

# Assessment of long-term glycemic control and its correlation with psychological variables in patients with type 2 diabetes mellitus in an urban community setting

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## ABSTRACT

**Background:** Patients with diabetes mellitus (DM) and their families may respond to the diagnosis, treatment, or complications of the disease with a variety of feelings, such as guilt anxiety depression or stress. The presence of diabetes changes one's life and creates demand of treatment. Not only emotions directly affect glycemia; emotional stress may disrupt the individual's eating habits, exercise programs, and daily routine, thereby altering daily diabetes management and impairing glycemic control. Existing literature suggests that depression may be more strongly related with glycemic control. Frustration to achieve good glycemic control could lead to depression. In addition, diabetes often serves as a focus for other problems and conflicts in life; in turn, diabetes may be influenced by these life stresses. **Objectives:** To assess long-term glycemic control (past three months) by glycosylated hemoglobin (HbA1c) in type 2 DM patients in an urban community setting. To study association between psychological variables (anxiety, depression, and stress) and HbA1c. **Materials and Methods:** It is a community-based cross-sectional study. 183 study subjects selected from urban community who were already diagnosed of type 2 DM with active treatment for more than 6 months. Stress, depression, and anxiety were the psychological factors evaluated individually in each study subjects using standard questionnaire. HbA1c was done by standardized high pressure liquid chromatography technique. **Results:** Out of 183 study subjects, 140 (i.e., 76.5%) subjects have fair glycemic control and 40 (23.5%) have poor glycemic control. 140 subjects (76.5%) have an anxiety scale reading of <14 and 43 subjects (23.5%) have a reading of more than or equal to 14. Out of 183 subjects, 47 subjects (25.7%) are depressed (mild, moderate, or severe categories). 136 subjects (74.3%) do not suffer from depression. 134 subjects (73.2%) have low susceptibility to stress related illness and 49 subjects (26.8%) have medium susceptibility to stress related illness. All the psychological variables, i.e., anxiety ( $\chi^2 = 32.655$ ,  $P < 0.0001$ ), depression ( $\chi^2 = 40.549$ ,  $P < 0.0001$ ), and stress ( $\chi^2 = 17.049$ ,  $P < 0.0001$ ) were found to very highly significantly associated with poor glycemic control. **Conclusion:** The study shows that there is a strong association between psychological variables and poor glycemic control.

**KEY WORDS:** Type 2 Diabetes Mellitus; Anxiety; Depression; Stress

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## INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease characterized by disorder in the metabolism of carbohydrates, lipids and amino acids either as a result of decreased insulin secretion or due to reduction to insulin sensitivity of the body cells, it is a disease that acquires epidemic form as

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its prevalence has five folded during the past 15 years and constitutes one of the major threats to human health in 21<sup>st</sup> century.<sup>[1-5]</sup>

Long standing DM is associated with increased prevalence of microvascular and macrovascular diseases. With the rising prevalence of diabetes, the number suffering from vascular complications of diabetes will also increase.<sup>[6]</sup>

Diabetes often serves as a focus for other problems and conflicts in life; in turn, diabetes may be influenced by these life stresses. Indeed, emotional stress leads to secretion of a variety of hormones (epinephrine hormone, cortisol) that, among their many biological effects, counteract the action of insulin. Not only emotions directly affect glycemia; emotional stress may disrupt the individual's eating habits, exercise programs, and daily routine, thereby altering daily diabetes management and impairing glycemic control with a patient's emotional needs and problems is an equally important component which may be used in a positive sense to enhance treatment and thus become an important component of therapy.<sup>[7]</sup>

It is widely known that patients with DM are at high risk of decreased psychological well-being due to strained coping with changed life routine right from the time of diagnosis of DM which is already presence in about half of the patients at the time of diagnosis.<sup>[8]</sup>

Diabetes-related distress refers to the emotional burden that may be an aspect of managing a chronic illness and can be found in both those with diabetes and their caregivers.<sup>[9]</sup>

Anxiety disorders are common and most frequent among all other psychiatric disorders. They bear a substantial "risk" and inability load, comparable to what is observed in chronic diseases, such as DM. Research has shown that the relation between depression, anxiety disorders and diabetes is bound to hyperglycemia, diabetes complication and restraints imposed by the disease.<sup>[10,11]</sup>

This study has been planned for assessment of long-term glycemic control and association with psychological variables such as anxiety depression and stress among type 2 diabetic subjects.

## MATERIALS AND METHODS

This study is a community-based cross-sectional study aimed at primarily assessing glycemic control over the past 3 months and its correlation with psychological variables.

The study was conducted in urban community under urban health center field practice area of Mumbai involving all Class IV Government employees quarters.

Study subjects included were already diagnosed case of type 2 DM and on active therapy for more than 6 months. The first baseline survey was done and number of eligible subjects was identified.

A total of 6865 individuals were screened for diabetic and its treatment status and 183 subjects with type 2 diabetes and more than 18 years of age were eligible for the study.

A semi-structured questionnaire to collect the sociodemographic profile and the details of the diabetes and its treatment. The details regarding diabetes included the duration of the condition, duration of treatment, type of treatment being received, complications due to diabetes, family history of diabetes, and body mass index. The level of diabetes control was assessed using the glycosylated hemoglobin (HbA1c) levels, fasting blood glucose, and postprandial blood glucose. Actual questionnaire administration and physical examination were followed by laboratory work up which was done in the health center attached to this colony by trained laboratory technicians.

Long-term glycemic control was assessed by estimating HbA1c (A1c fraction of hemoglobin) by high-pressure liquid chromatography technique. This technique is considered as the gold standard in the estimation of HbA1c. HbA1c estimation was done by M/S Thyrocare Ltd. This laboratory is a reputed highly specialized laboratory, which is equipped for high-quality work.

Stress, depression, and anxiety were the psychological factors evaluated individually in each study subjects. Hamilton's anxiety scale, Hamilton's depression scale, and stress assessment scale were used.<sup>[12]</sup>

Interpretation of anxiety scale was done on the basis of 14 symptoms graded on scale 0-4 and criteria for diagnosing mild anxiety was score of 18, moderate anxiety score of 25, and severe anxiety for score of 30. Hamilton's depression scale had 21 symptoms based questions and interpretation was done normal for 0-7 score, mild for 8-13 score, moderate for 14-18 score, and severe for 19-22 score and very severe for more than 23. Stress assessment for done using scale with interpretation as score of 0-149 low susceptibility to stress, 150-299 medium susceptibility to stress, and score more than 300 high susceptibility to stress.

Analysis was performed using the SPSS version 16.0. Descriptive statistics were carried out for different sociodemographic- and diabetes-related parameters. In between groups, difference was calculated for male and female study subjects using independent sample *t*-test. Pearson's correlation coefficient was calculated to find out the correlation between different diabetes-related parameters and the scores on Hospital anxiety and depression scale (HADS)-anxiety and HADS-depression scale. In addition, ANOVA

was carried out for the in between group comparisons. The level of significance for all the statistical tests was kept at  $P < 0.05$ .

## RESULTS

Among 183 study participants, 51% of respondents had poor glycemic control ( $>7$  HbA1c) and 49% had fair glycemic control ( $<7$  HbA1c) (Figure 1).

### Socioeconomic and Demographic Variables

Gender distribution among the study participants showed 51% cases were females and 49% were males. Age wise distribution showed 74 participants were  $<50$  years old and remaining 109 were  $>50$  years old. Among marital status, wise distribution 22 study participants were either unmarried or widow and rest 161 were married. Nuclear type of family was seen among 157 study participants and 26 had joint family. Duration of diabetes was  $\geq 6$  years among 54 participants and  $\leq 5$  years diabetes duration was seen among 129 study participants. The frequency for testing diabetes for control was seen  $<6$  months among 123 participants rest 60 participants had frequency for testing diabetes  $\geq 6$  months duration. Comparison of the demographic and socioeconomic variables along with fair and poor glycemic control showed that gender, age, type of family, marital status, and diabetes duration were not significant. Frequency of blood sugar testing was very highly significant with poor or fair glycemic control ( $P < 0.0001$ ) (Table 1).

Comparison of psychological variants with glycemic control showed that study subjects with anxiety rating score of more than 14 had significantly poor glycemic control compared to those with anxiety rating score of  $<14$  ( $\chi^2 = 32.655$ ,  $P < 0.0001$ ). Mild and above depression was significantly associated with poor glycemic control compared to normal score on depression rating scale ( $\chi^2 = 40.54$ ,  $P < 0.0001$ ). Medium susceptibility to stress on stress assessment scale

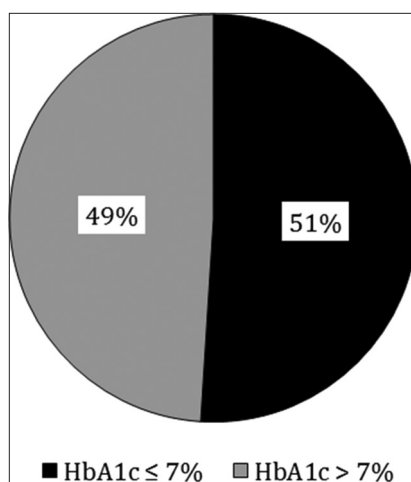
had poor glycemic control as compared to those with low susceptibility to stress ( $\chi^2 = 17.04$ ,  $P < 0.0001$ ) (Table 2).

Binary logistic regression analysis was performed to rule of the possible effect of confounding and interaction in univariate analysis as shown in Table 3. Duration of diabetes, the frequency of testing for diabetes, anxiety rating score, and depression rating score was found to statistically significant with poor glycemic control among the study participants.

## DISCUSSION

In the present community-based cross-sectional study, glycemic control status among the known diabetic subjects was evaluated. 51% of diabetic subjects were having fair glycemic control and 49% had poor glycemic control on the basis of HbA1c value estimation. Gender difference, age, marital status, type of family, and duration of DM were not significantly associated with poor glycemic control. Frequency of testing for blood sugar was significantly associated with poor glycemic control. The presence of anxiety, depression, and stress among diabetic subjects were significantly associated with poor glycemic control. In logistic regression analysis, duration of DM, frequency of testing blood sugar, anxiety and depression were independent risk factors for poor glycemic control.

Frequency of testing for DM was found to be significant with poor glycemic control in two different studies, Evans et al.<sup>[13]</sup> concluded that regular self-monitoring of blood glucose concentration is associated with improved glycemic control in both types of diabetes, and Harris<sup>[14]</sup> concluded that frequency of self-monitoring of blood glucose associated with HbA1c values in insulin treated type 2 diabetes patients. Significance of presence of anxiety with poor glycemic control was also noted by Mazze et al.<sup>[15]</sup> studied associations between glycemic control and psychological and social correlates such as personality, anxiety, depression, and quality of life. At each point during the study, the difference between those in good control and those in poor control in terms of anxiety, depression and quality of life was significant ( $P = 0.02$ ). Similarly for mild and above depression, Lustman et al.<sup>[16]</sup> did a study to find out whether depression is associated with poor glycemic control and concluded that depression was associated with poor glycemic control in patient with diabetes. After analyzing for stress those who have medium susceptibility were with poor glycemic control and similar finding was also resembled in a study conducted by Peyrot and McMurry<sup>[17]</sup> tested the hypothesis that chronic psychological stress is associated with worse glycemic control and conclude that chronic psychological stress is associated with worse glycemic control among those who do not cope effectively with stress. Overall if all psychological variants such as anxiety, depression, and stress are found to be present among subjects with DM, good glycemic control



**Figure 1:** Glycemic control status among study participants

**Table 1:** Comparison of demographic and socioeconomic profiles between those having poor and fair glycemic control

Parameters	Glycemic control		Chi-square	Significant
	Fair (%)	Poor (%)		
Gender				
Male	72 (80.0)	18 (20.0)	1.20 (0.73-2.93)	NS
Female	68 (73.1)	25 (26.9)		
Age				
<50 years	56 (75.7)	18 (24.3)	0.047 (0.49-1.55)	NS
≥50 years	84 (77.1)	25 (22.9)		
Marital status				
Married	122 (75.8)	39 (24.2)	0.39 (0.22-2.17)	NS
Unmarried and widowed	18 (81.8)	4 (18.2)		
Type of family				
Joint	18 (69.2)	8 (30.8)	0.89 (0.62-3.86)	NS
Nuclear	122 (77.7)	35 (22.3)		
Diabetes duration (years)				
≤5	96 (74.4)	33 (25.6)	1.05 (0.30-1.17)	NS
≥6	44 (81.5)	10 (19.5)		
Frequency of testing (months)				
<6	113 (91.9)	10 (8.1)	49.28 (6.06-31.44)	P<0.0001
≥6	27 (45.0)	33 (55.0)		

NS: Non-significant

**Table 2:** Comparison of psychological variants between those having poor and fair glycemic control

Psychological variants	Glycemic control		Chi-square	Significant
	Fair (%)	Poor (%)		
Anxiety rating score				
<14	121 (86.4)	19 (13.6)	32.655 (3.71-17.41)	P<0.0001
>14	19 (44.2)	24 (55.8)		
Depression assessment scale				
Normal	120 (88.2)	16 (11.8)	40.54 (4.64-22.06)	P<0.0001
Mild and above	20 (42.6)	27 (57.4)		
Stress assessment scale				
Low susceptibility	113 (84.3)	21 (15.7)	17.04 (2.11-9.10)	P<0.0001
Medium susceptibility	27 (55.1)	22 (44.9)		

**Table 3:** Logistic regression analysis

Variable	OR	95% CI (OR)	Z score	P value
Education	1.96	0.740-5.194	1.35	0.175
Duration of diabetes	6.206	1.179-32.65	2.16	0.031*
Frequency of testing	1216.4	19.22-76957.4	3.36	0.001*
Anxiety rating score	1671.6	14.25-196071.7	3.05	0.002*
Depression rating score	124.55	6.083-2550.07	3.13	0.002*
Stress	0.699	0.525-9.321	-0.27	0.787

\*P&gt;0.05. OR: Odds ratio, CI: Confidence interval

maintenance is must. Duration of DM with more than 6 years was found significant among the study subjects with poor glycemic control suggest that regular monitoring for glycemic control is must. Similar finding was also observed in a study by Moss et al.<sup>[18]</sup> who studied the association of glycemia with cause-specific mortality in a diabetic population. The study concluded that after controlling for other risk factors in proportional hazards models and considering underlying cause of death, HbA1c was significantly associated with mortality from diabetes along with the duration of disease.

The strength of this study is measurement of HbA1c is help us to identify actual glycemic control (average of 3 months blood sugar) among the known diabetic subjects as compared



to fasting and post prandial blood sugar. Assessment of psychological variable like anxiety depression and stress in the diabetic subjects will help in detection of glycemic control and complication related to poor glycemic control. The limitation of the study is as this study is a cross-sectional study to find out glycemic control and risk factors among known diabetic subjects conducted in community under urban health center of teaching hospital, a prospective study with 3 monthly measurements of HbA1c should be carried out in a large study base. This would enable better understanding role of risk factors and their association with glycemic control.

## CONCLUSIONS

Among 183 study subjects, 94 (51%) had fair glycemic control (HbA1c  $\leq$ 7%). The frequency of testing was one factor, which was strongly associated with glycemic control. High anxiety score, mild, and above depression and medium susceptibility for stress were significantly associated with poor glycemic control. Logistic regression analysis showed that duration of diabetes, frequency of testing, anxiety rating score, and depression rating score were independent risk factors for poor glycemic control.

## REFERENCES

- Zimmet P, Alberti KG, Shaw J. Global and societal implications of the diabetes epidemic. *Nature*. 2001;414(6865):782-7.
- Zimmet P. Globalization, coca-colonization and the chronic disease epidemic: Can the Doomsday scenario be averted? *J Intern Med*. 2000;247(3):301-10.
- Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004;27(5):1047-53.
- Sicree R, Shaw JE, Zimmet P. The global burden of diabetes. In: Gan D, editor. *Diabetes Atlas*. 2<sup>nd</sup> ed. Brussels: International Diabetes Federation; 2003. p. 15-71.
- International Diabetes Federation. *Diabetes Atlas 2000*. Brussels: International Diabetes Federation; 2000.
- Ramchandran A, Snehlata C, Vishwanathan V. Burden of Type 2 diabetes and its complications. *Curr Sci*. 2002;83(12):1471-6.
- Carol W. Northern Country Psychiatric Associates, Diabetes, Depression and Stress. Available from: <http://www.ncpamd.com/dm-depression>. [Last accessed on 2017 May 12].
- Chew BH, Shariff-Ghazali S, Fernandez A. Psychological aspects of diabetes care: Effecting behavioral change in patients. *World J Diabetes*. 2014;5(6):796-808.
- Ascher-Svanum H, Zagar A, Jiang D, Schuster D, Schmitt H, Dennehy EB, et al. Associations between glycemic control, depressed mood, clinical depression, and diabetes distress before and after insulin initiation: An exploratory, post hoc analysis. *Diabetes Ther*. 2015;6(3):303-16.
- Bogner HR, Morales KH, Post EP, Bruce ML. Diabetes, depression, and death: A randomized controlled trial of a depression treatment program for older adults based in primary care (PROSPECT). *Diabetes Care*. 2007;30(12):3005-10.
- Van der Does FE, De Neeling JN, Snoek FJ, Kostense PJ, Grootenhuys PA, Bouter LM, et al. Symptoms and well-being in relation to glycemic control in Type II diabetes. *Diabetes Care*. 1996;19(3):204-10.
- Sadock BJ. Psychiatry rating scale 7.8. Kaplan and Saddock's *Comprehensive Textbook of Psychiatry*. 7<sup>th</sup> ed. New York, NY: Deborah Blacker; 2002. p. 755-83.
- Evans JM, Newton RW, Ruta DA, MacDonald TM, Stevenson RJ, Morris AD. Frequency of blood glucose monitoring in relation to glycaemic control: Observational study with diabetes mellitus. *BMJ*. 1999;319(7202):83-6.
- Harris MI; National Health and Nutrition Examination Survey (NHANES III). Frequency of blood glucose monitoring in relation to glycemic control in patients with Type 2 diabetes. *Diabetes Care*. 2001;24(6):979-82.
- Mazze RS, Lucido D, Shamon H. Psychological and social correlates of glycemic control. *Diabetes Care*. 1984;7(4):360-6.
- Lustman PJ, Griffith LS, Clouse RE. Depression in adults with diabetes. Results of 5-yr follow-up study. *Diabetes Care*. 1988;11(8):605-12.
- Peyrot MF, McMurry JF Jr. Stress buffering and glycemic control. The role of coping styles. *Diabetes Care*. 1992;15(7):842-6.
- Moss SE, Klein R, Klein BE, Meuer SM. The association of glycemia and cause-specific mortality in a diabetic population. *Arch Intern Med*. 1994;154(21):2473-9.

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