

Depression: An epidemiological correlate of diabetes mellitus

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Abstract

India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed as “Diabetic Capital of the world.” The prevalence of depression among diabetics is 15-20% which is three times as compared to general population. Studies have identified depression as an independent risk factor for Type II Diabetes with relative risk of developing diabetes ranging from 1.3 to 3.0. This study was carried out to study the prevalence of Diabetes mellitus in age group above 20 years in an urban slum area and to study depression as an epidemiological correlate of Diabetes Mellitus. The cross-sectional study was conducted at urban slum area of central India in adults aged 20 years and above. Diabetes was diagnosed using WHO criteria 2006. The OGTT was performed using 75 gm of glucose. Depression was assessed by administering PHQ-9 scale, a self-report Hindi version. In present study, it was found that prevalence of Diabetes as 12.75% and among incident diabetics, 2.32% had moderately severe depression, 30.23% had moderate depression and 46.51% minor depression according to PHQ-9 Scale. When depression was assessed, it was almost present in (79.06%) subjects with Diabetes Mellitus, mild depression being the commonest (46.5%). The present study identified depression (P value -0.002) as the independent risk factors for type 2 Diabetes Mellitus. The present study identified depression as the independent risk factor for type 2 Diabetes Mellitus.

Keywords: Diabetes Mellitus, Depression, PHQ-9 Scale, Prevalence.

Access this article online

Website:

www.innovativepublication.com

DOI:

10.5958/2348-7682.2016.00007.5

Introduction

According to International Diabetes Federation (IDF) report published in 2009, the prevalence of Diabetes Mellitus (DM) has reached an epidemic level globally. There will be about 285 million adults having diabetes in 7 regions of the IDF. These numbers represent an increase of 39 million from 2007 and it is expected to be 439 million in 2030⁽¹⁾. Similarly, for India, there will be an increase of 58% from 51 million in 2010 to 87 million in 2030⁽²⁾.

India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed as “Diabetic Capital of the world”⁽³⁾. The primary driver of the epidemic of DM is the rapid epidemiological transition associated with changes in dietary pattern and decreased physical activity as evident from the higher prevalence of DM in the urban population. The most disturbing trend is the shift in age of onset of diabetes to a younger age in the recent years. This could have long lasting adverse effects on nation’s health and economy⁽⁴⁾.

The prevalence of depression among diabetics is 15-20% which is three times as compared to general population⁽⁵⁾ while depression may contribute to poor diabetes related outcomes, diabetes and its

complications may also contribute to poor depression outcomes⁽⁶⁾. The first longitudinal study investigating whether depression is a risk factor for diabetes was performed in 1996⁽⁷⁾ and since then more studies examined this association⁽⁸⁻⁹⁾.

Studies have identified depression as an independent risk factor for Type II Diabetes with relative risk of developing diabetes ranging from 1.3 to 3.0⁽¹⁰⁻¹²⁾. Depressed adults have a 37% increased risk of developing Type-II Diabetes mellitus. The pathophysiological mechanisms underlying this relationship are still unclear and warrant further research. A randomized controlled study is needed to test whether effective prevention or treatment of depression can reduce the incidence of Type-II Diabetes and its health consequences⁽¹³⁾.

In theory, the greater risk of Type-II diabetes in individuals with depression is believed to result from an increase in counter-regulatory hormone release and function, alterations in the glucose transport system, and increased immune-inflammatory activation. These physiologic alterations are thought to contribute to insulin resistance and beta islet cell dysfunction, which ultimately leads to the development of Type-II Diabetes⁽¹⁴⁾.

There are very few documented studies among diabetics in relation to depression in India and this study would generate new evidence in this regard.

Aims and Objectives

1. To study the prevalence of Diabetes mellitus in age group above 20 years in an urban slum area.

- To study depression as an epidemiological correlates of Diabetes Mellitus.

Material and Methods

The present community based cross-sectional study was conducted at Urban Health Training Centre (U.H.T.C.) area of Central India, which is an adopted area under the administrative control of tertiary care teaching hospital. U.H.T.C. is situated six kilometres away from tertiary care hospital. The total population of the area was 23,365. Study subjects consisted of people of age group of 20 years and above, who were residents of UHTC area from at least last 5 years pregnant and lactating mothers up to 12weeks, known case of type I diabetes mellitus, cases of secondary diabetes like DM due pancreatic, hormonal, genetic or other abnormalities, persons on drugs like lithium or steroids and persons not available even after 2 visits or not consenting were excluded from the study. Study protocol was approved by the Institution's Ethics Committee. Sample size was calculated considering the prevalence of diabetes in urban population to be 19.5%⁽¹⁵⁾, the sample size was calculated with 5% absolute precision and 1.5 design effect, for present study it will be 377 to which 5% non-response added so it became 397, which was rounded off to 400.

The total population of area is approximately 23,365 with 3375 houses; out of which the study population i.e. 20 years and above population was 14019 according to health survey done by UHTC in 2012. A list of subjects above 20 years was prepared and each subject was given unique identity number. Considering the sample size of 400, the sampling interval was calculated which was 35. The first study subject was selected by lottery method and then further study subjects were selected by systematic random sampling by taking every 35th person from that list. If that person was not available after second visit also or if that subject had any exclusion criteria according to study protocol and the person who were not consenting to participate in the study were excluded and the next person among the sampling interval was selected. All the study subjects were selected in this fashion till the desired sample size was reached. The study population was interviewed by house-to-house visit.

WHO STEPS approach was used to collect the data i.e. questionnaire, physical measures and biochemical investigation. The pretested questionnaire was modified according to local needs and study protocol. Questionnaire included questions related to socio-demographic information. Depression was assessed by administering PHQ-9 scale, a self-report Hindi version⁽¹⁶⁾.

Before collection of the data, informed consent was taken from the study subjects after explaining the purpose of the study in detail. The data was collected by interview method. For socio-economic

classification, B G Prasad classification was used considering AICPI of Dec 2012⁽¹⁷⁾.

The primary predictor of interest was major depression as determined by the Patient Health Questionnaire-9 (PHQ-9)⁽¹⁶⁾. The PHQ-9 is a self-report measure based on the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) (DSM-IV) criteria for major depression⁽¹⁷⁾. The PHQ-9 contains the 9 DSM-IV major depressive symptoms, with each item scored on a 0 to 3 Likert scale as "0" (not at all) to "3" (nearly every day). The criteria for major depression require at least 5 symptoms be endorsed more than one-half the time, including at least 1 of the cardinal symptoms of depressed mood or anhedonia. A recent systematic review found the PHQ-9 had 77% sensitivity and 94% specificity for a diagnosis of major depression based on a structured psychiatric interview⁽¹⁸⁾. The anthropometric measurements were also noted down to calculate BMI. All the physical instruments used for data collection, such as, measuring tape, weighing machine, stadiometer, stethoscope, sphygmomanometer were regularly checked for their validity and reliability throughout the period of data collection. Standard procedures were followed to minimize the errors due to use of these measuring tools. For blood sugar estimation, subjects were advised to remain fasting for overnight and participants were requested to refrain from consuming breakfast or any beverages until sample collection was done. Next morning blood samples for fasting blood sugar were drawn from the selected subjects following overnight fasting. Then immediately subjects were provided with 75 gm of glucose dissolved in 1 glass of water to drink it over 5 min. exactly after 2 hrs, post glucose venous blood sample was drawn. Subjects who stated that they had diabetes, were given a standard breakfast and a post prandial blood sample was collected one and half hours after breakfast⁽¹⁹⁻²⁰⁾.

All the blood samples were transported to tertiary care hospital within a short period of time in ice packs, for the analysis, which was carried out immediately. Diagnosis of abnormal glucose tolerance was made according to the WHO 2006 guidelines. The blood sugar analysis was done using Stat Sax 3300 Semi auto analyzer by glucose oxidase peroxidase method with the kit supplied by Transasia Biomedicals limited (ERBA) in the Central Clinical Lab of Tertiary Care Hospital and the readings were recorded. The diabetes was diagnosed based on drug treatment for diabetes and/or criteria laid by WHO⁽²¹⁾.

Data was entered in Microsoft Excel 2010 spreadsheet and analyzed with Epi Info 7 software (version 7.1.1.14) and open-epi software (version 3.03).

Results

Out of 400 eligible study subjects selected as per study protocol, 218 (54.5%) were male and 182 (45.5%)

were females. Among males, higher number of males 66 (30.27%) and among females, higher number of female 65 (35.71%) were from age group 40-49 years. Around three fourth of study population belonged to economically productive age group (30-59 years) (Table 1).

Among the study subjects, Hindu constituted 52.5%, while Buddhist and Muslim were 37.25% and 7% respectively. The higher proportion of Buddhist in this study was because of their predominant inhabitation in this slum area.

Among the study subjects (66%) belonged to nuclear families. This higher proportion was attributed to the urban area, where nuclear family culture is more prevalent than in rural areas. Among the study subjects, 76.2% were married and 8.75% were either separated, divorced, widow or widower. Though 6.5% of study subjects were still illiterate, 21.25% were educated up to secondary school and 25.5% of study subjects were having graduate and above graduate level education. It was also found that 43.25% study subjects were skilled workers. The study population was classified according to Updated B.G. Prasad Scale for socio-economic status using All India Consumer Price Index of Dec 2012. In this study, around four fifth (79.75%) subjects belonged to Classes III, IV, and V while one fifth (20.25%) belonged to class I and II

Table 1: Socio-demographic characteristics of the study subjects(n=400)

Characteristics	Number	Percentage
Religion		
Hindu	210	52.5
Muslim	28	7.0
Buddhist	149	37.25
Others	13	3.25
Education		
Illiterate	26	6.5
Upto primary	111	27.75
Upto secondary school	85	21.25
Upto HSC	76	19
Degree	64	16
Post Graduate	38	9.5
Age		
20-29 yrs	80	20
30-39 yrs	99	24.75
40-49 yrs	131	32.75
50-59 yrs	53	13.25
60-69 yrs	31	7.75
70-79 yrs	6	1.5
Occupation		
Professional	22	5.5
Skilled	173	43.25
Semi-skilled	39	9.75
Unskilled	14	3.5
House wife and students	152	38
Type of family		
Nuclear	264	66.0

Joint	61	15.25
Three generation	75	18.75
Socio-economic Status		
I	14	3.5
II	67	16.75
III	110	27.5
IV	136	34
V	73	18.25

Table 2: Distribution of study population according to results of Oral Glucose Tolerance Test(n= 400)

Results of OGTT	Frequency	%
Diabetes	51	12.75
Impaired Glucose Tolerance	43	10.75
Impaired Fasting Glucose	24	6
Normal OGTT	282	70.5
Total	400	100

The prevalence of Diabetes Mellitus in present study was 12.75%. The prevalence of impaired glucose tolerance was 10.75% and impaired fasting glucose was seen in 6% of study subjects. Out of 51 diabetics, 43 were incident cases and 8 were known Diabetes and were already on treatment (Table 2).

Nearly 33.33% of diabetic cases had positive family history in either parent or both parents. The 21.57% diabetics had hypertension and 78.43% were Normotensive. The present study revealed that nearly 39.21% were having normal BMI, 17.64% were in pre obese state, 35.29% were obese and 7.84% persons were found to be underweight. The 52.93% of study population was either obese or pre-obese and was at risk for Diabetes Mellitus.

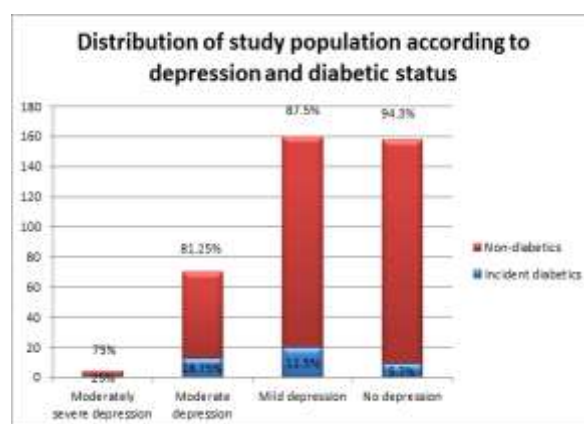


Fig.1: Distribution of study population according to Depression and Diabetic status

The Depression in diabetics is seen as a cause as well as its effect. It was difficult to state whether depression seen in already diagnosed cases existed since before the diagnosis of diabetes or developed after the diagnosis of diabetes. To study depression as a risk factor for diabetes in present study, PHQ-9 score of only incident cases (43 cases of DM) has taken for analysis (Fig. 1).

Though depression was categorized as mild, moderate, moderately severe and severe category, during study we didn't get any case of severe depression. In subjects with moderately severe depression prevalence of diabetes was highest while it was lowest in subjects without depression. It has been observed that there is linear association between degree of depression and diabetes. This association of depression with diabetes mellitus was found statistically significant (p value 0.002).

Discussion

In this present study, among 400 study subjects, the overall prevalence of Diabetes Mellitus was found to be 12.75%. Snehalatha C et al (2003) in a national survey of diabetes in six major cities of India in 1631 subjects of age 20 years and above, reported a prevalence of diabetes (12.1%)⁽²²⁾ and also Mohan V et al (2003) in a study among 1399 subjects of age group 20 years and above in a selected south Indian population found the prevalence of type 2 diabetes mellitus was 12%⁽²³⁾.

In the present study, it was observed that there was linear association between degree of depression and diabetes. This association of depression with diabetes mellitus was found statistically significant (p value 0.002). Fareeha F et al (2010) in a study conducted in an urban city of Pakistan, also observed that the prevalence of depression was significantly higher in subjects with newly diagnosed diabetes compared to subjects without diabetes (13% vs 6%; $p < 0.01$)⁽²⁴⁾. Similarly An Pan et al (2010) in a follow up study among 65,381 adult females aged 50 to 75 observed that those with depression had a 17% higher risk of developing diabetes - even after ruling out certain risk factors, such as BMI and physical activity⁽²⁵⁾.

Mezuk B et al (2008) in the meta-analytic review which included a total 13 studies that investigated depression as a risk factor for diabetes representing 6916 incident cases, observed that the risk for incident diabetes was 60% higher in depressed participants compared to non-depressed controls (RR 1.60, 95% CI 1.37-1.88)⁽²⁶⁾. Also Engum A (2007) in a study using data from a large Norwegian prospective population based study (n=37,291) reported that the risk of type 2 diabetes was higher (OR 1.8 95% CI 1.3-2.5) among participants with a high level of depression/anxiety at both baseline and follow up⁽²⁷⁾. Similarly Golden SH et al (2007) in a systematic review documented that poor health behaviours in depressed individuals like smoking, physical inactivity, caloric intake may increase the risk of type 2 diabetes. Depression is associated with physiological abnormalities, including activation of the hypothalamic-pituitary-adrenal axis, sympathoadrenal system, and pro-inflammatory cytokines, which can induce insulin resistance and contribute to diabetes risk⁽²⁸⁾.

Knol MJ et al (2006) in a meta-analysis observed that the pooled relative risk was 1.26 (1.13-1.39) using

the fixed effects model and 1.37 (1.14-1.63) using the random effects model. Results revealed that depressed adults have a 37% increased risk of developing type 2 diabetes mellitus⁽²⁹⁾. Brown C et al (2005) in the nested case control study also revealed that Individuals with newly diagnosed diabetes (1,622 of 33,257; 4.9%) were 30% more likely to have had a previous history of depression compared with people without diabetes (2,279 of 59,420; 3.8%). They had concluded that depression increases the risk of diabetes rather than vice-versa⁽³⁰⁾.

Conclusion

In present study it was found that 2.32% diabetics had moderately severe depression, 30.23% had moderate depression and 46.51% minor depression by using PHQ-9 Scale. When depression was assessed, it was almost present in (79.06%) subjects with Diabetes Mellitus, mild depression being the commonest (46.5%). The present study identified depression (P value -0.002) as the independent risk factor for type 2 Diabetes Mellitus.

Recommendations

All the subjects in age group more than 20 years with positive family history of diabetes mellitus, having sedentary lifestyle should be screened for Diabetes at the earliest opportunity. The present study had identified depression (P value -0.002) as the independent risk factor for type 2 Diabetes Mellitus hence all the patients with depression need screening for diabetes at regular interval.

As the depression is showing significant association with diabetes, hence measures should be taken for timely diagnosis and treatment of the depression in all diabetic subjects by health professionals.

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