Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 11, pp.42435-42442, November, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

A CLINICAL STUDY ON DEPRESSIVE DISORDER IN PATIENTS WITH TYPE 2 DIABETES MELLITUS IN NORTH-EASTERN INDIA

***,[1]Robin Victor, [1]Kamal Nath, [2]Giridhari Kar and [3]Subrata Naskar**

[1]Department of Psychiatry, Silchar Medical College and Hospital, India
[2]Department of Medicine, Silchar Medical College and Hospital, India
[3]Department of Psychiatry, Institute of Neurosciences, Kolkata

ARTICLE INFO

Article History:
Received 10th August, 2016
Received in revised form
25th September, 2016
Accepted 24th October, 2016
Published online 30th November, 2016

Key words:

Diabetes mellitus,
Depressive disorder,
HbA1C,
Glycaemic control.

ABSTRACT

Background: Diabetes mellitus (DM) has acquired an epidemic form and requires immediate attention. Depression is found to be common among patients with diabetes and it is associated with poor outcomes in disease control. However, the data on this important relationship are limited from North–Eastern India.

Aims: To study the prevalence and severity of depression in diabetes and to identify its correlation with sociodemographic variables, glycaemic control and other factors.

Settings and Design: A cross-sectional case study in which consecutive 150 diagnosed cases of type 2 DM cases were selected and interviewed to find if they fulfilled the ICD-10 criteria for depressive disorder. Severity of depression was assessed using Hamilton Depressive Rating Scale 17(items).Glycaemic control among the cases was assessed by measuring HbA1c level.

Results: The mean age of the study group was 50.19 ± 7.29 years with 52.66% males while 47.33% females. Prevalence of depressive disorder among the cases was 34.66%. Majority of the cases had mild depression (38.46%) followed by moderate depression (32.69%). Prevalence and severity of depression was higher in cases with age >50 years of age (49.39%), female sex (38.08%), rural background (46.15%), unmarried/separated subjects (91.66%), joint family structure (40%), lower education (45.09%), unemployment/unskilled/retired/housewife occupants (45.12%), and lower/lower middle socioeconomic status (48.48%). Depression was also associated with the duration of diabetes mellitus and the glycaemic control Majority of these findings were statistically significant ($p<0.05$).

Conclusions: Early identification of the type 2 diabetic cases who are more vulnerable to develop depressive disorder is extremely important for management and prognosis of both these chronic disorders.

Citation: Robin Victor, Kamal Nath, GiridhariKar and SubrataNaskar, 2016. "A clinical study on depressive disorder in patients with type 2 diabetes mellitus in North-Eastern India", *International Journal of Current Research*, 8, (11), 42435-42442.

INTRODUCTION

Diabetes mellitus (DM) is a rapidly growing public health problem. It has acquired an epidemic form and requires immediate attention. King *et al.* in 1998 had estimated that 300 million people worldwide will be affected by diabetes mellitus by the year 2025 but according to the recent WHO report the number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014 while the global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014. (World Health Organization 2016) As far as India is concerned presently around 62 million people are affected by diabetes mellitus and it ranks second to China which harbours 92.3 million diabetics. It has been estimated that by the year 2025 the countries with maximum number of people affected with diabetes will be India, China and United States. (King *et al*., 1998) Out of the estimated 1.4 billion population of India by the year 2030 over 100 million people will be suffering from diabetes mellitus which is an alarming figure. (Dixit and Pokala, 2016) Diabetes being a chronic illness has both short term and long term complications. It is a disease that requires adherence to a strict lifestyle and burdensome health care which causes both physical and psychological distress to the patient. The patient goes through a series of emotional setbacks ranging from anger, disgust, guilt, frustration and loneliness to developing psychiatric disorder like dysthymia, anxiety and depression (Jacobson *et al*., 1990). When it comes to association between diabetes and depression a bidirectional relationship is seen. It is well documented that prevalence of depression is higher in patients having Diabetes mellitus. A meta-analysis done by Anderson *et al.* (2001) found 42 studies from all around the

****Corresponding author: Robin Victor,***
Department of Psychiatry, Silchar Medical College and Hospital, India.

world showing higher prevalence of depression in people suffering from diabetes mellitus. While some prospective studies have shown that individuals with depression are twice more likely to develop type 2 diabetes mellitus than those who are non-depressed. (Eaton *et al*., 1996; Kawakami *et al*., 1999) Diabetes causes health related complications and puts a person through emotional, behavioural, cognitive and financial stress all of which lead to depression. Chronic stress associated with depression acts as an etiological factor and leads to poor lifestyle decisions such unhealthy eating, less exercise, smoking and also increases the level of cortisol, glucocorticoids and catecholamine in blood which leads to obesity, metabolic syndrome and insulin resistance all increasing the risk for diabetes. (Das *et al*., 2013) Tabák *et al.* (2014) and Musselman *et al.* (2003) in their researches have shown this bi-directional relationship among both the chronic disease. Hence comorbid diabetes with depression worsens the course of both these disorders leading to increased socio-economic stress, poor quality of life and higher mortality and morbidity among the patient. Diabetics having co-morbid depression have glucose deregulation and increased HbA1c level due to inability of the patient to adhere to strict treatment schedule and maintain self-care (McKellar *et al*., 2004). Also there is evidence that treatment of depression in early stages improves glycaemic control. A meta analytic study by Lustman *et al.* (2000) shows the relationship between depression and poor glycaemic control. Looking into the prevalence of depressive disorder in people having diabetes a wide variation is seen across the globe which is complicated by socio-demographic factors, such as gender ratio, education, race, ethnicity, social support, family type, socioeconomic status, and access to health needs.

In India a limited number of studies are there regarding this topic more so in the North-Eastern part, hence we have planned this study to find out the prevalence and severity of depressive disorder among the type 2 diabetes mellitus cases, evaluate the association between the socio-demographic variables and presence of depressive disorder along with its severity in DM and to compare the duration of diabetes and the level of glycosylated haemoglobin (HbA1c) and in patients with or without depressive disorder suffering from DM.

MATERIAL AND METHODS

This study was conducted in Silchar Medical College and Hospital, Assam which is a tertiary care hospital after taking proper approval of the institutional ethics committee. Main catchment area of this hospital is the whole Barak Valley of southern Assam, India, which comprises of the districts of Cachar, Karimganj & Hailakandi and along with the neighbouring states like Manipur, Mizoram and Tripura. Case was defined as "Any patient having type 2 Diabetes Mellitus aged 18 years or above attending the inpatient or outpatient Department of Medicine or Psychiatry, Silchar Medical College diagnosed as diabetic by faculty of Department of Medicine, Silchar Medical College and Hospital, Silchar based on venous blood sugar levels (FBS, PPBS or HbA1c) according to criteria adapted from American Diabetic Association 2014, 6 months prior to the interview." At first written informed consent from all patients/guardians was taken after explaining them the purpose and procedure of the study. Then all the cases who were selected consecutively for study were interviewed in detail using the below mentioned tool without any set limit. Interview pattern was flexible to elicit maximum data. For all cases privacy of interview and confidentiality was strictly maintained.

Inclusion criteria

- Cases from both the sex were included.
- Patients above 18 years of age having the diagnosis of type 2 Diabetes Mellitus based on venous blood sugar levels (FBS, PPBS or HbA1c) according to criteria adapted from American Diabetic Association 2014[13], 6 months prior to the interview were included.
- Patients and guardians who had given written consent to participate in the study were included in the study.

Exclusion criteria

- Patients under 18 years of age, with gestational diabetes mellitus, abusing any kind of substance, taking any drugs (except for the drugs used for the management of diabetes), suffering from severe debilitating or other comorbid chronic diseases (e.g. Hypertension, hypothyroidism etc.) and co-morbid severe anaemia were not included. Absence of these comorbid chronic medical conditions was confirmed by the faculty of Department of Medicine, Silchar Medical College and Hospital after relevant clinical examination and investigations.
- Patients or guardians not giving consent to participate in study were excluded from the study.
- Patients having past diagnosis of Depressive disorder or bipolar affective disorder were excluded.
- If the information provided by patients was not adequate or reliable they were excluded from the study.

Study design

This was a hospital based cross-sectional, single interview study which was approved by the institutional ethics committee in which 150 cases were selected consecutively who were diagnosed cases of type 2 Diabetes Mellitus and were interviewed to find if they fulfilled the International Classification of Disease and Related Health problems (ICD-10) (Organization, 1992) criteria for depressive disorder. The Psychiatric evaluation of the subjects was done by all the authors taking the interview combined. All the subjects were assessed for severity of depression using Hamilton Depressive Rating Scale 17(items) (Hamilton, 1960) independent of the ICD-10 diagnosis. Glycaemic control among the cases was assessed by measuring HbA1c level.

Tools

1.Socio-demographic proforma

- A standard proforma describing socio-demographic variables was used which was designed and standardized and tested in the Department of Psychiatry, SMCH.
- The socio-demographic proforma gave information about age, gender, religion, marital status, family type and domicile, education of patient, occupation and socioeconomic status.

2.Depressive disorder was diagnosed using International Classification of Disease (ICD-10) classification of mental and behavioural disorders(ICD-10 criteria)[14]

3.Severity of the depressive disorder was assessed by Hamilton Depressive Rating Scale 17 (items) (Hamilton, 1960)

Analysis of data

Appropriate data was collected, tabulated and Statistical analysis was done by GraphPad prism (http://www. graphpad.com) for windows version 6.01 and Statistical Package for the Social Sciences (SPSS v22) (SPSS Inc., Chicago, USA). Descriptive statistics were used to summarize the data. Fischer exact test and t-test was applied to find out p-value and statistical significance wherever necessary. Significance was determined at $P<0.05$.

RESULTS

In this hospital based single interview cross-sectional study Table 1 shows the socio-demographic variables of the cases. We found that most of the cases were from the age group of 50-59 years (42%) followed by 40-49 years (40%). The mean age of the study group was 50.19 ± 7.29 years. Out of 150 cases, 52.66% (n=79) were males while 47.33% (n=71) were females. Majority of the cases were of Hindu religion (53.33%) and from rural background (60.66%). We found that most of the cases were married (92%). In family type most of the cases had a joint family (53.33%) followed by nuclear family (46.66%).

Table 1. Socio-demographic variables of the study subjects

Variables	Total(n=150)	Percentage
Age-range		
30-39	7	4.6%
40-49	60	40%
50-59	63	42%
60-69	19	12.7%
70-80	1	10.6%
Gender		
Male	79	52.66%
Female	71	47.33%
Religion		
Hindu	80	53.33%
Muslim	65	43.33%
Others	5	3.33%
Domicile		
Rural	91	60.66%
Urban	59	39.33%
Marital status		
Married	138	92%
Unmarried	1	0.6%
Widow/widower	11	7.3%
Family structure		
Joint	80	53.33%
Nuclear	70	46.66%
Education		
Illiterate	30	20%
Primary	72	48%
Secondary	39	26%
Graduate	9	6%
Occupation		
Unemployed/ unskilled/ retired	14	9.33%
Housewife	68	45.33%
Skilled	21	14%
Business	19	12.66%
Service	25	16.66%
Professional	3	2%
Socio-economic status		
Lower	43	28.66%
Lower middle	56	37.33%
Middle	40	26.66%
Upper middle	7	4.6%
Upper	4	2.6%

Looking into the education majority had primary education (48%) followed by secondary education (26%) and 20% were illiterate. Most of the cases were housewives (45.33%) and least number of cases were from professional group (2%). Socio-economic status wise most of the cases were from lower middle class (37.33%) followed by lower class (28.66%).

Among the total sample of 150 patients, 52 cases (i.e. 34.66%) fulfilled the ICD-10 diagnostic criteria of depressive disorder as shown in Table 2.

Table 2. Distribution of depressive disorder among the cases

Presence of depression	Absence of depression	Total number of cases
52	98	150
34.66%	65.33%	100%

The comparison and statistical association of the socio-demographic variables of the cases with or without depressive disorder is shown in table 3. We found that cases ≥ 50 years of age had higher depression (49.39%) as compared to those < 50 years of age (16.41%) which was highly statistically significant ($p<0.0001$). Mean age of the cases having depressive disorder was 54.94 ± 7.21 years while that of non-depressed group was 47.67 ± 5.99 years. Females had a higher prevalence of depression (38.03%) as compared to their male counterparts (31.64%). Depression was higher in the subjects who were hailing from rural background (46.15%) as compared to those from urban background (16.94%) and this was statistically significant ($p=0.0002$). We found that the unmarried/ widow/ widower group of cases (91.66%) had higher prevalence of depression as compared to the married cases (29.71%) which was highly significant ($p<0.0001$) while subjects from joint family (40%) had higher depression as compared to the those from nuclear family (28.57%). Illiterate/ primary educated group (45.09%) had higher depression in contrast to secondary educated/ graduate group (12.5%) which was statically significant ($p<0.0001$). In occupation we found that unemployed/ retired/ housewife/ unskilled group (45.12%) had higher depression as compared to the skilled/service/ business/ professional group (22.05%) which was statistically significant ($p= 0.003$) while cases belonging to lower/ lower middle socioeconomic status (48.48%) had a higher prevalence of depression as compared to the those from middle/ upper middle and upper class (7.8%) which was highly statistically significant ($p<0.0001$).

The distribution of the HAM-D score among the cases having depressive disorder is shown in table 4. Out of the 52 cases fulfilling the ICD-10 criteria for depressive disorder we found that 38.46% of the cases had mild depression (n=20) followed by 32.69% having moderate depression (n=17), 15.38 % having severe depression (n=8) and 13.46 % having profound depression (n=7). Also the mean HAM-D score of the cases having depressive disorder was 14.56 ± 5.10 while that of non-depressed group was 5.60 ± 0.96. The comparison and statistical association of the distribution of the socio-demographic variables of cases having depressive disorder according to severity based on HAM-D score is shown in Table 5. For the application of statistics severe and profound depression were combined in a single category due to few number of cases in each.

Table 3. Comparision of sociodemographic variales in study subjects with or without depression

Variables	Depression present (n=52)	Depression absent (n=98)	Total (n=100)	P-value	Or	95% confidence interval	P value significance
Age range							
<50 years	11 (16.41%)	56 (83.58%)	67	<0.0001	0.201	0.09254 to 0.4375	Significant
≥50 years	41 (49.39%)	42 (50.60%)	83				
Gender							
Male	25 (31.64%)	54 (68.35%)	79	0.492	0.75	0.3844 to 1.481	Not significant
Female	27 (38.03%)	44 (61.97%)	71				
Domicile							
Rural	42(46.15%)	49(53.84%)	91	0.0002	4.2	1.896 to 9.305	Significant
Urban	10 (16.94%)	49 (83.05%)	59				
Marital status							
Married	41 (29.71%)	97 (70.28%)	138	<0.0001	0.038	0.004801 to 0.3076	Significant
Others	11 (91.66%)	1 (8.33%)	12				
Family type							
Joint	32 (40%)	48 (60%)	80	0.170	1.667	0.8402 to 3.306	Not significant
Nuclear	20 (28.57%)	50 (71.42%)	70				
Education							
Illiterate/primary	46 (45.09%)	56 (54.90%)	102	<0.0001	5.75	2.245 to 14.72	Significant
Secondary/ graduate	6 (12.5%)	42 (87.5%)	48				
Occupation							
Unemployed/ retired/ housewife/ unskilled	37 (45.12%)	45 (54.87%)	82	0.003	2.9	1.414 to 5.967	Significant
Skilled/service/ business/ professional	15 (22.05%)	53 (77.94%)	68				
Socio-economic status							
Lower/lower middle	48 (48.48%)	51 (51.51%)	99	<0.0001	11.06	3.701 to 33.04	Significant
Middle/upper middle/upper	4 (7.8%)	47(92.15%)	51				

Table 4. Severity of depression according to ham-d score

Severity	Depressed individuals	Percentage
Mild (8-13)	20	38.46%
Moderate (14-18)	17	32.69%
Severe (19-22)	8	15.38%
Profound (>23)	7	13.46%
Grand total	52	100%

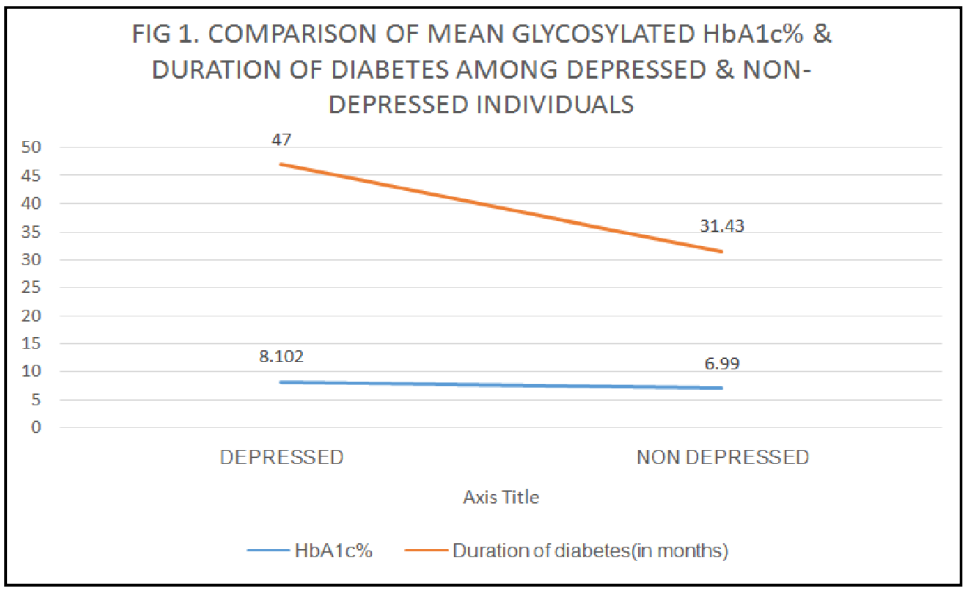
*HAM-D SCORE Source- Hamilton M: A rating scale for depression. Journal of Neurology Neurosurgery and Psychiatry 23:56–62, 1960.

Table 5. Association between the socio-demographic variables according to severity of depression

Variables	Mild (n=20)	Moderate (n=17)	Severe/ profound (n=15)	χ^2,df	P value	P-value significance
Age						
<50	6 (30%)	1(5.88%)	4(26.66%)	3.59, 2	0.166	Not significant
≥ 50	14(70%)	16(94.11%)	11(73.33%)			
Gender						
Male	11(55%)	8(47.05%)	6(40%)	0.783, 2	0.676	Not significant
Female	9(45%)	9(52.94%)	9 (60%)			
Domicile						
Rural	13(65%)	16(94.11%)	13(86.66%)	5.488, 2	0.064	Not significant
Urban	7 (35%)	1(5.88%)	2(13.33%)			
Marital status						
Married	19(95%)	15(88.23%)	7(46.66%)	13.34, 2	0.001	Significant
Others	1(5%)	2(11.76%)	8(53.33%)			
Family structure						
Joint	11 (55%)	10(58.82%)	11(73.33%)	1.29, 2	0.523	Not significant
Nuclear	9(45%)	7(41.17%)	4(26.67%)			
Education						
Upto primary	17(85%)	15(88.23%)	14(93.33%)	0.5844, 2	0.746	Not significant
Above primary	3(15%)	2(11.76%)	1(6.66%)			
Occupation						
Unemloyed/housewife unskilled /retired/	11(55%)	13(76.47%)	13(86.66%)	4.536, 2	0.103	Not significant
Skilled/ service/business/ professional	9(45%)	4(23.52%)	2(13.33%)			
Socio-economic status						
Lower/lower middle	17(85%)	16(94.11%)	15(100%)	2.347, 2	0.309	Not significant
Middle/ upper middle/	3(15%)	1(5.88%)	0			

Table 6. Comparison of mean glycosylated hba1c% & duration of diabetes among depressed & non-depressed individuals

Variables	Depressed	Non depressed	P-value	T	P-value significance
Hba1c%	8.102± 0.488	6.99± 0.295	<0.0001	17.21	Significant
Duration of diabetes (in months)	47 ± 23.11	31.43 ± 11.72	<0.0001	5.483	Significant



While comparing we found that most of the cases with mild (70%), moderate (94.11%) and severe/profound depression (73.33%) were from the age group of ≥ 50 years. However, this was not statistically significant (p = 0.166). We found that mild depression was more in the male group (55%) while moderate (52.94%) and severe/profound depression (60%) was more in the female group. Most of the subjects having mild (65%), moderate (94.11%) and severe/profound depression (86.66%) were found to be hailing from rural background however this was not statistically significant (p=0.064). We observed that most of the cases with mild (95%) and moderate depression (88.23%) were married while severe/profound depression was higher among the unmarried/ widow/widower group (53.33%). All these findings were statistically significant (p = 0.001). Looking into the family type we found that most of the subjects having mild (55%), moderate (55.82%), severe/profound depression (73.33%) belonged to joint family; no statistical significance was found (p=0.523). We also found that mild (85%), moderate (88.23%), severe/profound depression (93.33%) was more in the cases who were illiterate / primary educated however no statistical significance was present (p = 0.746). Occupation wise all three categories i.e. Mild (55%), moderate (76.47%), severe/profound depression (86.66%) were higher in the unemployed/housewife/retired/unskilled labour group. We did not find any significant statistical significance between the occupation of the cases and severity of the depression (p=0.103). Majority of the cases with mild (85%), moderate (94.11%) and all the cases of severe/profound depression (100%) were from lower/lower middle socioeconomic class. However, these findings were not statistically significant (p= 0.309).

On comparing the mean glycosylated HbA1c% & duration of diabetes (in months) among depressed & non-depressed individuals as shown in Table 7 and Fig 1 we found that the mean of glycosylated haemoglobin (HbA1c %) level among the subjects with depressive disorder to be 8.102 ± 0.48 which was higher than those without depressive disorder (6.99 ± 0.295). Similarly the mean duration of Diabetes Mellitus in the subjects with depressive disorder was 47 ± 23.11 months and those without depressive disorder was 31.43 ± 11.72 months respectively. Unpaired t-test was applied and the difference between groups was highly statistically significant (p <0.0001) in both the comparisions.

DISCUSSION

In this hospital based cross sectional study we took 150 cases of type 2 diabetes mellitus and evaluated them to find the prevalence of depressive disorder. We found 34.66% of the cases to be suffering from depressive disorder which is higher than in normal population (10-20%) (Editor *et al*., 2000). Worldwide there is a variation in the prevalence of depressive disorder depending upon the various sociocultural and ethnical factors. Also there is variation in the prevalence among the community and hospital based study, higher depression being reported from the hospital based studies. A population based meta-analysis done by Gavard *et al.* (1993) which included 20 studies from all over the world found the prevalence of depression among the diabetic samples to be ranging between 8.5- 27.3% while Anderson *et al*. (2001) in their meta-analysis which included 42 studies found the prevalence of depression between 8-61% among the subjects suffering from diabetes mellitus. Habtewold *et al.* (2015) from Ethiopia in tertiary care centre based study found 13% of the diabetics to be suffering from depression which is much lower than our finding. Pouwer *et al*. (2010) from Netherlands found depression to be ranging from 37-43% while Sotiropoulos *et al*. (2008) in study on Greek population found prevalence of depression to be 33.4% among the NIDDM patients, both of which were outpatient-based studies having results similar to our findings. Das *et al.* (2013) from Eastern India in their hospital based study found 46.5% of type 2 DM cases to have co morbid depression while Raval *et al.* (2010) and Thour *et al.* (2013) from Northern India, in their hospital based study found 40.66% and 41% of the patients with type 2 DM to be suffering from depressive disorder respectively. These studies reported a slightly higher prevalence of depression compared to our results. Now regarding the severity of depressive disorder among our cases, out of the 52 cases suffering from depressive disorder we found 38.46 % to be suffering from mild depression, 32.69% had moderate depression, 15.38% had severe while 13.46% had profound depression based on the HAM-D score. Our findings were almost similar to a study by Das *et al.* (2013) from Eastern India who found majority of the cases having moderate depression (36.7%) followed by mild depression (32.2%). On comparing the presence and severity of depressive disorder with socio-demographic factors we found that cases having age ≥ 50 years (49.39%) had a higher prevalence of depression as compared to those having age <50 years

(16.41%) which was statistically significant. All categories i.e. mild (70%), moderate (94.11%), severe/profound depression (73.33%) were higher in the age group ≥ 50 years. A study from Chandigarh, India by Raval *et al.* (2010) found higher likelihood of depression in diabetics having age ≥ 54 years of age which was statistically significant ($p < 0.05$). Across the gender depressive disorder was higher in the females (38.03%) as compared to the males (31.64%) and while looking into the severity, mild depression was higher in males (55%) while moderate (52.94%) and severe/profound (60%) depression was higher in females. Lopez-de-Andrés *et al.* (2015) from Spain and Ali *et al*. (2006) in their studies found similar higher prevalence of depression among the female diabetics. Chaudhry *et al.* (2016) reported that males showed a higher percentage in the mild depression category (27.27%), while moderate to severe depression was found to be more prevalent in females (71.43%) based on HDRS scores which is similar to our results. This may be attributed to the variation in the socio-cultural, physical, psychological and financial factors which vary across the male and female gender. We found that the unmarried/widow/widower (91.66%) had a higher prevalence of depression compared to the married cases (29.71%) and while mild and moderate form of depression peaked in the married group, severe/profound form was more among the unmarried/widow/widower group.

All the findings were statistically significant ($p<0.05$). Murrell *et al*. (1983) and Akhtar-Danesh *et al*. (2007) reported a similair higher prevelance of depression among the umarried, divorced and the seperated group. Cases from rural background (46.15%) had a higher prevelance of depression as compared to the urban population (16.94%) which was statistically significant (0.064) and all three categories i.e. mild, moderate and severe/profound depression were higher in the cases having rural domicile. Our results corraborated with studies done by Thour *et al.* (2013) and Sinha *et al*. (2013) from India and Gao *et al*. (2009) from China. This can be attributed to the fact that the people from the rural areas do not adequate resources to get appropriate health care and necessary management for chronic disease such as diabetes or depression which adds to their stress. Subjects from joint family (40%) had higher prevalence of depression and all three types ie. Mild (55%), moderate (58.82%) and severe/profound (73.33%) were higher in the cases from joint family. The reason behind this could be that most of these families were from rural areas with only one or two members earning just enough to fulfil the basic needs thus having poor quality of life and if any adult member is suffering from a chronic physical/psychological illness in the family, it acts as an added burden. Illiterate/ primary educated group (45.09%) had higher depression in contrast to secondary educated/ graduate group (12.5%) which was statically significant ($p<0.0001$). We also found that all three types of depression were higher in the illiterate/ primary educated group. Peyrot *et al*. (1997) and Katon *et al*. (2008) found higher prevalence of depression in the less educated group which is similar to our result. In occupation we found that unemployed/ retired/ housewife/ unskilled group (45.12%) had higher depression as compared to the skilled/service/ business/ professional group (22.05%) which was statistically significant ($p= 0.003$) also all three categories of depression were higher in this group. We found that cases belonging to lower/ lower middle socioeconomic status (48.48%) had a higher prevalence of depression as compared to those from middle/ upper middle and upper class (7.8%) which was highly statistically significant (<0.0001). We also observed that most of the cases having mild (85%) and moderate (94.11%) depression and almost all the cases having severe / profound depression (100%) belonged to the lower/ lower middle socio-economic status. We observed this association independent of the duration of DM. However a clearer picture would have emerged if we would have taken the association between the duration of DM and socio-economic status. Akhtar-Danesh *et al*. (2007) from Canada, Katon *et al*. (2008) and Patel *et al*. (2003) from India found a similar higher prevalence of depression among the people from lower strata of the society. The marginalized section of the society is exposed to physical, psychological and financial burden and if any member from this section exposed to chronic illness such as diabetes with co-morbid depression it leads to more complication and increases the cost of treatment which most of them are not able to afford and it further adds to the distress.

Higher mean duration of Diabetes Mellitus was found in the depressed group (47 ± 23.11 months) compared to the non-depressed group (31.43 ± 11.72 months) the difference being highly statistically significant ($p <0.0001$). Duration of diabetes mellitus is an indicator of chronic stress and is a risk factor for medical and psychological disturbance (Peyrot and Rubin, 1997). A study by Das *et al*. (2013) found similair increased mean duration of diabetes among the cases having co-morbid depression (44.83 ±42.65 months) as compared to the individuals who did not suffer from depression (35.40±35.69 months). We also found that mean HbA1c % level among the depressed group was higher (8.102 ± 0.48) compared to the non-depressed group (6.99 ± 0.295). The difference between groups was highly statistically significant ($p < 0.0001$). Several studies have shown the relationship between the poor glycaemic control and depression (Van Tilburg *et al*., 2001; Das *et al*., 2013; Wagner *et al*., 2009). Glycaemic control is one of the predictors of the metabolic risk and appropriate self-care behaviour that affects the short and long term complications in diabetes mellitus. Presence of depression leads to poor self-care, unhealthy behaviours and lack of strict adherence to medication regimen all of which worsen the diabetes (Gonzalez *et al*., 2008). There is also evidence that early management of depression leads to proper glycaemic control thus improving the prognosis of DM (Lustman *et al*., 2000). Thus, age >50 years of age, female sex, rural background, unmarried/separated subjects, joint family structure, lower education, unemployment/unskilled/retired/ housewife occupants, and lower/lower middle socioeconomic status were more likely to be associated with presence and increased severity of depressive disorder in the people suffering from DM and most of these findings were statistically significant. Presence of depression also had association with the duration of diabetes mellitus and the glycaemic control which was also statistically significant.

Conclusion

From our study we observed that co-morbid depression in type 2 DM is high and is predominantly found in the marginalized and discriminated sections of the society who are exposed to various psychosocial stressors. Duration and severity of diabetes is highly correlated with the comorbid depressive disorder. Our findings were almost similar to most of the national and international studies done on this topic. However, this study has few limitations. As this tertiary care medical centre based study, it may not reflect actual prevalence and severity of depressive disorder in type 2 diabetic patients in

general population as well as pattern of socio-demographic variables prevalent in the community. The number of study subjects taken were less and no control group was taken. Hence, more number of prospective studies involving larger number of cases followed up for longer duration need to be conducted for detailed evaluation of association between depressive disorder and DM.

REFERENCES

Akhtar-Danesh N, Landeen J. 2007. Relation between depression and sociodemographic factors. *Int J Ment Health Syst*., 1(1):4.

Ali S, Stone MA, Peters JL, Davies MJ, Khunti K. 2006. The prevalence of co-morbid depression in adults with Type 2 diabetes: a systematic review and meta-analysis. *Diabet Med*., Nov;23(11):1165–73.

American Diabetes Association, Executive summary: Standards of medical care in diabetes--2014. Diabetes Care. 2014;37 Suppl 1(January):5–13.

Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. 2001. The Prevalence of Comorbid Depression. *Diabetes Care*, 24(6):1069–78.

Chaudhry R, Mishra P, Mishra J, Parminder S, Mishra B. 2010. Psychiatric morbidity among diabetic patients: A hospital-based study. *Ind Psychiatry J (Internet)*. Medknow Publications, (cited 2016 Jun 9);19(1):47. Available from: http://www.industrialpsychiatry.org/text.asp?2010/19/1/47/77637

Das R, Singh O, Thakurta RG, Khandakar MR, Ali SN, Mallick AK, *et al*. 2013. Prevalence of Depression in Patients with Type II Diabetes Mellitus and its Impact on Quality of Life. *Indian J Psychol Med*., Jul;35(3):284–9.

Dejenie Habtewold T, Radie YT, Sharew NT. 2015. Prevalence of Depression among Type 2 Diabetic Outpatients in Black Lion General Specialized Hospital, Addis Ababa, Ethiopia. *Depress Res Treat*., 184902.

Dixit R, Pokala N. 2016. Opinion of doctors about unmet needs of rural diabetics. *Int J Basic Clin Pharmacol*., (Internet). (cited 2016 Jun 8);116–20. Available from: http://www.ijbcp.com/?mno=205764

Eaton WW, Armenian H, Gallo J, Pratt L, Ford DE. 1996. Depression and Risk for Onset of Type II Diabetes: A prospective population-based study. *Diabetes Care*, Oct;19(10):1097–102.

Editor JS, Editor V A S. Kaplan & Sadock ' S, 2000. Comprehensive Textbook of Psychiatry. *Psychiatry Interpers Biol Process (Internet)*., II:4884. Available from: http://www.amazon.co.uk/Sadocks-Comprehensive-Textbook-Psychiatry-Saddocks/dp/0781768993

Gao S, Jin Y, Unverzagt FW, Liang C, Hall KS, Ma F, *et al*. 2009. Correlates of depressive symptoms in rural elderly Chinese. *Int J Geriatr Psychiatry*, Dec;24(12):1358–66.

Gavard J a, Lustman PJ, Clouse RE. 1993. Prevalence of Depression in Adults With Diabetes. *Diabetes Care*, 16(8):1167–78.

Gonzalez JS, Safren SA, Delahanty LM, Cagliero E, Wexler DJ, Meigs JB, *et al*. 2008. Symptoms of depression prospectively predict poorer self-care in patients with Type 2 diabetes. *Diabet Med*., Sep;25(9):1102–7.

Hamilton M. 1960. A rating scale for depression. *J Neurol Neurosurg Psychiatry*, Feb;23:56–62.

http://www.graphpad.com

Jacobson AM, Adler AG, Wolfsdorf JI, Anderson B, Derby L. 1990. Psychological characteristics of adults with IDDM. Comparison of patients in poor and good glycemic control. *Diabetes Care*, Apr;13(4):375–81.

Katon WJ. 2008. The Comorbidity of Diabetes Mellitus and Depression. *Am J Med*., 121(11 SUPPL. 2):8–15.

Kawakami N, Takatsuka N, Shimizu H, Ishibashi H. 1999. Depressive symptoms and occurrence of type 2 diabetes among Japanese men. *Diabetes Care*, Jul;22(7):1071–6.

King H, Aubert RE, Herman WH. 1998. Global burden of diabetes, 1995-2025: Prevalence, Numerical estimates, and projections. *Diabetes Care*, Sep;21(9):1414–31.

Lopez-de-Andrés A, Jiménez-Trujillo MI, Hernández-Barrera V, de Miguel-Yanes JM, Méndez-Bailón M, Perez-Farinos N, *et al*. 2015. Trends in the prevalence of depression in hospitalized patients with type 2 diabetes in Spain: Analysis of hospital discharge data from 2001 to 2011. PLoS One. 10(2):e0117346.

Lustman PJ, Anderson RJ, Freedland KE, de Groot M, Carney RM, Clouse RE. 2000. Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care*, Jul;23(7):934–42.

Lustman PJ, Freedland KE, Griffith LS, Clouse RE. 2000. Fluoxetine for depression in diabetes: a randomized double-blind placebo-controlled trial. *Diabetes Care*, May;23(5):618–23.

McKellar JD, Humphreys K, Piette JD. Depression increases diabetes symptoms by complicating patients' self-care adherence. *Diabetes Educ*., Jan;30(3):485–92.

Murrell SA, Himmelfarb S, Wright K. 1983. Prevalence of depression and its correlates in older adults. *Am J Epidemiol*., Feb;117(2):173–85.

Musselman DL, Betan E, Larsen H, Phillips LS. 2003. Relationship of depression to diabetes types 1 and 2: Epidemiology, biology, and treatment. *Biol Psychiatry*, 54(3):317–29.

Organization WH. 1992. The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines. WorldHealthOrganization, 1–267.

Patel V, Kleinman A. 2003. Poverty and common mental disorders in developing countries. *Bull World Health Organ*., Jan;81(8):609–15.

Peyrot M, Rubin RR. 1997. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care*, 20(4):585–90.

Pouwer F, Geelhoed-Duijvestijn PHLM, Tack CJ, Bazelmans E, Beekman A-J, Heine RJ, *et al*. 2010. Prevalence of comorbid depression is high in out-patients with Type 1 or Type 2 diabetes mellitus. Results from three out-patient clinics in the Netherlands. *Diabet Med*., 27(2):217–24.

Raval A, Dhanaraj E, Bhansali A, Grover S, Tiwari P. 2010. Prevalence & determinants of depression in type 2 diabetes patients in a tertiary care centre. *Indian J Med Res (Internet)*., Aug;132(August):195–200. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20716820

Sinha SP, Shrivastava SR, Ramasamy J. 2013. Depression in an older adult rural population in India. *MEDICC Rev*., Oct;15(4):41–4.

Sotiropoulos A, Papazafiropoulou A, Apostolou O, Kokolaki A, Gikas A, Pappas S. 2008. Prevalence of depressive symptoms among non insulin treated Greek type 2 diabetic subjects. *BMC Res Notes*, Jan;1:101.

Tabák AG, Akbaraly TN, Batty GD, Kivimäki M. 2014. Depression and type 2 diabetes: A causal association? *Lancet Diabetes Endocrinol*., 2(13):236–2452.

Thour A, Das S, Sehrawat T, Gupta Y. 2013. Depression among patients with diabetes mellitus in North India

evaluated using patient health questionnaire-9. *J Family Community Med (Internet)*., 20(1):12–9. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3663159&tool=pmcentrez&rendertype=abstract

Van Tilburg MA, McCaskill CC, Lane JD, Edwards CL, Bethel A, Feinglos MN, *et al*. 2001. Depressed mood is a factor in glycemic control in type 1 diabetes. Psychosom Med. Jan;63(4):551–5.

Wagner JA, Abbott GL, Heapy A, Yong L. 2009. Depressive symptoms and diabetes control in African Americans. *J Immigr Minor Health*, Feb;11(1):66–70.

World Health Organization. 2016. Global report on diabetes. World Health Organization; Available from: http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf

****