

Duration of Diabetes Predicts Severe Depression and Cognitive Decline in North Indian Adults With Type 2 Diabetes: A Mixed Methods Cross-Sectional Study

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is associated with elevated rates of psychological comorbidity. The study examined the prevalence and correlates of psychological dysfunction among adults with T2DM in North India, focusing on disease duration and psychosocial factors. A convergent mixed-methods design was employed with 87 adults (ages 40–75) with T2DM for > 1 year, recruited from a tertiary care hospital. Quantitative assessments included the DASS-42, GHQ-12, MHQoL, MoCA and Bender Gestalt Test. Focus Group Discussions (n= 12 participants) explored lived experiences of emotional distress, coping, sleep and eating patterns. Pearson correlations and hierarchical regression analyses examined relationships between diabetes duration and psychological outcomes. Mean diabetes duration was 11.9 years. Participants exhibited severe depression mean = 21.05, SD= 4.19), moderate anxiety (mean= 12.95, SD= 4.74), moderate stress (mean= 18.35, SD= 5.59), compromised quality of life (mean= 4.26, SD= 0.15), psychological distress (mean= 5.79, SD = 1.5) and mild cognitive impairment (mean= 23.22, SD= 4.39) and visuomotor impairment (mean= 11.5, SD= 4.38). Diabetes duration correlated significantly with depression ($r= 0.450$, $p<0.01$), stress ($r=0.365$, $p<0.01$) and visuomotor impairment ($r= 0.523$, $p<0.01$) and inversely with quality of life ($r= -0.648$, $p<0.01$) and general health ($r= -0.806$, $p<0.01$). Qualitative findings revealed emotional repression, food-related shame, sleep disturbance and maladaptive coping. Psychological dysfunction is highly prevalent in T2DM, with longer disease duration predicting greater depression, cognitive decline and reduced quality of life. Findings underscore the necessity for routine mental health screening and integrated psychosocial care in diabetes management.

Keywords: Anxiety, Depression, General Health, Psychological Dysfunction, Stress, Type 2 Diabetes Mellitus

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a significant chronic metabolic disorder marked by enduring hyperglycaemia resulting from insulin resistance and/or relative insulin deficiency (1). Its prevalence is escalating rapidly globally, including in India, where over 77 million adults

are currently suffering from T2DM (2). Currently, there is an increasing acknowledgment of significant psychological comorbidities that complicate disease management and patient outcomes. Alongside traditional complications, such as neuropathy, nephropathy, cardiovascular disease, and retinopathy, T2DM often

coexists with mental health disorders, including depression, anxiety, diabetes-specific distress, and cognitive impairment.

Recent studies indicate that the prevalence of psychiatric comorbidity in individuals with T2DM varies from 19% to nearly 60% (3), with depression being the most prevalent condition, impacting approximately 30–42% of patients (4,5). These rates are significantly elevated compared to the non-diabetic population, particularly impacting women and older adults. Anxiety disorders, diabetes-related distress, and substance use issues frequently co-occur (6,7), especially during critical periods such as diagnosis, the emergence of complications, or the necessity for more rigorous treatment protocols. The burden of these comorbidities is not only epidemiologically significant but also has profound clinical consequences: depression, anxiety, and distress are independently linked to decreased self-care, suboptimal medication adherence, inadequate dietary regulation, diminished physical activity, and ultimately, poorer glycemic control and increased rates of complications. The presence of mental health comorbidity significantly elevates the risk of all-cause mortality, hospitalizations due to complications, and detrimental health expenditures (6,8).

The association between T2DM and psychological comorbidity is complex and likely bidirectional: the stress associated with disease management, worries about complications, and societal stigma may adversely affect mental health, whereas depression and anxiety have been demonstrated to increase the risk of developing diabetes and impede effective glycemic control (6,9). Moreover, epidemiological evidence suggests that women and individuals of lower socioeconomic status may face increased risk, and that cultural and systemic factors can intensify psychological distress within T2DM populations (4,5,7).

In spite of this, mental health screening and treatment integration are still not consistent in diabetes care, especially in places where resources are limited or where people come from different cultures. Gender, socioeconomic status, social support, and cultural factors can all increase susceptibility to psychological distress, while ineffective coping mechanisms or maladaptive behaviors—such as substance abuse or social withdrawal—may intensify the burden of disease. Considering these challenges, the current study aimed to deliver an evaluation of psychological dysfunction—including depression, anxiety, stress, quality of life, cognitive function, and associated variables—among adults with T2DM. This study aims to elucidate the extent and characteristics of psychological dysfunction in T2DM by concentrating on both clinical and psychosocial dimensions. Through these efforts, it aims to inform best

practice for holistic patient-centered diabetes care, promote the systematic integration of mental health in chronic disease management, and provide a foundation for targeted psychosocial interventions in high-risk populations.

METHODOLOGY

Study Design:

A convergent parallel mixed-methods design was employed, in which both quantitative and qualitative data were collected, analyzed separately and then integrated at the interpretation stage to develop a comprehensive understanding of psychological dysfunction in adults with T2DM. The quantitative part of the study was conducted using a cross-sectional design, in which the correlational association between the duration of diabetes and psychological dysfunction was examined. The qualitative section employed Focus Group Discussions (FGDs) to contextualise quantitative findings with participants' lived experiences of emotional distress, coping, sleep, eating patterns and social behaviour.

Ethics and Informed Consent:

The study was conducted after approval from the Institutional Ethics Committee (IEC) of Santosh Deemed University, Ghaziabad, Uttar Pradesh, India (No.: SU/2025/CRF/396). Written informed consent was obtained from all participants before participating in the study. The participants were assured of the confidentiality of the informational and the freedom to withdraw at any time without any consequences. For participants with low literacy, the procedure for obtaining informed consent was conducted verbally in India in the presence of a witness.

Participants and Sampling:

Participants were recruited from the Out-patient Department of Medicine, Santosh Deemed University. Consecutive sampling was used to approach all eligible adults attending the OPD during the recruitment period. Participants who met the eligibility criteria and provided informed consent were enrolled until the target sample size was reached.

Sample Size Justification:

Based on an expected prevalence of depression in T2DM of approximately 30%, a margin of error of 10% and a confidence level of 95%, the minimum required sample size was calculated using the formula:

$$\begin{aligned} n &= \frac{Z^2 \times p(1-p)}{e^2} \\ &= \frac{(1.96)^2 \times 0.30 \times 0.70}{(0.10)^2} \\ &\approx 81 \end{aligned}$$

A final sample of 87 participants was recruited, exceeding the minimum requirement and providing adequate statistical power for correlation analyses.

Inclusion and Exclusion Criteria:

Inclusion Criteria:

1. Adults aged 40 to 75 years
2. Clinical diagnosis of T2DM for at least one year, confirmed via medical records
3. Ability to understand and respond to assessment tools administered in English or Hindi

4. Willingness to provide written informed consent

Exclusion Criteria:

1. Current diagnosis of an acute psychiatric disorder requiring patient care (e.g., acute psychosis, manic episode)
2. Severe cognitive impairment precluding informed consent (MoCA < 10)
3. Inability to communicate in English or Hindi
4. Refusal to participate

Figure 1 depicts the flow diagram of the study

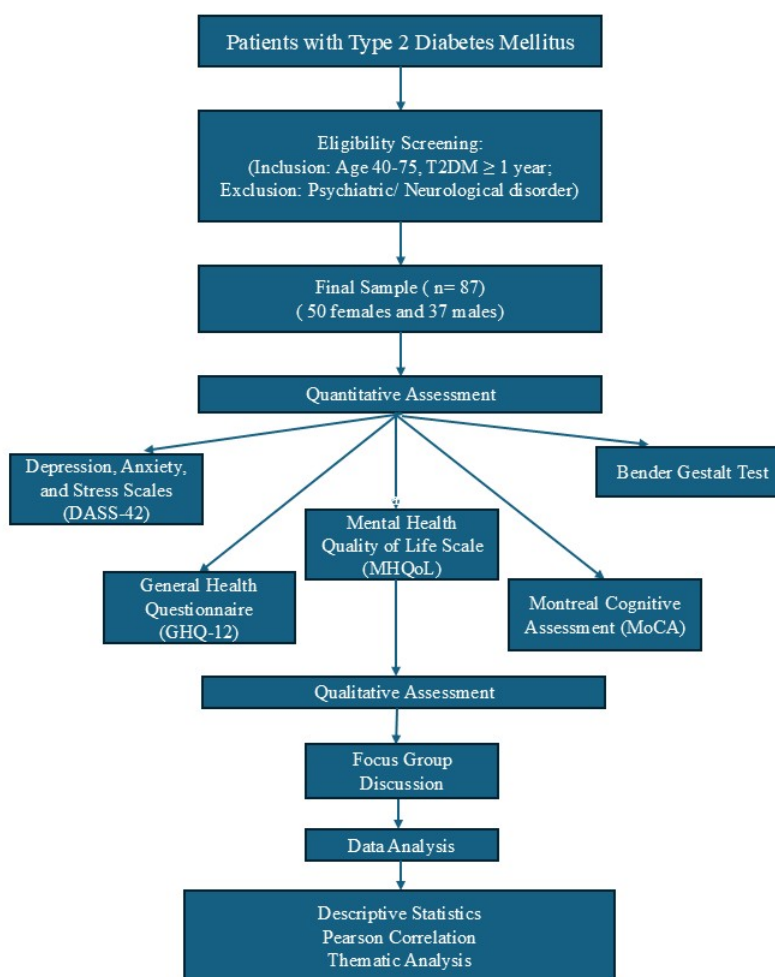


Figure 1: Flowchart representing participant recruitment, assessments and data analysis.

Quantitative Data Collection:

All assessments were administered by trained research personnel in a private room at the OPD. The entire data collection process took approximately 60-75 minutes per participant. The following validated instruments were used:

1. Depression, Anxiety and Stress Scale – 42 items (DASS-42) (10): Assesses severity of depression, anxiety and stress symptoms over the past week. Severity classifications used:
Depression: Normal (0-9), Mild (10-13), Moderate (14-20), Severe (21-27), Extremely Severe (28+)

Anxiety: Normal (0-7), Mild (8-9), Moderate (10-14), Severe (15-19), Extremely Severe (34+)

Stress: Normal (0-14), Mild (15-18), Moderate (19-25), Severe (26-33), Extremely Severe (34+)

2. General Health Questionnaire – 12 items (GHQ-12) (11) : Screens for general psychological distress. Scored using binary (0-0-1-1) method; a total score ≥ 4 indicates clinically significant psychological distress
3. Mental Health Quality of Life Scale (MHQoL-7D): Assesses seven dimensions of mental health-related quality of life. Lower scores indicate poorer quality of life.
4. Montreal Cognitive Assessment (MoCA): Detects mild cognitive impairment. Scores range from 0-30; a score < 26 indicates mild cognitive impairment, with one point added for participants with ≤ 12 years of education (12)
5. Bender Visual-Motor Gestalt Test- Second Edition (BGT-II): Assesses visuomotor coordination. The Koppitz Developmental Scoring System was used, where higher error scores indicate greater visuomotor impairment.

Demographic and clinical data – including age, gender, diabetes duration, family history, medication regime, HbA1c levels (from medical records within the preceding 3 months), socioeconomic status, educational level, sensory function (assessed via standardised clinical examination) and substance use history (classified as current, past or none) – were collected via investigator-administered structured interview

Clinical stability was defined as: Stable = HbA1c $\leq 7.5\%$ with no acute complications in the preceding 6 months; Unstable = HbA1c $> 7.5\%$ or presence of an active complication requiring intervention.

Quantitative Data Analysis

Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were summarized as frequencies and percentages.

Initially, Pearson's correlation analysis was conducted to examine bivariate associations between HbA1c and key demographic, clinical, and psychological variables. A correlation matrix was prepared for all major study variables.

To determine independent predictors of HbA1c while controlling for confounding variables, a hierarchical multiple regression analysis was performed. HbA1c was entered as the dependent variable. Predictor variables were entered in three sequential blocks based on theoretical relevance:

- Block 1 (Demographic Variables): age, gender, socioeconomic status, and educational qualification.
- Block 2 (Clinical Variables): duration of diabetes, health status, family history of diabetes, and available treatment-related variables.
- Block 3 (Psychological Variables): depression, anxiety, stress (DASS-42), quality of life (MHQoL-7D), and general health (GHQ-12).

At each step, model fit indices including correlation coefficient (R), coefficient of determination (R^2), adjusted R^2 , F -statistic, and significance values were examined. Standardized beta coefficients (β), 95% confidence intervals, and p -values were reported for individual predictors.

A p -value of < 0.05 was considered statistically significant for all analyses. This analytical framework enabled a robust evaluation of whether psychological variables independently predicted glycemic control beyond demographic and clinical influences.

Qualitative Data Collection

A subset of 12 participants was purposively selected from the quantitative sample of FGDs, stratified by gender (6 women, 6 men), diabetes duration (short: < 5 years; medium: 5-15 years; long: > 15 years), and clinical stability, to ensure maximum variation in experiences. Written consent was re-obtained for FGD audio recording.

Three FGDs were conducted (4 participants each), each lasting approximately 60-75 minutes, facilitated by a trained qualitative researcher with prior FGD experience. A semi-structured topic guide was used, covering: (1) emotional experience of living with diabetes, (2) sleep patterns and nocturnal disturbances, (3) relationship with food and dietary restriction, (4) substance use and coping, and (5) social support and help-seeking. Sessions were conducted in Hindi, audio-recorded with participant permission and transcribed verbatim. Member checking was conducted by sharing summary themes with participants to verify interpretive accuracy.

Qualitative Data Analysis:

Transcripts were analysed using Braun and Clarke's six-phase thematic analysis framework: (1) data familiarisation, (2) initial code generation, (3) theme searching, (4) theme reviewing, (5) theme definition and naming, and (6) report production (13). Two researchers independently coded a randomly selected 20% of transcripts; inter-rater reliability was assessed using Cohen's Kappa (target $\kappa \geq 0.70$). Disagreements were resolved through discussion and consensus. A reflexivity statement was prepared, acknowledging that the research team included clinicians who may hold assumptions about diabetes-related distress.

Mixed Methods Integration:

Quantitative and qualitative findings were integrated using a convergent parallel integration approach (14). Integration occurred at the interpretation stage via:

1. Joint display table: Juxtaposing quantitative scores with corresponding qualitative themes (e.g., high DASS-42 depression scores alongside the theme of emotional repression)
2. Meta-inferences: Drawing conclusions that required both data sources to explain (e.g., why duration correlates with stress was contextualised by the qualitative theme of progressive fatigue and avoidance behaviours)
3. Convergence and divergence analysis: Noting where qualitative themes confirmed, elaborated or challenged quantitative patterns

RESULTS

Quantitative Analysis:

The sample included 87 people with T2DM. The sample comprised 50 female and 37 male participants. Of the participants, 52% had a positive family history of diabetes, whereas 35% had no such history. Paternal inheritance was most prevalent among those who indicated a family history (14), followed by maternal inheritance (9), and both parents (6). Most of the participants (58 people) lacked or had irrelevant information regarding which family member had diabetes.

In terms of pharmacological treatment, the most common medication prescribed to patients was pioglitazone (20 cases), which was followed by metformin (16 cases), insulin (16 cases), metformin plus insulin (14 cases), sitagliptin (13 cases), and glimepiride (8). The group's educational backgrounds were also diverse: 26 had a diploma, 26 were postgraduates, 16 had finished high school, and 14 were graduates.

As for their socioeconomic status, there were 26 participants in the low-income group, 30 in the high-income group, and 31 in the middle-income group. 50 people were classified as clinically stable and 37 as unstable based on health status evaluations.

Functional and sensory health indicators were assessed among participants. Specifically, 42 individuals reported intact touch sensation, whereas 45 did not. Similarly, 41 participants demonstrated intact vision, while 46 did not; 41 had intact hearing, whereas 46 did not. Furthermore, 40 participants exhibited intact olfactory function, compared to 47 who did not, and 43 participants reported intact gustatory function, while 44 did not. 47 people had a negative history of night blindness, while 40 had a positive history. 30 participants denied any history of substance abuse, while 57 participants reported a history.

Duration of diabetes and the psychological and cognitive assessments conducted in the study yielded the following results, as shown in Table 1.

Table 1: Mean and SD values of Duration of diabetes among participants and their scores of 7 psychological parameters

Parameter	Mean	SD
Duration of Diabetes (in years)	11.9	1.41
Depression (DASS-42)	21.05	1.49
Anxiety (DASS-42)	12.95	4.74
Stress (DASS-42)	18.35	5.59
MHQoL	4.26	0.15
GHQ - 12	5.79	1.5
Cognitive Impairment (MoCA)	23.22	4.39
Visuo-motor Skills (Bernard Gestalt)	11.5	4.38

Numerous significant correlations between the dataset's psychological, cognitive, and diabetes-related variables were found by correlation analysis, as denoted in Table 2.

Table 2: Pearson correlation coefficient between diabetes and psychological factors

	Depression	Anxiety	Stress	MHQoL	Well-being	Visual-motor Skills	Cognitive Impairment
Duration of Diabetes (Years)	0.450**	0.222*	0.365**	-0.648**	-0.806**	0.523**	-0.791**

** . Correlation is significant at the 0.01 level (2-tailed).
* .

Correlation is significant at the 0.05 level (2-tailed).

Diabetes duration demonstrated significant positive correlations with scores of Cognitive Impairment on Bender Gestalt test ($r = 0.523$), stress ($r = 0.365$), and depression ($r = 0.450$), indicating that longer-term diabetes is associated with increased psychological distress and neuropsychological impairment. There was only a slight correlation between the chronicity of diabetes and anxiety symptoms, as evidenced by the weaker correlation between duration and anxiety ($r = 0.222$).

On the other hand, the length of diabetes showed significant negative correlations with the GHQ-12 general health scores ($r = -0.806$), MoCA cognitive scores of visual-motor skills ($r = -0.791$), and MHQoL-7D quality of life scores ($r = -0.648$). This suggests that a longer duration of diabetes is linked to worse quality of life, cognitive impairment, and a decline in overall psychological health.

A correlation matrix was generated to examine bivariate relationships among all key variables, including demographic, clinical, and psychological measures. Pearson's correlation analysis indicated weak and non-significant associations between HbA1c and psychological variables such as depression, anxiety, stress, and quality of life (all $p > .05$).

Prior to regression analysis, assumptions of normality, linearity, and homoscedasticity were evaluated and met. Multicollinearity diagnostics indicated acceptable levels, with variance inflation factor (VIF) values < 2 for all predictors, suggesting no significant multicollinearity.

Hierarchical Multiple Regression Analysis

A hierarchical multiple regression analysis was conducted to determine whether demographic, clinical, and psychological variables independently predicted HbA1c levels after controlling for potential confounders.

Block 1: Demographic Variables

In the first step, demographic variables (age, gender, socioeconomic status, and educational qualification) were entered into the model. The overall model was not statistically significant, $F(4, 82) = 1.084$, $p = .370$, explaining 5.0% of the variance in HbA1c ($R^2 = .050$; adjusted $R^2 = .004$).

None of the individual demographic variables emerged as significant predictors (all standardized β coefficients, $p > .05$), indicating that HbA1c levels were not independently associated with demographic characteristics.

Block 2: Clinical Variables

In the second step, clinical variables including duration of diabetes, health status, and family history were added to the model to account for potential confounding effects. Where available, HbA1c-related clinical indicators and treatment variables (e.g., medication type) were considered.

The addition of clinical variables did not significantly improve the model ($\Delta R^2 = .007$, F change (3, 79) = 0.199, $p = .897$). The full model remained non-significant, $F(7, 79) = 0.686$, $p = .683$, with an adjusted R^2 of $-.026$.

None of the clinical predictors showed a statistically significant independent association with HbA1c (all β , $p > .05$). These findings suggest that, after controlling for demographic factors, clinical variables did not contribute meaningfully to glycemic variability in this sample.

Block 3: Psychological Variables

In the final step, psychological variables including depression, anxiety, and stress (DASS-42), quality of life (MHQoL-7D), and general health (GHQ-12) were entered into the model.

The inclusion of psychological variables did not significantly improve model fit ($R^2 = .048$, adjusted $R^2 = -.015$, $F(5, 76) = 0.762$, $p = .580$). The change in explained variance was minimal and non-significant.

Importantly, none of the psychological variables demonstrated significant independent effects on HbA1c after controlling for demographic and clinical confounders (all β , $p > .05$; 95% confidence intervals included zero).

Overall Model Interpretation

Across all hierarchical steps, no statistically significant predictors of HbA1c were identified. The total variance explained by the models remained low (4%–6%), indicating limited explanatory power. The addition of clinical and psychological variables did not significantly improve prediction beyond demographic factors.

The lack of significant findings persisted even after adjusting for potential confounders, suggesting that the observed relationships between psychological variables

and glycemic control are weak and may not represent independent effects.

After controlling for demographic and clinical confounders, psychological variables (depression, anxiety, stress, quality of life, and general health) were not significant independent predictors of HbA1c levels. These findings suggest that glycemic control in this population is likely influenced by other factors not captured in the current model.

Qualitative Analysis:

Three FGDs with 12 participants yielded four major themes contextualizing psychological burden in T2DM. Quotes are translated from Hindi; identifiers indicate gender and diabetes duration (e.g. F-12y = Female, 12 years).

Theme 1: Emotional Repression and Social Withdrawal

Participants consistently described suppressing negative emotions to avoid burdening family members, particularly women who feared being perceived as weak. This emotional inhibition manifested as social isolation:

"I don't tell my children how scared I am about going blind. I just smile and say everything is fine. But inside, I cry every night." (F-64Y)

"I stopped going to family functions. Everyone asks why I'm not eating this or that. It's easier to stay home." (F-51Y)

Longer duration correlated with increased social inhibition, as participants progressively withdrew from gatherings where food was central. Many expressed persistent negative affect and hopelessness about future complications (*"I know it's coming for me too.... there's no cure, only management"*), aligning with severe depression detected quantitatively.

Theme 2: Conflicted Relationship with Food

Dietary management was deeply emotionally charged, with participants using moral language ("guilt", "sin", "weakness") to describe eating behaviours. Many described meal skipping driven by frustration or self-punishment:

"When I eat something, I feel so guilty, like I've committed a sin. I know I'm killing myself slowly." (F-48y)

"Some days I'm so angry about all the foods I can't eat that I just don't eat at all." (M-70y)

Food's central role in Indian social life created a lose-lose dilemma: adhering to restrictions meant isolation and family conflict. While eating socially acceptable foods caused poor glycemic control and subsequent shame. Participants noted that emotional distress intensified cravings for restricted foods, creating a bidirectional cycle between psychological and metabolic dysfunction.

Theme 3: Sleep Disturbance as Overlooked Mediator

Sleep disruption was universal yet rarely addressed by healthcare providers. Participants described fragmented sleep due to nocturia, nocturnal hypoglycemia and anticipatory anxiety:

"I wake up 4-5 times every night to urinate. By morning I'm exhausted before the day even starts." (M-64y)

"I'm terrified I'll have a hypo in my sleep and not wake up. So I keep checking my sugar at night. I barely sleep." (F-54y)

Poor sleep was explicitly linked to worsened mood, irritability, cognitive fog and reduced self-care adherence, suggesting sleep disturbance may both result from and amplify psychological dysfunction. This bidirectional relationship represents a critical but unassessed intervention target.

Theme 4: Heterogenous Coping Strategies

Coping varied widely from adaptive (spirituality, peer support, structured routines) to maladaptive (substance use, avoidance, denial). Substance use was framed as intentional stress management despite health awareness:

"When I'm frustrated, a cigarette calms me down. I know it's bad but it's the only thing that helps." (M-19y)

"I drink a little when I can't sleep or when I'm feeling too sad. It helps me forget about diabetes for a while." (M-12y)

Participants accessing peer support reported feeling less isolated (*"When I joined a support group, I realized I'm not alone"*), while those with long duration expressed profound burnout (*"After 18 years...I'm just tired. I don't care anymore"*). This exhaustion directly undermined self-care and quality of life.

Integration of Quantitative and Qualitative Findings:

Table 3 integrates quantitative psychological assessments with corresponding qualitative themes, demonstrating convergence and elaboration:

Domain	Quantitative Finding	Qualitative Theme	Integration
Depression	DASS-42 mean = 21.05 (Severe range)	Emotional repression; fear of burdening family; hopelessness about complications	Convergence + Elaboration: Severity confirmed; mechanisms revealed (emotional suppression, family burden fears)
Anxiety	DASS_42 mean = 12.95 (Moderate range)	Fear of hypoglycemia; worry about blindness/amputation; social eating anxiety	Convergence + Elaboration: Moderate anxiety confirmed; specific triggers identified (nocturnal hypoglycemia, complication fears, social eating)
Stress	DASS_42 mean= 18.35 (Moderate range)	Overwhelmed by dietary restriction; self-care exhaustion; coping inability	Convergence + Elaboration: Stress levels confirmed; lived experience shows sources (dietary burden, self-care
Quality of Life	MHQoL mean = 4.26 (Compromised)	Social isolation due to diet; avoidance of gatherings; loss of enjoyment	Convergence + Elaboration: Reduced QoL quantified; qualitative explains pathways (social withdrawal, dietary-related isolation)
Cognitive Function	MoCA mean = 23.22 (Below cutoff <26)	Forgetfulness; difficulty with medications, “mental fog”	Convergence: Mild cognitive impairment detected quantitatively and reported subjectively
Sleep Disturbance	Not measured	Prevalent insomnia; nocturia; hypoglycemia anxiety; chronic fatigue	Qualitative expansion: Identified critical gap: sleep disturbance emerged as major theme but was unmeasured in quantitative battery
Coping	Not measured	Mixed adaptive/maladaptive strategies; substance use; burnout	Qualitative expansion: heterogeneity revealed

Table 3: Integration of Quantitative and Qualitative Findings from participants

Meta-Inferences:

Three key insights required both data sources:

1. Duration-Depression Mechanism: The correlation between diabetes duration and depression ($r= 0.450$, $p<0.01$) is explained by progressive disease burden accumulation, anticipatory anxiety about complications and treatment fatigue – mechanisms identified qualitatively
2. Social isolation Mediates Quality of Life: Longer duration correlated with reduced quality of life ($r= 0.648$, $p< 0.01$) through progressive social withdrawal driven by dietary stigma and insulin-related shame, creating a pathway: duration isolation reduced QoL.
3. Sleep as Unmeasured mediator: Qualitative findings suggest sleep disturbance may mediate relationships between diabetes and

depression/anxiety, representing a bidirectional amplification cycle undetected by quantitative measures.

Qualitative methods effectively detect presence and severity of psychological dysfunction; qualitative inquiry illuminated lived experience, mechanisms and contextual factors. Strong convergence validated findings, while qualitative expansion identified critical assessment gaps – particularly sleep disturbance, eating-related distress and coping heterogeneity – essential for comprehensive diabetes care.

DISCUSSION

The study's quantitative results offer robust proof of the substantial psychological toll that people with T2DM bear. The DASS-42 showed moderate to high levels of psychological distress with mean scores of 19.1, 14.81, and 14.09 for stress, depression, and anxiety, respectively with depression falling in the severe category. These

findings are in line with earlier studies that showed that people with T2DM are more likely to experience psychological dysfunction because of the chronic nature of the condition, its complications, and the requirements of self-management (15, 16). It has been demonstrated that psychological distress in people with T2DM negatively impacts glycemic control, medication adherence, and general quality of life, resulting in a vicious cycle that makes managing the disease more difficult (17, 18).

The population's mental health issues are further highlighted by the mean General Health Questionnaire (GHQ-12) score of 7, which indicates moderate psychological dysfunction. Scores in this range indicate severe emotional distress that needs medical attention, and the GHQ-12 is frequently used to evaluate overall psychological well-being. This result is consistent with research showing that people with T2DM have high levels of psychological dysfunction, which is frequently associated with the strain of managing a chronic condition and anxiety about consequences like neuropathy, retinopathy, and cardiovascular disease (19, 20).

A mean score of 5.02 on the Mental Health Quality of Life (MHQoL) denotes a compromised quality of life, which is in line with earlier studies that demonstrate the detrimental effects of T2DM on both physical and mental health-related quality of life. The dual burden of managing diabetes and its related psychological issues, such as anxiety and depression, are frequently blamed for the lower MHQoL scores in this population (18, 20). Additionally, the decline in quality of life is made worse by diabetes-related complications like neuropathy and nephropathy, underscoring the necessity of integrated care approaches that consider both mental and physical health (16).

The substantial correlation between the length of diabetes and psychological outcomes is one of the study's main conclusions. Increased depression, stress, and cognitive impairments were associated with longer disease duration, as indicated by negative correlations with GHQ-12 ($r = -0.806$), MoCA ($r = -0.791$), and MHQoL ($r = -0.648$) scores. These findings are in line with earlier research that highlighted the long-term psychological toll of managing chronic illnesses (20, 22). Long-term diabetes is frequently accompanied by chronic hyperglycemia and insulin resistance, which are known to exacerbate neuroinflammation and cognitive decline and make managing the condition even more difficult (22). Participants in this study scored below the cutoff point for normal cognitive function, indicating particularly significant cognitive impairments as determined by the Montreal Cognitive Assessment (MoCA). This result is consistent with data that T2DM is a substantial risk factor

for dementia and mild cognitive impairment, most likely because of metabolic dysregulation and vascular damage (22).

Significant relationships between psychological distress and quality of life were also found in the study. Lower MHQoL scores were linked to higher levels of anxiety and depression, highlighting the significant influence of mental health on general wellbeing. This result is in line with research showing a reciprocal relationship between psychological distress and T2DM patients' quality of life (15, 19). For example, people who are more depressed are less likely to practice self-care practices like consistent exercise and blood sugar monitoring, which lowers their quality of life (17).

The quantitative information also emphasizes how stress affects diabetes care. Poorer self-management practices and a lower quality of life were linked to elevated stress levels as measured by DASS-42 scores. It has been demonstrated that stress triggers the hypothalamic-pituitary-adrenal (HPA) axis, raising cortisol levels that can worsen hyperglycemia and reduce insulin sensitivity (15, 16). The psychological toll of stress and this physiological reaction combine to produce a vicious cycle that deteriorates the mental and physical health of people with T2DM.

In the present study, bivariate correlations indicated that longer duration of diabetes was associated with greater depressive and stress symptoms, more neuropsychological impairment and poorer general health, cognitive performance and mental health-related quality of life, supporting the notion of a substantial cumulative psychological burden in longstanding T2DM. By contrast, neither demographic, clinical nor psychological variables predicted HbA1c independently in the hierarchical regression and the total explained variance was modest. This apparent discrepancy is expected given that multiple regression estimates the unique contribution of each factor after accounting for shared variance with other correlated predictors; in our sample, duration of illness, clinical status and psychological distress are interrelated. So their individual effects on HbA1c are statistically attenuated. Combined with the relatively small sample and large number of predictors, this may have limited power to detect small independent effects on glycaemic control, even though the overall burden of psychological dysfunction is clearly elevated.

These findings suggest that while psychological and cognitive problems are common and strongly linked to each other and to disease chronicity, glycaemic control in this population is likely influenced by a broader constellation of behavioural, biological and treatment-related factors not fully captured in the present model.

Thus, the non-significant regression coefficients for psychological variables should not be interpreted as evidence against their clinical relevance, but rather as an indication that, within this small and clinically heterogeneous sample, they do not exert a large independent effect on HbA1c after adjustment for correlated demographic and clinical factors.

In addition to the quantitative results, the qualitative findings of this study offer a more thorough understanding of the psychological and social difficulties that people with T2DM encounter. Significant levels of emotional repression, maladaptive coping strategies, and social disengagement were reported by participants; these findings together demonstrate the severe psychological effects of having diabetes. These findings align with earlier studies that highlight how diabetes-related distress compromises emotional health and self-management practices (15, 17)

The participants' widespread sense of social isolation was one of the most notable themes to come out of the focus group discussions. Due to the dietary restrictions and lifestyle modifications necessary for diabetes management, many people reported feeling cut off from their social networks. Participants, for example, stated that they steer clear of social events to avoid having to defend their insulin use or food choices. In addition to making loneliness worse, this avoidance behavior restricts access to social support, which is a vital defense against psychological distress.

Another recurrent theme was emotional repression, as participants reported having trouble expressing their sadness, fear, and frustration. In order to avoid burdening their families, many people reported repressing their emotions, which resulted in an accumulation of untreated psychological distress. This is consistent with research that shows emotional suppression is a prevalent but unhealthy coping mechanism used by people with long-term conditions, frequently leading to increased anxiety and depressive symptoms (23).

Avoidance behaviors and substance abuse were also commonly mentioned as maladaptive coping mechanisms. Despite being aware of the negative effects on their health, some participants acknowledged using alcohol or smoking as a coping mechanism for the stress of managing their condition. Others said that feelings of exhaustion and overwhelm caused them to put off important self-care duties like blood sugar monitoring and medication adherence. These actions show major obstacles to efficient diabetes care in addition to the psychological toll of having the disease (21).

Participants reported frequent interruptions to their sleep because of nocturnal blood sugar fluctuations and anxiety about hypoglycemia, highlighting sleep disturbances as a

critical issue. Their psychological distress was exacerbated by poor sleep, which led to a vicious cycle of exhaustion, irritability, and poor self-care. This result is in line with research that found sleep disturbances to be a prevalent but underappreciated problem in T2DM, frequently associated with psychological (such as anxiety and depression) and physiological (such as neuropathy and nocturia) factors (15).

The stigma attached to diabetes, which participants indicated was a major cause of their emotional distress, was another significant theme. Many people felt that others were judging them because of their condition, especially if they couldn't meet social norms about physical activity or body weight. In addition to lowering their self-esteem, this stigma deterred them from asking for assistance or being candid about their difficulties. Studies have shown that stigma can exacerbate diabetes-related distress by causing feelings of guilt, shame, and social disengagement (17).

Some participants showed resilience in the face of these difficulties by embracing adaptive coping mechanisms like mindfulness exercises, taking up hobbies, and looking for support from community groups that cater to people with diabetes. Better emotional health and a more proactive approach to illness management were linked to these constructive coping strategies. As part of comprehensive diabetes care, this finding emphasizes the value of developing resilience and encouraging adaptive coping mechanisms (24).

CONCLUSION

This study offers important insights into the psychological health of individuals with T2DM; however, several limitations must be considered. First, the cross-sectional design precludes establishing causality between psychological dysfunction and quality of life. Longitudinal research would be required to clarify the direction and persistence of these associations. Second, the relatively small sample size ($n = 87$) may limit the generalizability of the findings, and the study may have been underpowered to detect subtle subgroup differences or interactions despite a balanced gender distribution. Third, reliance on self-reported questionnaires introduces the potential for response biases, including social desirability and recall bias, which may lead to underreporting of psychological symptoms. Fourth, the analysis did not control potentially confounding variables such as duration of diabetes, presence of complications, medication regimens, or co-existing chronic conditions, all of which could affect both psychological status and quality of life. Finally, the study was conducted within a specific geographic and healthcare context, which may limit external validity; cultural, socioeconomic, and healthcare system factors could influence psychological outcomes in other populations. Future research should

aim for larger, more diverse samples, adopt longitudinal designs, and account for relevant clinical and contextual factors to provide a more comprehensive understanding of the interplay between diabetes and mental health.

In summary, this study illustrates that individuals with T2DM endure a significant burden of psychological dysfunction, evidenced by increased mean scores for depression, anxiety, and stress, alongside diminished mental health-related quality of life and cognitive performance. The data indicate that an extended duration of diabetes is significantly correlated with heightened psychological distress, neurocognitive impairment, and deteriorated general health, emphasizing the chronic and cumulative effects of the disease on mental well-being.

The significant negative correlation between psychological distress and quality of life underscores the critical importance of mental health in holistic diabetes management. These findings corroborate the prevailing consensus in contemporary literature that the effective management of T2DM should encompass not only metabolic control but also the incorporation of routine psychological screening and evidence-based psychosocial interventions to enhance clinical and quality of life outcomes. This study's findings on the prevalence and impact of psychological comorbidity urge diabetes care teams to adopt holistic, multidisciplinary strategies that address the physical and mental health requirements of their patients. This research adds to the growing body of evidence that putting mental health on the same level as physical health is important for improving the lives of people with T2DM.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions:

Sonakshi Bhargava: Conceptualization, Methodology, Data Curation, Formal Analysis, Original draft preparation; **Rani Srivastava:** Conceptualization, Methodology, Original draft preparation, Supervision; **Ashok Kumar:** Conceptualization, Writing- Reviewing and Editing, Supervision; **Gunjan Uttam:** Formal Analysis and Writing- Reviewing and Editing; **Shuvojit Moulik:** Writing- Reviewing and Editing, Supervision **Renaissan Dutta:** Formal Analysis, Writing- Reviewing and Editing;

Ethics approval

Ethical statement was obtained from the Institutional Ethics Committee of Santosh Deemed to be University (No.: SU/2025/CRF/396).

Data availability

The corresponding author has access to all of the study's supporting data and results. Data will be provided upon request, taking legal and ethical requirements into account.

Abbreviation:

T2DM: Type 2 Diabetes Mellitus

DASS-42:

GHQ-12: General Health Questionnaire – 12 items

MHQoL-7D: Mental Health Quality of Life Scale

MoCA: Montreal Cognitive Assessment

REFERENCES

1. Hameed I, Masoodi SR, Mir SA, Nabi M, Ghazanfar K, Ganai BA. Type 2 diabetes mellitus: from a metabolic disorder to an inflammatory condition. *World journal of diabetes*. 2015 May 15;6(4):598. 10.4239/wjd.v6.i4.598
2. WHO. Diabetes - India (Internet). www.who.int. 2025. Available from: <https://www.who.int/india/diabetes>
3. Kumar V. To study the relationship between psychiatric comorbidities in individuals with type 2 diabetes mellitus and quality of life. *European Journal of Cardiovascular Medicine*. 2020 Apr 30;10:40-4. <https://doi.org/10.61336/ejcm>
4. Mikaliūkštienė A, Žagminas K, Juozulynas A, Narkauskaitė L, Salyga J, Jankauskienė K, Stukas R, Šurkienė G. Prevalence and determinants of anxiety and depression symptoms in patients with type 2 diabetes in Lithuania. *Medical science monitor: international medical journal of experimental and clinical research*. 2014 Feb 4;20:182. 10.12659/MSM.890019
5. Namjoo S, Mirzaei M, Foroughan M, Harouni GG, Aboubakri O. Prevalence and determinants of depression, anxiety and stress among the Iranian older people with type 2 diabetes. *Journal of Renal Injury Prevention*. 2022 Jan 30. 10.34172/jrip.2022.10
6. Sayed Ahmed HA, Fouad AM, Elotla SF, Joudeh AI, Mostafa M, Shah A, Shah J, Mohamed SF. Prevalence and associated factors of diabetes distress, depression and anxiety among primary care patients with type 2 diabetes during the COVID-19 pandemic in Egypt: a cross-sectional study. *Frontiers in psychiatry*. 2022 Jun 3;13:937973. <https://doi.org/10.3389/fpsyt.2022.937973>

7. Sun N, Lou P, Shang Y, Zhang P, Wang J, Chang G, Shi C. Prevalence and determinants of depressive and anxiety symptoms in adults with type 2 diabetes in China: a cross-sectional study. *BMJ open*. 2016 Aug 1;6(8):e012540. <https://doi.org/10.1136/bmjopen-2016-012540>
8. Alkhayyal, A. K., Almalki, A. S., Alsaed, M. S., Almedaires, S. A., AlMuhaish, A. A., Almikhla, S. M., ... and ALBUJAYS, A. (2025). Prevalence of Anxiety and Depression Among Patients With Type 2 Diabetes Mellitus in Eastern Region, Saudi Arabia: A Cross-Sectional Study. *Cureus*, 17(2). 10.7759/cureus.79490
9. Sanatkar S, Baldwin P, Clarke J, Fletcher S, Gunn J, Wilhelm K, Campbell L, Zwar N, Harris M, Lapsley H, Hadzi-Pavlovic D. The influence of personality on trajectories of distress, health and functioning in mild-to-moderately depressed adults with type 2 diabetes. *Psychology, health and medicine*. 2020 Mar 15;25(3):296-308. <https://doi.org/10.1080/13548506.2019.1668567>
10. Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British journal of clinical psychology*. 2005 Jun;44(2):227-39. <https://doi.org/10.1348/014466505X29657>
11. Comotti A, Fattori A, Greselin F, Bordini L, Brambilla P, Bonzini M. Psychometric evaluation of GHQ-12 as a screening tool for psychological impairment of healthcare workers facing COVID-19 pandemic. *La Medicina del lavoro*. 2023 Feb 14;114(1):e2023009. <https://doi.org/10.23749/mdl.v114i1.13918>
12. Lord AR, Amitrano NR, González DA. Reliability and validity of the Montreal Cognitive Assessment's auditory items (MoCA-22). *The Clinical Neuropsychologist*. 2024 Apr 2;38(3):783-98. <https://doi.org/10.1080/13854046.2023.2261634>
13. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative research in psychology*. 2006 Jan 1;3(2):77-101. <http://dx.doi.org/10.1191/1478088706qp063oa>
14. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs—principles and practices. *Health services research*. 2013 Dec;48(6pt2):2134-56. <https://doi.org/10.1111/1475-6773.12117>
15. Chew BH, Vos RC, Metzendorf MI, Scholten RJ, Rutten GE. Psychological interventions for diabetes-related distress in adults with type 2 diabetes mellitus. *Cochrane Database of Systematic Reviews*. 2017(9). <https://doi.org/10.1002/14651858.CD011469.pub2>
16. Hackett RA, Steptoe A. Type 2 diabetes mellitus and psychological stress—a modifiable risk factor. *Nature Reviews Endocrinology*. 2017 Sep;13(9):547-60. <https://doi.org/10.1038/nrendo.2017.64>
17. Fisher L, Hessler DM, Polonsky WH, Mullan J. When is diabetes distress clinically meaningful? Establishing cut points for the Diabetes Distress Scale. *Diabetes care*. 2012 Feb 1;35(2):259-64. <https://doi.org/10.2337/dc11-1572>
18. Alzahrani O, Fletcher JP, Hitos K. Quality of life and mental health measurements among patients with type 2 diabetes mellitus: a systematic review. *Health and quality of life outcomes*. 2023 Mar 22;21(1):27. <https://doi.org/10.1186/s12955-023-02111-3>
19. Jafari A, Moshki M, Naddafi F, Ghelichi-Ghojogh M, Armanmehr V, Kazemi K, Nejatian M. Depression literacy, mental health literacy, and their relationship with psychological status and quality of life in patients with type 2 diabetes mellitus. *Frontiers in Public Health*. 2024 Jul 11;12:1421053. <https://doi.org/10.3389/fpubh.2024.1421053>
20. Esubalew H, Belachew A, Seid Y, Wondmagegn H, Temesgen K, Ayele T. Health-related quality of life among type 2 diabetes mellitus patients using the 36-item short form health survey (SF-36) in central Ethiopia: a multicenter study. *Diabetes, Metabolic Syndrome and Obesity*. 2024 Dec 31:1039-49. <https://doi.org/10.2147/DMSO.S448950>
21. GLÜMER C, Hvidberg AD, Helgstrand LA. 548-P: The effects from type 2 diabetes management programs on mental health and diabetes distress. *Diabetes*. 2023 Jun 20;72(Supplement_1):548-P. <https://doi.org/10.2337/db23-548-p>
22. Aruoma OI, Narrain D, Indelicato J, Bourdon E, Murad F, Bahorun T. Cognitive impairment in patients with type 2 diabetes mellitus: Perspectives and challenges.
23. Petkus AJ, Gum A, Wetherell JL. Thought suppression is associated with psychological distress in homebound older adults. *Depression and anxiety*. 2012 Mar;29(3):219-25. <https://doi.org/10.1002/da.20912>
24. Hermanns N, Schmitt A, Gahr A, Herder C, Nowotny B, Roden M, Ohmann C, Kruse J, Haak T, Kulzer B. The effect of a diabetes-specific cognitive behavioral treatment program (DIAMOS) for patients with diabetes and subclinical depression: results of a randomized controlled trial. *Diabetes Care*. 2015 Apr 1;38(4):551-60. <https://doi.org/10.2337/dc14-1416>