southern India found a prevalence of 45.2 percent among individuals with DM, 30.9 percent of them having moderate depression while remaining 14.3 percent having severe depression. Majority of them were uninformed of their status. Furthermore, out of those who were aware,

only 11.5 percent had consulted a psychiatrist for treatment.[1]

Diabetes mellitus and depression are interlinked with one another where depression may contribute to the poor diabetes control and diabetes may also contribute to the poor management of depression.

The prevalence of depression was found to be high in both urban and rural India. In a cross-cultural study conducted by World Health Organization (WHO), the most common diagnosis in primary health care setting was depression. Several studies have shown the association between diabetes and depression. But the direction of the relationship is unclear. In addition to depression being a consequence of T2DM, it can be a risk factor, or a triggering factor, for the onset of T2DM. Thus, there can be a bidirectional relationship between DM and depression.

Diabetic individuals without any depressive symptoms at baseline were found to have higher chances of developing depressive symptoms during follow-up period, according to a recent study.[2] Few reviews and meta-analyses found that there is an increased risk of incident DM in people with depression and vice versa.[3]

Diabetic complications are known to have a negative impact on the quality of life and similarly depression. The co-occurrence of depressive symptoms and DM may even further decrease quality of life. Hence it should be stressed that awareness is needed regarding the importance of treatment of depressive symptoms within DM care. Studies have shown that depression can be well treated in individuals with DM. But only a small percentage of DM individuals are currently being recognized as being depressed in primary and secondary medical care settings.

The available data regarding depression in DM individuals in south India is limited. Hence, authors have taken up this study to find out the prevalence of depression in Diabetes Mellitus individuals attending a Tertiary hospital in Pondicherry and to study its impact on Diabetes Mellitus.

The aim of the present endeavor was to study the prevalence of depression in diabetic patients, its impact on the clinical course of diabetes and to study the association between clinical courses of depression and diabetes.

METHODS

It was a prospective analytical study done in diabetic patients aged more than 30 years at MGMCRI, tertiary care center in Pondicherry, from January 2016 to June 2017. Patients who were found to have psychiatric illness or substance abuse or on any psychiatric medications were used as exclusion criteria.it was a convenience sampling.

Project proposal was presented in institutional human ethics committee and the approval was granted in January 2016. Informed consent were obtained from the study participants and their legal guardians.

Sample size of 30 was calculated based on the prevalence of depression to be 18% among T2DM patients from a previously conducted study.

Data regarding socio-demographic factors, clinical details such as duration of illness, modality of treatment and presence of other comorbidities were collected by interviewing the patient.

Upon enrollment into the study, a semi structured data collection proforma was used to record the socio-demographic details. SCIP (Standard for clinicians' interview in psychiatry) a standard screening tool was used to screen the patients for any psychiatric disorders. Patients who had psychiatric disorders other than depression were excluded from the study and referred to psychiatry. Those patients who were screened positive for depression were subjected to self-administered questionnaire (patient Health Questionnaire) PHQ9 and depression was confirmed.

Their baseline FBS, PPBS, HbA1c were measured. HbA1c level was categorized as: a level less than 7.5%, 7.6-8.5 and more than 8.5%. They were enrolled in the study as cases.

They were sent to psychiatry for further management. They were given either counselling, pharmacotherapy or both depending upon the severity.

Diabetic patients were screened for depression till the study sample size of 30 was reached. From the total number of diabetic patients screened, the prevalence of depression was calculated.

Equal number of T2DM patients who were screened negative for psychiatric disorders and who consented for 3 months follow up were taken as control. Their baseline FBS, PPBS and HbA1c were measured. Both cases and controls were reviewed after three months and their FBS, PPBS and HbA1c were repeated. The cases were reviewed by psychiatry twice a month for counselling and their depressive symptoms were assessed after three months of intervention. Both the group`s glycemic control was compared in terms of their socio demographic profile, co morbidities, FBS, PPBS and HbA1c levels and statistically analyzed.

All data were entered into a data collection proforma sheet and were entered into Excel (MS Excel 2011).

Statistical analysis

Descriptive statistics was done for all data and were reported in terms of mean values and percentages. Suitable statistical tests of comparison were done. Continuous variables were analysed with unpaired t test, paired t test and ANOVA. Categorical variables were analysed with the Chi-Square Test and Fisher Exact Test. Statistical significance was taken as P <0.05. The data was analysed using SPSS version 16 and Microsoft Excel 2007.

RESULTS

On analyzing the age distribution of the study participants (Table 1) the mean age of participants with DM and depression was 53.77years, as compared to 53.20years among participants with DM without depression. The data was analysed with unpaired t test and this difference was found to be statistically not significant (p=0.8608). In both the study groups the number of female participants was more. It was 56.67% among the subjects DM with depression and 53.33% among the subjects DM without depression (Table 1). There was no statistically significant difference between the two groups with regards to gender distribution (p=0.7953). Among 30 subjects with DM and depression, 17 (56.6%) were females and 13 (43.4%) were males.

Table 1: Comparison of socio demographic profile.

	DM with depression	DM without depression	P value
Mean age in years	53.7	53.2	0.8608 (unpaired t test)
Gender			
Male	13	14	0.7953 (chi square test)
Female	17	16	
Education			
Literate	20	16	0.2927 (chi square test)
Illiterate	10	14	
Occupation			
Skilled	2	6	0.5589 (chi squared test)
Unskilled	28	24	
Income status/month			
<5000	18	23	0.1653 (chi square test)
>5000	12	7	
Domicile			
Urban	4	5	0.7182 (chi square test)
Rural	26	25	
Marital status			
Married	27	27	0.9999 (chi square test)
Single	1	0	
Widow	2	3	

It is evident (Table 1) that 33.33% of subjects with DM and depression were illiterate, while 46.67% of subjects with DM without depression were illiterate. The data was analysed with chi - squared test and this difference was found to be statistically not significant (p=0.2927). It is evident from the Table 1 that most of the subjects with DM and depression were less than 5000 income brackets (60%) and among subjects with DM without depression majority were less than 5000 income brackets (76.67%). The data was analysed with chi-squared test which revealed no statistically significant association between income status and study comparison groups (p =0.1653). Most of the subjects in the group DM with depression were from rural areas (86.67%). Similarly, majority of the subjects in the group DM without depression too were from rural areas (83.33%) (p= 0.7182) (Table 1) The data was analysed with chi - squared test which reveals no statistically significant difference between the two study groups in terms of domicile (p >0.05). It was observed that 90% of participants in both the groups were married (Table 1) There was no statistically significant difference in terms of marital status between the two study groups (p =0.9999).

Table 2: Comparison of clinical profile between two groups.

	DM with depression	DM without depression	P value
Comorbidities			
CKD	2	1	0.7869 (chi squared test)
TB	3	2	
Hypertension	9	5	
NIL	19	20	
Duration of DM			
Mean years	9.67	6.63	0.0473* (unpaired t test)
Treatment status			
OHA	26	23	0.3171 (chi squared test)
Insulin	1	5	
Both	3	2	

It is evident from the co-morbidities status (Table 2) that most of the subjects in the group DM with depression had hypertension as co-morbidity (16.67%). Similarly, in the group DM without depression too, majority had hypertension as co-morbidity (13.33%) (p= 0.7869). The data was analysed with chi-squared test which reveals no statistically significant difference in terms of co-morbidities between the two study groups (p>0.05) (Table 2). The subjects in the group DM with depression had diabetes for a mean duration of 9.67years compared with subjects in the group DM without depression with a mean duration of 6.63years. The data was analysed with unpaired t test which reveals the subjects in the group DM with depression had significantly longer duration of DM than the subjects without depression.

It is evident from the treatment status (Table 2) that most of the subjects in the group DM with depression were on oral hypoglycemic drugs (86.67%). Similarly subjects in the group DM without depression too majority were on oral hypoglycemic drugs (76.67%) (p= 0.3171). The data was analysed with chi-squared test which reveals no statistically significant difference in terms of treatment between the two study groups (p>0.05).

Table 3: Comparison of glycemic control between two groups.

Mean	DM with Depression	DM without Depression	P value (unpaired t test)
FBS (Baseline)	218.57	196.07	0.2576
FBS (Follow-up)	155.20	146.33	0.4425
P value (paired t test)	0.0001*	<0.001*	
PPBS (Baseline)	267.27	259.03	0.7285
PPBS (Follow-up)	202.97	198.43	0.7054
P value (paired t test)	0.0003*	0.0002*	
HBA1C (Baseline)	9.22	9.12	0.8060
HBAIC (Follow-up)	9.04	8.70	0.3940
P value (paired t test)	0.6288	0.0058*	

It is evident from the fasting blood sugar distribution (Table 3) that most of the subjects in the group DM with depression had mean FBS of 218.57mg/dl and 155.20mg/dl at baseline and 3 months follow up respectively (p=0.0001). Similarly subjects in the group DM without depression had mean FBS of 196.07 and 146.33 mg/dl at baseline and 3 months respectively (p=<0.0001). The data was analysed with paired t test which reveals statistically significant difference in FBS levels between baseline and 3 months follow up among the group DM with depression (p<0.05). The data was analysed with paired t test which reveals (Table 3) statistically significant difference in FBS levels between baseline and 3 months follow up among the group DM without depression (p<0.05)The data was analysed with unpaired t test which reveals that there is no statistically significant difference in FBS ,both at baseline and also at follow up between the two groups.

It is evident from the post prandial blood sugar distribution (Table 3) that most of the subjects in the group DM with depression had mean PPBS of 267.27 and 202.97mg/dl at baseline and 3 months follow up respectively. Similarly subjects in the group DM without depression had mean PPBS of 259.03and 198.40mg/dl at baseline and 3 months respectively. The data was analysed with paired t test which reveals statistically significant difference in PPBS levels between baseline and 3 months follow up in the group DM without depression (p<0.05). The data was analysed with paired t test which reveals statistically significant difference in PPBS levels between baseline and 3 months follow up in the group DM without depression (p<0.05). The data was analysed with unpaired t test which reveals that there is no statistically significant difference in PPBS, both at baseline and also at follow-up between the two groups.

It is evident from the Hba1c distribution (Table 3) that most of the subjects in the group DM with depression had mean Hba1c of 9.22 and 9.04 at baseline and 3 months follow up respectively. Similarly subjects in the group DM without depression had mean Hba1c of 9.12 and 8.70 at baseline and 3 months respectively.

The mean reduction of HbA1C levels from baseline (9.12) to 3months (8.70) follow up was significantly lower in DM without depression group (p=0.05). The data was analysed with paired t test which reveals statistically significant association of Hba1c levels between baseline and 3 months follow up among the group DM without depression (p<0.05). The data was analysed with paired t test which reveals no statistically significant improvement in Hba1c levels from baseline to 3 months follow up in the group DM with depression (p>0.05).

The data was analysed with unpaired t test which reveals no statistically significant difference in Hba1c levels between the two study groups in baseline (p>0.05) and in follow up (p>0.05).

Table 4: Prevalence of depression in the study population.

Prevalence of depression in study population	DM with depression	DM without depression	Total
Number	30	170	200
Percentage	15.00	85.00	100.00

Table 5: Severity of depression in the study population at baseline and follow up.

Severity of depression	Severity - baseline	%	Severity - follow up	%
Nil	0	0.00	14	46.67
Mild	12	40.00	14	46.67
Moderate	15	50.00	2	6.67
Severe	3	10.00	0	0.00
Total	30	100.00	30	100.00
P value (Chi squared test)			<0.0001*	

Among the 200 diabetic patients who were screened for depression, 30 were found to have depression (Table 4).

Thus, the prevalence of depression in our study was found to be 15%.

It is evident from the severity of depression status (Table 5) that most of the subjects in the group DM with depression had moderate depression (50%) at baseline and had mild or nil depression (46.67%) at 3months follow up. The data was analysed with chi-squared test which reveals statistically significant improvement in the severity of depression between baseline and follow up ($p<0.05$).

It shows that (Table 6) there is statistically significant association between domicile status with severity of depression. People with mild and moderate depression were from rural area where as those from urban area were found to have severe depression.

Table 6: Relationship between socio demographic factors and co morbidities with severity of depression.

Relationship between socio demographic factors and co morbidities with severity of depression	Mild depression (n=12)	Moderate depression (n=15)	Severe depression (n=3)	P value
Age	51.83±25.92	53.93±26.97	60.67±30.33	0.5224
Gender				
Male %	58.33	33.33	33.33	0.2085
Female %	41.67	66.67	66.67	
Socioeconomic status				
Upper	33.33	40.00	0.00	0.1406
Upper middle	8.33	6.67	0.00	
Middle/lower middle	25.00	13.33	33.33	
Middle/upper lower	25.00	40.00	0.00	
Lower	8.33	0.00	66.67	
Domicile status				
Rural	91.67	93.33	33.33	0.0133*
Urban	8.33	6.67	66.67	
Duration of diabetes	8.83±4.42	9.20±4.60	14.33±7.17	0.3707
Comorbidities				
Yes	16.67	40.00	100.00	0.0011*
No	83.33	60.00	0.00	

Table 7: Relationship between glycemic control and severity of depression.

Relationship between glycemic control and severity of depression	Mild depression (n=12)	Moderate depression (n=15)	Severe depression (n=3)	P value
FBS - baseline	151.00±75.50	257.80±128.90	292.67±146.33	0.0002*
FBS - follow up	140.33±70.17	160.13±80.07	190.00±95.00	0.2291
PPBS - baseline	184.58±92.29	318.53±159.27	341.67±170.83	<0.0001*
PPBS - follow up	184.67±92.33	218.87±109.43	196.67±98.33	0.1388
HbA1c - baseline	7.93±3.96	9.59±4.79	10.77±5.38	0.0016*
HbA1c - follow up	7.57±3.78	8.32±4.16	9.07±4.53	0.0110*

Table 8: Relationship between improvement in glycemic indices and severity of depression.

Relationship between improvement glycemic indices and severity of depression	Mild depression (n=12)	Moderate depression (n=15)	Severe depression (n=3)	P value (single ANOVA test)
FBS - difference	10.67±5.55	97.67±37.84	102.67±18.72	0.7582
PPBS - difference	0.09±0.09	99.66±34.72	145.00±25.79	0.7938
HbA1c - difference	0.36±0.03	1.27±1.18	1.70±0.79	0.0462*

It shows that (Table 6) there is statistically significant association between co morbidities and severity of depression. People with severe depression were found to have associated co morbidities more than the people with

mild and moderate depression. Subjects with severe depression were found to have poor glycemic control at baseline when compared with subjects having mild and moderate depression. The difference in baseline glycemic parameters were statistically significant when compared between groups based on severity of depression (Table 7). Similarly, difference in follow up HbA1c was found to be statistically significant between the groups having mild, moderate and severe depression, with subjects having severe depression with the highest HbA1c levels (Table 7).

Table 8 shows that there is no statistically significant association between improvement in FBS and PPBS from baseline to follow up and the severity of depression. But it shows a statistically significant difference in the improvement in HBA1C between the groups having mild, moderate and severe depression with subjects having severe depression having maximum improvement.

DISCUSSION

Socio demographic factors

In present study there was no significant difference in age between the two groups. Few Indian studies have shown that elderly people were more depressed than young diabetic individuals.[4] In present study it was also observed that 40% of participants with DM and depression were in the age group of 51-60 years.

In present study in both the study groups the number of female participants was more, and there was no statistically significant difference in the sex distribution. Many studies have shown a female a preponderance, but few studies have shown insignificant difference in gender.[4] In current study, education status did not have any impact on depression. In both the groups, majority were housewives and it was observed that 90% of participants in both the groups were married, which did not reveal any statistical significance. The findings were similar to a study done in Bahrain et al.[5]

Among the group with depression, people from urban domicile were found to have severe depression than people from rural. The diagnosis of T2DM and its poor understanding may lead to additional stress causing depression in people from rural area. In the same way people living in urban area are subjected to stress from their work place and cost of living which makes them also equally susceptible. The income status table shows that most of the subjects in the group DM with depression were in the less than 5000 income brackets (60%) and among subjects with DM without depression group majority were in the less than 5000 income brackets (76.67%). There was no statistically significant association between depression and income status which is similar to a study done in U.S.[6]

Majority of both the groups did not have any co morbidities. Among co morbidities available both the groups were more associated with hypertension when compared to other co morbid conditions. Among the group with depression, severe the depression, the more they were associated with co morbidities. In present study the duration of DM between the group DM with depression and group DM without depression was meaningfully significant. This is evident by the increased mean duration of DM in group DM with depression compared to group DM without depression. The same view was echoed in a study by Iype et al.[7]

It was also observed that 30% subjects in the group DM with depression having diabetes duration of 11-15years had significant depression as compared to 3.3% subjects with DM and without depression, implying that longer the duration of DM, greater is the chances of developing depression. There was no significant difference in treatment between the two study groups. Among the group with depression, majority were under treatment with OHAs. It was contradictory to a study done in Bangladesh were significant depression was found in insulin users where it was attributed to pain caused by using insulin injections.[8]

Prevalence of depression in study population

Among 200 diabetic patients who were screened, 30 were found to have depression. Thus, the prevalence of depression in our study was found to be 15%. Studies from India, both urban and rural, were recently summarized in a systematic review by Poongothai et al.[9] The prevalence of depression in T2DM patients in present study (15%) was nearly similar to a large population-based study done in Chennai.[10]

The prevalence of depression in Karnataka was reported to be high at 29.3%, while in a rural population of Maharashtra, it was 31.4%. Ali et al, reported a 27.05 percent prevalence of depression in type 2 diabetes patients.[11] Raval et al, reported a 41 percent prevalence of depression among type 2 diabetes patients in a tertiary care center.[12] Another study from southern India reported a prevalence of depression as 49 percent among the diabetes patients. The prevalence of depression in diabetics was found to be almost twice (35.38 percent) that in control subjects (20 percent) in a study by Siddiqui et al.[8]

PHQ9

In present study the baseline patient health questionnaire score distribution was similar to a study done in India.[1] The difference in scores between baseline and follow up in group DM without depression was meaningfully significant. This shows that there is significant improvement in depression after intervention.

Association of depression with diabetes

On comparing various socio demographic factors with the severity of depression, it was found that people from rural area have mild to moderate depression but people from urban have severe depression.

People with severe depression were found to be associated with comorbidities more when compared to people with mild to moderate depression.

On comparing the glycemic control with severity of depression, the FBS, PPBS and HBA1C were more at baseline in subjects having severe depression when compared with subjects having mild to moderate depression showing the negative impact of depression on diabetes.

The fall in HbA1c from baseline to follow up was statistically significant in the group having severe depression showing the positive effect of improvement in depression on glycemic control.

CONCLUSION

Based on the results and the methodology employed, we have concluded that:

The prevalence of depression in T2DM patients was 15% in current study. About 40% DM patients with depression were in the age group of 51-60 years. Diabetic patients with depression had longer duration of diabetes when compared with DM patients without depression implying longer the duration of DM, greater is the chances of developing depression. There was a statistically significant improvement in depression on intervention. Among the study participants of DM with depression group, those from urban domicile, comorbidities, higher baseline FBS, PPBS and HbA1c levels had severe depression when compared to those with mild and moderate depression implying negative impact of depression on diabetes. The difference in FBS, PPBS at baseline and at follow up between the two study groups were compared and it was found to be statistically insignificant. Though the level of HbA1c remained higher among those with severe depression during follow-up, it was also observed that the fall in the HbA1c level was significantly higher among those with severe depression as compared to those with mild and moderate depression implying that treating depression has a benefit over glycemic control. There is no statistical significance in association of socio-demographic profile with depression. This study highlights the importance of screening DM patients for depression. Intervention for depression can lead to better glycemic control.

ACKNOWLEDGEMENTS

Authors would like to acknowledge guide Dr. Lokesh S. (Professor and Head, Department of General Medicine), Co-guide Dr. Sivaprakash. B (Professor and Head, Department of Psychiarty) and Dr. Arun Kumar Ramachandrappa (Assistant Professor, Department of General Medicine) for their valuable suggestions, continued guidance, support and encouragement in doing this study. Author thanks the Chairman, Vice Chancellor, Dean and Dean Research of author Medical College and Hospital for their every help in making this study possible.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Rajkumar A, Lokesh S, Sivaprakash B, Kumar AR. Prevalence and implications of depression in type-2 diabetes mellitus: a follow up study. Int J Adv Med 2019;6:110-7.