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A Study to Evaluate Relationship between Anxiety Depression and Glycemic Control among Type 2 Diabetes Mellitus Patients

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ABSTRACT

Background: Diabetes Mellitus is one of the most widespread disorders in public health, requiring careful glycemic control to prevent complications. Alongside physical challenges, DM patients often experience psychological distress, particularly anxiety and depression, which can further complicate diabetes management and influence psychological well-being, and diminish the quality of life of individuals. **Aim of study:** To evaluate the relationship between anxiety, depression, and glycemic control among Type 2 Diabetes Mellitus patients. **Material and Methods:** A descriptive cross-sectional study was conducted on 301 Type 2 Diabetes Mellitus patients at Liaquat University Hospital Hyderabad, Sindh, Pakistan from May 2024 to October 2024. Non-probability-purposive sampling technique was used to collect data. Anxiety and depression levels were measured using the GAD-7 and PHQ-9 scales, respectively. HbA1c level was used to assess glycemic control. Data was analyzed using SPSS 26.0; Descriptive analysis including mean, frequency, percentage, and standard deviation was used along with the Fisher test to analyze significant relationships. **Results:** Among the 301 T2DM patients, 52.49% were male with a mean age of 46.16 years. Most participants lived in urban areas (69.44%) and 50.5% were intermediate or below in education. Most of the participants (73.09%) were unemployed, and 96.7% were married. In terms of glycemic control (GC), 76.74% of participants had poor glycemic control (HbA1c $\geq$ 7.1). Individuals with poor glycemic control demonstrated significantly higher levels of anxiety ($p < 0.009$) and depression ($p < 0.016$). **Conclusion:** Poor glycemic control is strongly linked to increased anxiety and depression in T2DM patients. These findings highlight the need for incorporating mental health screening and interventions into diabetes care to improve both psychological and physical health outcomes.

INTRODUCTION

Worldwide, Diabetes Mellitus (DM) is one of the most prevalent disorder in public health. It is an illness related to the metabolism of carbohydrates in which there is an insistently elevated blood glucose level because of insufficient insulin production or activity(1). There are mainly two forms of diabetes mellitus: type 1, which appears in childhood and is frequently mediated by immune processes, and type 2, which appears later in life, particularly in old age, and is brought on by pancreatic diseases(2).

The International Diabetes Federation (IDF) reports that in 2021, 537 million persons globally are estimated to have DM; by 2030 and 2045, respectively, this figure is predicted to rise to 643 million and 783 million(3). DM is becoming

increasingly common in most countries, but 79% of individuals with this disease live in low and middle-income nations, and this increase is predicted to be more severe in these low-middle-income nations(4).

Pakistan is among the worst impacted nations globally, ranking third in terms of the proportion of adult diabetics, after China and India. In Pakistan, 33 million persons suffer from diabetes, with a prevalence of roughly 26.7% overall(5).

DM is a disorder that frequently has several coexisting conditions. Anxiety and depression are a couple of these comorbidities, and they can have a damaging effect on one's Quality of Life (QoL), treatment non-adherence, and prognosis(6).

Patients with diabetes experience anxiety and depression about twice as frequently as people without diabetes. Among the overall population, the one-year prevalence rate of depression and anxiety was 10% and 18%, respectively. Compared to the general population, the prevalence of depression and anxiety disorders is almost 60% greater in those with type 2 diabetes(7). These illnesses are not only incapacitating, but they also increase the chance of deadly consequences like suicide and overall cause death(8, 9).

According to previous studies study done in Ethiopia explore that inadequate glycemic control and depression are directly related (10). Similarly, another study conducted in Korea found that Poor glycemic control and chronic hyperglycemia have been linked to a higher prevalence of anxiety and depression(11). A study carried out in Pakistan also showed that a substantial percentage of diabetes patients had depression (44%)(12). However, some studies suggest that there is no significant relationship between anxiety, depression, and GC. A study conducted in the United States of America (USA) presents that there is no association between depression and diabetes(13). Another Iranian research also discovered no meaningful correlation between GC and depression(14).

Despite the established links, research on the interaction between anxiety, depression, and GC in people with T2DM is notably lacking. In light of the above justification, the significance of T2DM as a major public health issue, and the fact poor glycemic control can develop anxiety and depression, the current study aims to ascertain the relationship between anxiety, depression, and GC in T2DM patients. This will enable prompt treatment and a decrease in the disease burden.

The significance of this study aligns with the United Nations' Sustainable Development Goal (SDG) 3, which aims to good health and well-being for all at all ages. Considering the urgent need to address the psychological well-being of this population, it is important to look into the relationship between anxiety, depression, and GC in patients with T2DM. Depression and anxiety are prevalent comorbidities among individuals with T2DM, often exacerbating the challenges of managing this chronic condition. Understanding the impact of glycemic control on mental health can lead to more effective treatment strategies, allowing healthcare providers to offer comprehensive care that addresses both physiological and psychological factors. This all-encompassing strategy not only improves the QoL for patients but also increases adherence to diabetes treatment, which may lower the risk that comes with inadequate glycemic control.

Research Questions

1. What is the relationship between depression and GC in patients with type 2 diabetes mellitus?
2. Is there any connection between anxiety and GC in individuals with type 2 diabetes mellitus?

MATERIAL AND METHODS

This was a descriptive cross-sectional study conducted on 301 T2DM patients at Diabetic Out-Patient-Department Liaquat University Hospital Hyderabad, Sindh, from May 2024 to October 2024. The sample size was determined from the previous literature prevalence rate (26.7%)(15), by using the openepi calculator *https://www.openepi.com/Menu/OE_Menu.html*. Non-probability-purposive sampling technique was used to enroll participants for data collection. The patients were included in this study if they were adults, aged above 30 years and who were newly diagnosed. Patients who had recent HbA1c records and agreed to sign written informed consent.

All those patients were excluded from this

study who had Type 1 Diabetes Mellitus, seriously ill or altered level of consciousness, already diagnosed with any mental illness, or patients who were not willing to sign written informed consent.

The structured questionnaire was used to collect data physically, which includes socio-demographic variables (gender, age, marital status, occupational status, and educational status). Glycemic control was assessed by the patient's HbA1c record which was categorized into two categories Good GC (HbA1c < 7.0%) and Poor GC (HbA1c ≥ 7.1%). Anxiety was assessed by using the generalized Anxiety disorder scale -7 (GAD-7), the reliability of this screening tool was α = 0.86(16) and depression was evaluated by using the Patient Health Questionnaire-9 (PHQ-9) scale, the reliability of this tool was α = 0.91(16).

Data was analyzed by using Statistical Package for Social Sciences version (SPSS) 26.0 for Windows. Descriptive analysis including mean, frequency, percentage, and standard deviation was used to analyze age, gender, occupational status, marital status, educational status, and glycemic control. Fisher exact test was used to evaluate the relationship of anxiety and depression with glycemic control. The level of significance was taken as ≤0.05.

Ethical approval was taken from the Research Ethics Committee (REC) Liaquat University of Medical & Health Sciences Jamshoro (LUMHS). Informed written consent was taken in local language from patients after explaining the study. Surety guidance was provided and assured that record use only for research purposes and confidentiality of all information will be maintained.

RESULT

Among the total number of 301 participants, the patient's age ranged from 30 to 70 years, with a mean age of 46.16 years±9.079 (Figure-1). Most of the respondents were male (n=158, 52.49%), and (n=143, 47.51%) were female, according to their residential status, the urban residential rate was higher (69.44%) than rural residential (30.56%), unemployed subjects were more (73.09%) than employed subjects (26.91%). The majority of individuals were married (n=291, 96.7%) compared to the small number of unmarried (n=10, 3.3%). In accordance with their educational status majority of the participants 50.5% were Intermediate or below followed by Illiterate 43.5% and only 6.0% were Graduates (Table 1).

Figure 1

Age distribution of participants

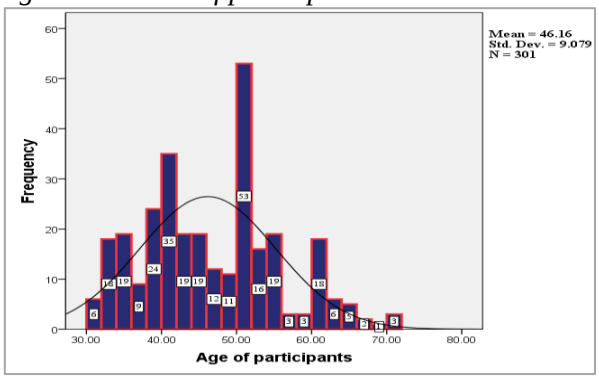

Table 1

Demographic factors of participants

Demographic Factors		Frequency	Percentage
Gender	Male	158	52.49 %
	Female	143	47.51 %
Residential status	Urban	209	69.44 %
	Rural	92	30.56 %
Occupational status	Employed	81	26.91 %
	Unemployed	220	73.09 %
Marital Status	Single	10	3.3 %
	Married	291	96.7 %
Educational status	Illiterate	131	43.5 %
	Intermediate or below	152	50.5 %
	Graduates or above	18	6.0 %

Out of the total 301 study subjects, good glycemic control patients were in low number 23.26%, while poor glycemic control was found to increase 76.74% (Figure-2).

Figure 2

Glycemic control of T2DM patients

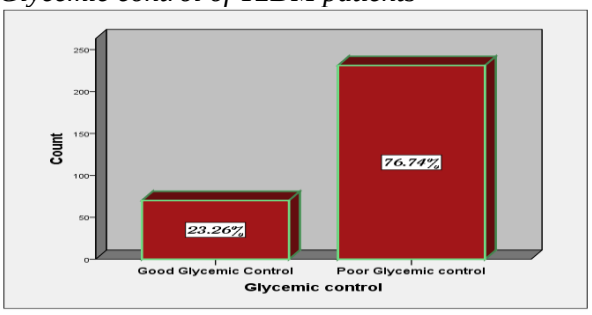

Table 2 shows the relationship of anxiety with Glycemic control, among the total sample (301 individuals) 54.5% had minimal anxiety, 38.3% had mild anxiety, 6.6% had moderate anxiety and 0.6% of T2DM participants had severe anxiety. Among those with poor glycemic control (76.7%) show higher levels of anxiety, with 38.1% experiencing minimal anxiety, 32.7% experiencing mild anxiety and 5.6% having moderate anxiety, compared to 16.4%, 5.6%, and 1.0% with a good glycemic control group (23.3%). The relationship is statistically significant ($p < 0.009$), suggesting that poor glycemic control is linked to greater anxiety.

Table 2

Relationship of anxiety with Glycemic control

Anxiety level	Glycemic Control		Total	Fisher exact	P value
	Good GC	Poor GC			
Minimal (0-4)	49 (16.4%)	115 (38.1%)	164 (54.5%)		
Mild (5-9)	17 (5.6%)	98 (32.7%)	115 (38.3%)		
Moderate (10-14)	3 (1.0%)	17 (5.6%)	20 (6.6%)	10.561	< .009
Severe (15-21	1 (0.3%)	1 (0.3%)	2 (0.6%)		
Total	70 (23.3%)	231 (76.7%)	301 (100%)		

Table 3 reveals that out of the total sample (301 T2DM individuals), 64.8% were suffering from none or minimal depression, 30.9% had mild depression, 4.0% had moderate depression, only 0.3% experienced moderate severe depression and none of them underwent severe depression. When compared with glycemic control 18.3% of individuals with good glycemic control reported none to minimal depression, while 46.5% of those with poor glycemic control experienced similar levels of depression. Furthermore, only 4.0% of the good control group had mild depression, compared to 26.9% in the poor glycemic control group. The data shows minimal reporting of moderate depression (1.0% vs. 3.0%) and no cases of moderate-severe or severe depression among those with good glycemic control. The Fisher exact test indicated a statistically significant association ($p = 0.016$), emphasizing that poor glycemic control is linked to higher levels of depression.

Table 3

Relationship of depression with glycemic control

Depression severity	Glycemic Control		Total	Fisher exact	P value
	Good GC	Poor GC			
None-Minimal (0-4)	55 (18.3%)	140 (46.5%)	195 (64.8%)		
Mild (5-9)	12 (4.0%)	81 (26.9%)	93 (30.9%)		
Moderate (10-14)	3 (1.0%)	9 (3.0%)	12 (4.0%)	9.143	0.016
Moderate severe (15-19)	0 (0%)	1 (0.3%)	1 (0.3%)		
Severe (20-27)	0 (0%)	0 (0%)	0 (0%)		
Total	70 (23.3%)	231 (76.7%)	301 (100%)		

DISCUSSION

The study shows that among participants the age distribution of study participants ranged from 30 to 70 years, with a mean age of 46.16 years. These findings are consistent with a descriptive cross-sectional study conducted through WHO STEPS surveys in 56 countries which reported that the mean age of type 2 DM was 45.1 years in males and 45.0 years in females(17).

This study found that there was a slight majority of males (52.49%) compared to female participants (47.51%). Similarly, a study conducted in Pakistan in 2022 reported a slight preponderance of males (52.5%) over females (47.5%) among 590 type 2 diabetes patients(18).

The results indicate that among residential status 69.44% of participants were urban dwellers, while 30.56% lived in rural areas. These findings are compatible with a study done in Africa which states that urban residents were more affected by T2DM compared to rural dwellers(19).

According to occupational status, the current study suggests that 73.09% of participants were unemployed, while only 26.91% were employed. These findings are in agreement with the study conducted in Iran explores that in terms of employment having T2DM were employed 79.2% and the rest (20.8%) were unemployed(14).

Similar to previous studies, the higher rate of T2DM participants were married individuals (96.7%) while only 3.3% were single, this aligns with research conducted in Pakistan which suggests that approximately 90% of the participants were married only 10% were single(20).

The study suggests the educational status of participants, among them the majority (50.5%) of participants had an educational level of "Intermediate or below," while a smaller proportion were illiterate (43.5%), and only 6.0% had a "Graduate or above" level of education. These findings are Consistent with previous studies that reported that lower education levels are steadily associated with higher T2DM prevalence (21, 22).

The study reveals that glycemic control among individuals with T2DM, most respondents had poor glycemic control (76.74%), and only 23.26% of individuals achieved good glycemic control, which supports previous findings, a study conducted in India shows that 78.3% of individuals had poor glycemic control and only 21.7% had good glycemic control(23), while a study conducted in Nigeria stated that about 73.75% of the subjects had poor glycemic control(24). Consistently a further study conducted in Punjab province in Pakistan presents that good glycemic control was 14.5% and the remaining 85.5% were poor glycemic control(25).

The current study shows a significant relationship between higher levels of anxiety and poorer glycemic control ($p < 0.009$). This suggests that patients with poor glycemic control are more likely to experience elevated levels of anxiety. This finding aligns with recent studies, such as a study conducted in Mexico, which reported that anxiety was significantly associated with unstable glycemic control ($p < 0.001$)(26). Another study on T2DM in 2024 further corroborates these results, indicating that there was a direct and positive correlation ($p = 0.05$) observed between the anxiety score and glycemic control(27).

The results indicate a significant association between glycemic control and depression severity ($p = 0.016$), suggesting that poor glycemic control can contribute to the development or worsening of depressive symptoms in individuals with diabetes. This finding aligns with recent literature that highlights that high blood glucose levels can impact mental health, particularly in those with diabetes. A study conducted in Poland in 2020 supported the current study, it demonstrated that the risk of depressive symptoms in T2DM patients increases with poor glycemic control ($P <0.010$)(28). Furthermore, an analysis in Pakistan demonstrated that the impact of glycemic control on mental health is significant, with patients experiencing higher depression rates correlating with elevated HbA1c levels(12).

These studies suggest that poor glycemic control induces anxiety and depression which contributes to poor quality of life. These findings underscore the importance of addressing glycemic control not only as a physical health measure but also as a critical component of mental health management. Effective diabetes management strategies are aimed at stabilizing these levels.

CONCLUSION AND RECOMMENDATIONS

The findings revealed a significant relationship between poor glycemic control and heightened levels of anxiety and depression. Patients with poor glycemic control were more likely to experience increased anxiety and depression. This highlights the importance of monitoring and managing blood sugar levels not only for physical health but also for maintaining psychological well-being. Addressing glycemic control effectively could help reduce the emotional and mental health burdens faced by diabetes patients. Mental health professionals should be part of the diabetes care team to provide counseling and psychological support, helping patients manage the emotional burden of their condition. Further longitudinal studies should investigate the effectiveness of improving glycemic control to develop positivity in mental health.

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