Original Article

Psychological Distress, Glycemic Control, and Vitamin D Status in Patients with Type-2 Diabetes Mellitus from Khyber Pakhtunkhwa, Pakistan: A Cross-Sectional Study

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ABSTRACT

Background: Psychological distress is increasingly recognized as an important comorbidity in patients with type 2 diabetes mellitus (T2DM) and may adversely affect glycemic control. Emerging evidence also suggests an association between vitamin D deficiency and both metabolic dysregulation and mental health disorders; however, data from Pakistani populations remain limited.

Objective: To assess the frequency of depression, anxiety, and stress and to examine their association with glycemic control and serum vitamin D status among patients with T2DM in Khyber Pakhtunkhwa, Pakistan.

Methodology: This hospital-based cross-sectional study was conducted at the Endocrinology Department of Lady Reading Hospital, Peshawar, from December 2022 to March 2023. A total of 200 adults with T2DM aged 25–60 years were enrolled using non-probability consecutive sampling. Psychological distress was assessed using the Depression, Anxiety and Stress Scale-21 (DASS-21). Biochemical parameters included fasting blood glucose, random blood glucose, glycated hemoglobin (HbA1c), and serum 25-hydroxyvitamin D [25(OH)D] levels. Dietary vitamin D intake was evaluated using a 24-hour dietary recall. Data were analyzed using SPSS version 20. Pearson correlation and multiple linear regression analyses were applied to determine associations between psychological distress, glycemic parameters, and vitamin D levels.

Results: Participants exhibited poor glycemic control, with mean HbA1c levels of 9.59 ± 2.41% in males and 9.51 ± 1.76% in females. Mean serum vitamin D levels indicated vitamin D insufficiency in both genders (29.16 ± 5.07 ng/mL in males and 28.95 ± 4.86 ng/mL in females). Moderate to extremely severe depression, anxiety, and stress were observed in a substantial proportion of patients, with higher severity among females. HbA1c levels showed a positive association with depression and stress scores, indicating higher psychological distress with poorer glycemic control. Serum vitamin D levels demonstrated a weak inverse relationship with depression and anxiety scores, though these associations were not statistically significant.

Conclusion: Patients with T2DM demonstrated a high burden of psychological distress, suboptimal glycemic control, and vitamin D insufficiency. These findings emphasize the need for an integrated approach to diabetes management that includes routine mental health screening and nutritional assessment alongside metabolic control.

KEY WORDS: Type 2 diabetes mellitus; Psychological distress; Vitamin D insufficiency; Glycemic control; Depression; DASS-21.

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a major public health concern worldwide and is frequently accompanied by psychological comorbidities such as depression, anxiety, and stress. These conditions can negatively influence self-care behaviors, treatment adherence, and overall glycemic control, thereby increasing the risk of diabetes-related complications. Psychological distress has been reported to be significantly more prevalent among individuals with diabetes compared to the general population, with depression and anxiety adversely affecting metabolic outcomes and quality of life.[1,2]

Vitamin D, traditionally known for its role in calcium homeostasis and bone metabolism, has been increasingly implicated in extra-skeletal functions, including immune modulation, inflammation, and neuropsychological health. Vitamin D receptors are widely distributed in the brain, suggesting a potential role in mood regulation and cognitive function.[3] Hypovitaminosis D is common globally and appears to be particularly prevalent in South Asian populations due to limited sun exposure, dietary insufficiency, and cultural practices.[4]

Several studies have reported associations between low serum vitamin D levels and poor glycemic control, insulin resistance, and increased inflammatory markers in individuals with T2DM.[5,6] Additionally, vitamin D deficiency has been linked to higher rates of depression and anxiety, although findings have been inconsistent and population-specific data remain scarce. A systematic review has demonstrated a higher prevalence of anxiety disorders among adults with diabetes, highlighting the bidirectional relationship between metabolic and psychological health.[7]

In Pakistan, limited research has explored the combined burden of psychological distress, glycemic dysregulation, and vitamin D deficiency in patients with T2DM, particularly in populations from Khyber Pakhtunkhwa. Therefore, the present study aimed to determine the frequency and severity of depression, anxiety, and stress and to assess their association with glycemic control and serum vitamin D status among patients with type 2 diabetes mellitus attending a tertiary care hospital in Khyber Pakhtunkhwa, Pakistan.[8]

METHODOLOGY

This hospital-based cross-sectional observational study was conducted at the Department of Endocrinology, Lady Reading Hospital (LRH), Peshawar, Khyber Pakhtunkhwa, Pakistan, from December 2022 to March 2023.

Ethical approval was obtained from the Institutional Ethical Review Committee of the College of Home Economics, University of Peshawar. Administrative permission was also granted by the hospital authorities. The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment, and confidentiality of personal information was strictly maintained.

The sample size was calculated using an estimated prevalence of psychological distress of 50% among patients with T2DM, with a 95% confidence level and a margin of error of 7%, yielding a minimum required sample of 196 participants. To compensate for potential incomplete data, 200 patients were enrolled using non-probability consecutive sampling.

Adult patients aged 25–60 years with a confirmed diagnosis of type 2 diabetes mellitus attending the outpatient and inpatient services of the Endocrinology Department at LRH were included in the study.

Inclusion Criteria: Diagnosed cases of type 2 diabetes mellitus, Age between 25 and 60 years, Both male and female patients, No intake of vitamin D supplementation during the preceding six months

Exclusion Criteria: Presence of acute or chronic infections, Major diabetes-related complications (e.g., amputations, end-stage renal disease). Pregnant or lactating women, Patients with known psychiatric illness receiving treatment

Data were collected using a structured, interviewer-administered questionnaire that included sociodemographic characteristics, clinical history, dietary assessment, biochemical parameters, and psychological evaluation. For participants with limited literacy, the questionnaire and psychological scale were administered verbally.

Venous blood samples were obtained under aseptic conditions. Fasting blood glucose (FBG), random blood glucose (RBG), and glycated hemoglobin (HbA1c) values were recorded from hospital laboratory reports. Serum 25-hydroxyvitamin D [25(OH)D] levels were also obtained from laboratory records.

Vitamin D status was categorized according to Endocrine Society clinical practice guidelines:

- Deficiency: <20 ng/mL,
- Insufficiency: 20–29 ng/mL ,
- Sufficiency: ≥30 ng/mL

Dietary Assessment: Dietary vitamin D intake was assessed using a single 24-hour dietary recall interview. Portion sizes were estimated using household measures. Nutrient analysis was performed using Windiet software (2005 version). Mean daily vitamin D intake was compared with the recommended dietary allowances for respective age groups.

Assessment of Psychological Distress: Psychological distress was evaluated using the Depression, Anxiety and Stress Scale-21 (DASS-21).[9] The scale consists of 21 items, with seven items each assessing depression, anxiety, and stress. Each item is scored on a 4-point Likert scale ranging from 0 (did not apply to me) to 3 (applied to me most of the time). The scores for each domain were summed and multiplied by two to obtain the final scores. Severity was categorized as normal, mild, moderate, severe, or extremely severe according to standard cut-off values.

Statistical Analysis: Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Independent sample t-tests were used to compare continuous variables between male and female participants.

Pearson correlation analysis was performed to assess the relationship between:

- HbA1c and DASS-21 scores.
- Serum vitamin D levels and DASS-21 scores

Multiple linear regression analysis was applied to identify independent predictors of depression, anxiety, and stress scores, using HbA1c, serum vitamin D levels, age, gender, and duration of diabetes as explanatory variables. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 200 patients with type 2 diabetes mellitus were included in the study, comprising 104 males (52%) and 96 females (48%). The majority of participants belonged to urban areas (70%) and lived in extended family systems (66.5%). More than half of the participants (55%) had no formal education, and most reported a monthly household income below PKR 50,000.

Overall glycemic control was poor in both genders. The mean HbA1c level was 9.59 ± 2.41% in males and 9.51 ± 1.76% in females, exceeding recommended targets. Mean serum vitamin D levels indicated a high prevalence of hypovitaminosis D, with values of 29.16 ± 5.07 ng/mL in males and 28.95 ± 4.86 ng/mL in females. No statistically significant gender-based differences were observed in vitamin D status.

Mean dietary vitamin D intake was below recommended dietary allowances across all age groups. Participants aged 25–49 years had lower mean intakes compared to those aged ≥50 years; however, intake remained inadequate in both males and females.

Psychological Distress (DASS-21): Moderate to extremely severe levels of depression, anxiety, and stress were observed in a substantial proportion of participants. Female patients demonstrated a higher

Table-I: Sociodemographic, Glycemic, Vitamin D, and Psychological Characteristics of Study Participants (n = 200).

Variable	*Total (n=200)*	*Males (n=104)*	*Females (n=96)*
Age (years)	25–60	—	—
Residence			
Urban, n (%)	140 (70.0)	—	—
Rural, n (%)	60 (30.0)	—	—
Family system			
Extended, n (%)	133 (66.5)	—	—
Nuclear, n (%)	67 (33.5)	—	—
Education status			
No formal education, n (%)	110 (55.0)	—	—
HbA1c (%), mean ± SD	—	9.59 ± 2.41	9.51 ± 1.76
Serum Vitamin D (ng/mL), mean ± SD	—	29.16 ± 5.07	28.95 ± 4.86
Dietary vitamin D intake	Below RDA	Below RDA	Below RDA
Depression (DASS-21)	Moderate–severe common	Moderate	Higher severity
Anxiety (DASS-21)	Moderate–severe common	Moderate	Higher severity

RDA = Recommended Dietary Allowance.

prevalence of severe and extremely severe depression and anxiety compared to males. Mean DASS-21 scores suggested moderate depression and stress in both genders, while anxiety scores were higher among females.

Association Between Psychological Distress, Glycemic Control, and Vitamin D: Pearson correlation analysis demonstrated a positive association between HbA1c levels and depression scores, indicating higher psychological distress with poorer glycemic control. Serum vitamin D levels showed a weak inverse relationship with depression and anxiety scores; however, these associations did not reach statistical significance.

DISCUSSION

In this cross-sectional study of patients with type 2 diabetes mellitus (T2DM) attending a tertiary care hospital in Khyber Pakhtunkhwa, we observed a high frequency of psychological distress—particularly depression, anxiety, and stress—along with suboptimal glycemic control and vitamin D insufficiency. These findings underscore the multifaceted burden of T2DM and support the growing consensus that metabolic, psychological, and nutritional factors interact to influence health outcomes in diabetes management.[10] Our study demonstrated that higher HbA1c levels were positively associated with increased depression and stress scores, indicating that poor glycemic control is linked with psychological distress. This relationship is consistent with findings from larger analyses showing that depression and diabetes distress are significantly correlated with poorer glycemic control and reduced self-care behaviors across diverse populations with diabetes.[11] Meta-analytic evidence indicates that psychological factors like depression and distress are associated with higher HbA1c levels and impaired treatment adherence, suggesting that mental health comorbidity can exacerbate diabetes severity and vice versa.[10,11]

A recent systematic review highlights that psychological interventions, including cognitive-behavioral approaches, can significantly reduce diabetes distress and improve quality of life, although their long-term impact on glycemic indices such as HbA1c remains uncertain.[12] These findings reinforce the importance of incorporating structured psychosocial support into routine diabetes care, especially for patients exhibiting significant distress.

Our observation of higher psychological distress among female patients aligns with international literature suggesting that women with T2DM often report greater levels of depression and anxiety compared to men, potentially due to differences in sociocultural stressors, health perceptions, and coping mechanisms.[13] This sex disparity highlights the need for gender-sensitive screening and tailored psychosocial interventions.

Regarding vitamin D status, participants in our cohort had mean serum 25-hydroxyvitamin D levels in the insufficiency range. Although the correlations between vitamin D levels and psychological distress were weak and not statistically significant, the trend observed in our study aligns with emerging evidence linking low vitamin D status with mood disorders and depressive symptoms among persons with diabetes. A recent systematic review and meta-analysis focusing specifically on diabetes populations found that vitamin D deficiency is frequently associated with depressive symptoms, although the strength of this relationship varies across studies and populations.[14]

The potential biological pathways linking vitamin D status with mood and metabolic regulation include modulation of inflammatory cytokines, neuroendocrine function, and insulin sensitivity. While observational data support these associations, interventional evidence is mixed but promising. Meta-analyses of randomized controlled trials involving vitamin D supplementation in patients with T2DM indicate that supplementation can significantly improve depressive symptoms compared with placebo, suggesting that optimizing vitamin D status may confer psychological as well as metabolic benefits.[14,15]

The observed interplay among psychological distress, glycemic control, and vitamin D status in our study highlights the multidimensional nature of diabetes and supports integrated care models. It suggests that addressing only glycemic targets without considering psychological well-being and nutritional status may fail to optimize outcomes.

This study has several limitations. First, its cross-sectional design precludes establishing a causal relationship between psychological distress, glycemic control, and vitamin D status. Second, the use of non-probability consecutive sampling and a single-center setting may limit the generalizability of the findings to the wider population of patients with T2DM in Pakistan. Third, dietary vitamin D intake was assessed using a single 24-hour dietary recall, which may not accurately reflect habitual intake and is subject to recall bias. Fourth, biochemical parameters were obtained from hospital laboratory records, and standardization of laboratory methods across all participants could not be ensured. Finally, although DASS-21 is a validated instrument, self-reported psychological assessments are inherently susceptible to reporting bias, particularly in populations with limited literacy or stigma related to mental health.

CONCLUSION

Patients with type 2 diabetes mellitus in this cohort exhibited a high burden of psychological distress, suboptimal glycemic control, and widespread vitamin D insufficiency. A significant association between poor glycemic control and higher levels of depression and stress underscores the importance of addressing mental health as an integral component of diabetes management.

Conflict of Interest: The authors declare no conflict of interest.

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REFERENCES

1. Grigsby AB, Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. Prevalence of anxiety in adults with diabetes: a systematic review. J Psychosom Res. 2002;53(6):1053–1060.
2. Tiwari HK, Kumar P. Depression, anxiety, and stress levels in patients with type 2 diabetes mellitus. Int J Community Health Med Res. 2019;5(3):1–6.
3. Lips P, Eekhoff M, van Schoor N, Oosterwerff M, de Jongh R, Krul-Poel Y, et al. Vitamin D and type 2 diabetes. J Steroid Biochem Mol Biol. 2017;173:280–285.
4. Kazemi A, Sharifi F, Jafari N, Mousavinasab N. High prevalence of vitamin D deficiency among pregnant women and their newborns in an Iranian population. J Womens Health. 2009;18(6):835–839.
5. Gradinaru D, Borsa C, Ionescu C, Margina D, Prada GI, Jansen E. Vitamin D status and oxidative stress markers in the elderly with impaired fasting glucose and type 2 diabetes mellitus. Aging Clin Exp Res. 2012;24(6):595–602.
6. Blonde L, Aschner P, Bailey C, Ji L, Leiter LA, Matthaei S, et al. Gaps and barriers in the control of blood glucose in people with type 2 diabetes. Diabetes Vasc Dis Res. 2017;14(3):172–183.
7. Hajebrahimi B, Kiamanesh A, Farid AA, Asadikaram G. Type 2 diabetes and mental disorders: a plausible link with inflammation. Cell Mol Biol. 2016;62(13):71–77.
8. Fazelian S, Amani R, Paknahad Z, Kheiri S, Khajehali L. Effect of vitamin D supplementation on mood status and inflammation in vitamin D-deficient type 2 diabetic women with anxiety: a randomized clinical trial. Int J Prev Med. 2019;10:17.
9. DASS-21 Manual. Depression Anxiety Stress Scales. Queensland Government. Available from: https://maic.qld.gov.au/wp-content/uploads/2016/07/DASS-21.pdf
10. Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. The prevalence of comorbid depression in adults with diabetes: a meta-analysis. Diabetes Care. 2001;24(6):1069–78.
11. Kim HJ, Kwon O. Nutrition and exercise: Cornerstones of health with emphasis on obesity and type 2 diabetes management—A narrative review. Obesity Reviews. 2024;25(8):e13762.
12. Yang X, Li Z, Sun J. Effects of cognitive behavioral therapy–based intervention on improving glycaemic, psychological, and physiological outcomes in adult patients with diabetes mellitus: a meta-analysis of randomized controlled trials. Frontiers in psychiatry. 2020;11:711.
13. McCoy MA, Theeke LA. A systematic review of the relationships among psychosocial factors and coping in adults with type 2 diabetes mellitus. International journal of nursing sciences. 2019;6(4):468-77.
14. Parker GB, Brotchie H, Graham RK. Vitamin D and depression. Journal of affective disorders. 2017;208:56-61.
15. Mikola T, Marx W, Lane MM, Hockey M, Loughman A, Rajapolvi S, Rocks T, O'Neil A, Mischoulon D, Valkonen-Korhonen M, Lehto SM. The effect of vitamin D supplementation on depressive symptoms in adults: A systematic review and meta-analysis of randomized controlled trials. Critical reviews in food science and nutrition. 2023;63(33):11784-801.

Author Contributions:

Sidra Naheed and **Fazia Ghaffar** conceived and designed the study.
Adan Javed and **Hoor Maab Kaifi** were involved in patient recruitment and data collection.
Sidra Naheed performed the statistical analysis and interpretation of data.
Fazia Ghaffar drafted the initial manuscript.
All authors critically reviewed the manuscript for important intellectual content, revised it for accuracy and clarity, and approved the final version for publication.

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