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The Interplay of Psychiatric Symptomatology, Coping Strategies, and Glycemic Control in Type 2 Diabetes: A Cross-Sectional Analysis Integrating Clinical and Psychosocial Dimensions

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Abstract

Background: The bidirectional relationship between type 2 diabetes mellitus (T2DM) and mental health is established, yet the specific interplay between psychiatric symptoms, coping strategies, and glycemic control remains complex. This study investigates differences in these factors between patients with well-controlled and poorly controlled T2DM.

Methods: In this cross-sectional study, 106 patients from an academic endocrinology clinic were stratified by HbA1c levels into well-controlled (<7.5%, n=53) and poorly controlled (≥7.5%, n=53) groups. Psychiatric symptoms were assessed using the Symptom Checklist-27 (SCL-27), and coping strategies using the Brief COPE inventory. Analyses included independent t-tests and adjusted models controlling for cardiovascular history.

Results: Patients with poor glycemic control exhibited significantly higher mean scores across all SCL-27 dimensions, including depression and obsessive-compulsive traits, which reached clinical thresholds ($p < 0.001$). Regarding coping strategies, "substance use" was significantly higher in the poorly controlled group ($p = 0.021$). Conversely, "self-blame" was significantly more prevalent in the well-controlled group ($p = 0.028$), potentially reflecting adherence-related vigilance rather than maladaptive distress. No significant differences were observed in other problem-focused or emotion-focused coping strategies.

Conclusion: Poor glycemic control is strongly associated with elevated psychiatric symptomatology, particularly depression and somatization. While substance use as a maladaptive coping mechanism correlates with worse metabolic outcomes, self-blame may paradoxically relate to better control through heightened responsibility. Integrated care models addressing both psychological distress and specific maladaptive coping mechanisms are essential for optimizing diabetes management.

Keywords: Type 2 Diabetes, Psychiatric Symptoms, Coping Strategies, Glycemic Control, SCL-27, Brief COPE, Diabetes Distress.

1. Introduction

Type 2 Diabetes Mellitus (T2DM) represents a global health crisis, with prevalence rates projected to reach 700 million by 2045 [1]. Beyond its physiological burden, characterized by microvascular and macrovascular complications, T2DM imposes a significant psychological toll on patients. The daily demands of self-management—including dietary restrictions, medication adherence, and glucose monitoring—create a unique emotional burden known as "diabetes distress" [2, 3]. Unlike general psychiatric disorders, diabetes distress is specifically tied to the fears, frustrations, and burdens of living with the disease [4].

The relationship between mental health and glycemic control is bidirectional. Psychological distress can lead to poor self-care behaviors, resulting in hyperglycemia, while chronic hyperglycemia and its complications can exacerbate psychological suffering [5]. Studies have consistently shown that depression and anxiety are twice as prevalent in diabetic populations compared to the general population [6, 7]. Furthermore, recent evidence from Northwest

Ethiopia indicates that severe psychological distress is independently associated with poor glycemic control, mediated by factors such as treatment burden and fear of hypoglycemia [8].

Coping strategies play a pivotal role in how patients navigate these challenges. According to Lazarus and Folkman's theory, coping can be problem-focused (addressing the source of stress) or emotion-focused (managing emotional responses) [9]. While problem-focused coping is generally associated with better self-care, emotion-focused and avoidance coping styles have been linked to lower quality of life and poorer metabolic outcomes [10, 11]. However, findings remain heterogeneous; some studies suggest that certain emotion-focused strategies, such as acceptance, may be adaptive in chronic illness contexts [12].

Despite extensive literature, there is a gap in understanding how specific psychiatric symptom clusters (beyond general depression) and nuanced coping mechanisms differ between patients with well-controlled versus poorly controlled diabetes in specific cultural contexts. This study aims to bridge this gap by comparing psychiatric symptoms and coping strategies in T2DM patients stratified by glycemic control status.

We hypothesize that patients with poor glycemic control will exhibit higher levels of psychiatric symptomatology and rely more heavily on maladaptive coping mechanisms.

2. Methods

2.1. Study Design and Setting

This cross-sectional study was conducted at the Endocrinology Clinic of Iran'slargest academic hospital, Imam Khomeini Complex Hospital, over a two-year period. The study protocol was approved by the ethics committee of Tehran university of medical sciences (Approval ID:

IR.TUMS.REC.IKHC. 1400.419) and written informed consent was obtained from all participants.

2.2. Participants

The study included 106 adult patients (aged 18–65 years) diagnosed with T2DM. Participants were recruited via random sampling and divided into two equal groups based on their most recent HbA1c levels:

- **Well-Controlled Group:** HbA1c < 7.5% (n = 53)
- **Poorly Controlled Group:** HbA1c ≥ 7.5% (n = 53)

Exclusion criteria included dementia, acute psychosis, severe physical illness preventing questionnaire completion, and cognitive impairments. Demographic and clinical data, including age, gender, duration of diabetes, and history of cardiovascular disease, hypertension, and psychiatric disorders, were collected.

2.3. Instruments

Symptom Checklist-27 (SCL-27): Psychiatric symptoms were assessed using the SCL-27, a shortened version of the SCL-90-R. This validated instrument evaluates six dimensions: somatization, obsessive-compulsive, interpersonal sensitivity, depression, phobic anxiety, and paranoid ideation. Scores range from 0 (not at all) to 4 (extremely). A mean score >1 indicates symptomatic status, and >3 indicates severe psychopathology [13, 14].

Brief COPE Inventory: Coping strategies were measured using the Brief COPE inventory, which assesses 14 coping responses categorized into three broader styles: problem-focused (active coping, planning, instrumental support), emotion-focused (acceptance, emotional support,

humor, positive reframing, religion), and avoidance/dysfunctional (denial, behavioral disengagement, self-blame, substance use, venting) [15, 16].

2.4. Statistical Analysis

Data were analyzed using SPSS version 29. Normality was assessed using Kolmogorov-Smirnov tests. Independent t-tests were used to compare means between the two groups. Given the significant difference in cardiovascular history between groups ($p = 0.011$), adjusted analyses were performed to control for this confounder. A p-value < 0.05 was considered statistically significant. **(Figure 1)**

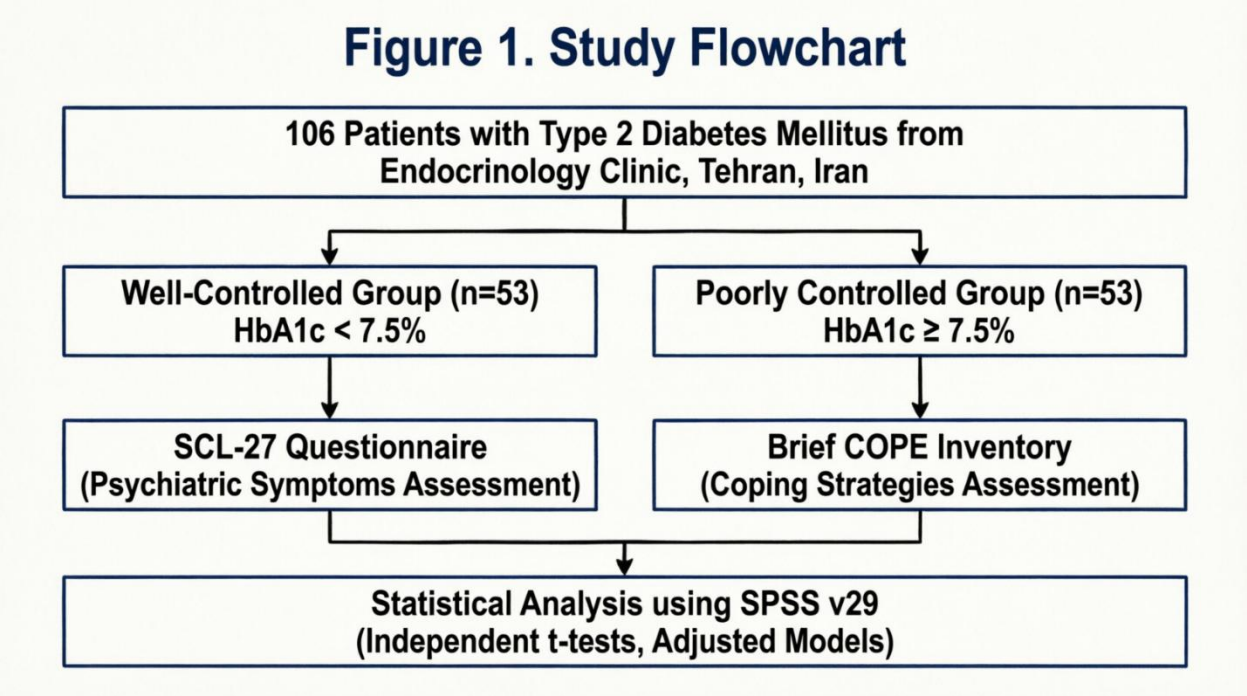

Figure 1. Study Flowchart. Schematic representation of the study design. A total of 106 patients with type 2 diabetes mellitus were recruited from the Endocrinology Clinic, and stratified into two equal groups based on glycemic control status (HbA1c < 7.5% vs. HbA1c ≥ 7.5%). Both groups completed the SCL-27 questionnaire for psychiatric symptom assessment and the Brief COPE inventory for coping strategies evaluation. Data were analyzed using SPSS v29.

3. Results

3.1. Demographic and Clinical Characteristics

The demographic and clinical characteristics of the study population are summarized in Table 1. The study sample consisted of 54.7% women and 45.3% men, with a median age of 60 years. There were no significant differences between the well-controlled and poorly controlled groups regarding age, gender, BMI, duration of diabetes, or history of hypertension and psychiatric disorders. However, the poorly controlled group had a significantly higher prevalence of cardiovascular disease (41.5% vs. 18.9%, p = 0.011). Consequently, subsequent analyses were adjusted for cardiovascular history.

Table 1. Demographic and clinical characteristics of the study participants stratified by glycemic control status.

Variable	**Well-Controlled (n=53)**	**Poorly Controlled (n=53)**	**P-value**
Age (years), mean ± SD	57.00 (15.0)	60.00 (9.0)	0.248
Gender, n (%)			
Female	33 (62.3%)	25 (47.2%)	0.119
Male	20 (37.7%)	28 (52.8%)	
BMI (kg/m²), mean ± SD	28.5 ± 4.2	29.1 ± 4.5	0.456
Duration of diabetes (years), median (IQR)	8.00 (5.0)	9.50 (4.5)	0.084

Variable	Well-Controlled (n=53)	Poorly Controlled (n=53)	P-value
Hypertension, n (%)	26 (49.1%)	32 (60.4%)	0.249
Cardiovascular disease, n (%)	10 (18.9%)	22 (41.5%)	**0.011**
Psychiatric history, n (%)	1 (1.9%)	2 (3.8%)	1.000

Abbreviations: BMI, body mass index; HbA1c, hemoglobin A1c; IQR, interquartile range; SD, standard deviation.

3.2. Psychiatric Symptomatology (SCL-27)

Patients with poor glycemic control demonstrated significantly higher mean scores across all six psychiatric dimensions compared to the well-controlled group (**Table 2 & Figure 2**).

Table 2. Comparison of mean Symptom Checklist-27 (SCL-27) subscale scores between well-controlled and poorly controlled diabetic patients.

SCL-27 Dimension	Well-Controlled (HbA1c < 7.5%)	Poorly Controlled (HbA1c ≥ 7.5%)	P-value	Adjusted P-value
Somatization	0.36 ± 0.50	0.87 ± 0.94	<0.001	<0.001
Obsessive-Compulsive	0.51 ± 0.53	1.00 ± 0.84	<0.001	<0.001

SCL-27 Dimension	Well-Controlled (HbA1c < 7.5%)	Poorly Controlled (HbA1c ≥ 7.5%)	P-value	Adjusted P-value
Interpersonal Sensitivity	0.17 ± 0.28	0.55 ± 0.69	<0.001	<0.001
Depression	**0.45 ± 0.46**	**1.62 ± 0.14**	**<0.001**	**<0.001**
Phobic Anxiety	0.22 ± 0.35	0.59 ± 0.78	0.002	<0.001
Paranoid Ideation	0.32 ± 0.43	0.78 ± 0.96	0.002	<0.001

Abbreviations: HbA1c, hemoglobin A1c; SD, standard deviation; SCL-27, Symptom Checklist-27.

Note: Values are mean ± SD. Adjusted for cardiovascular disease history.

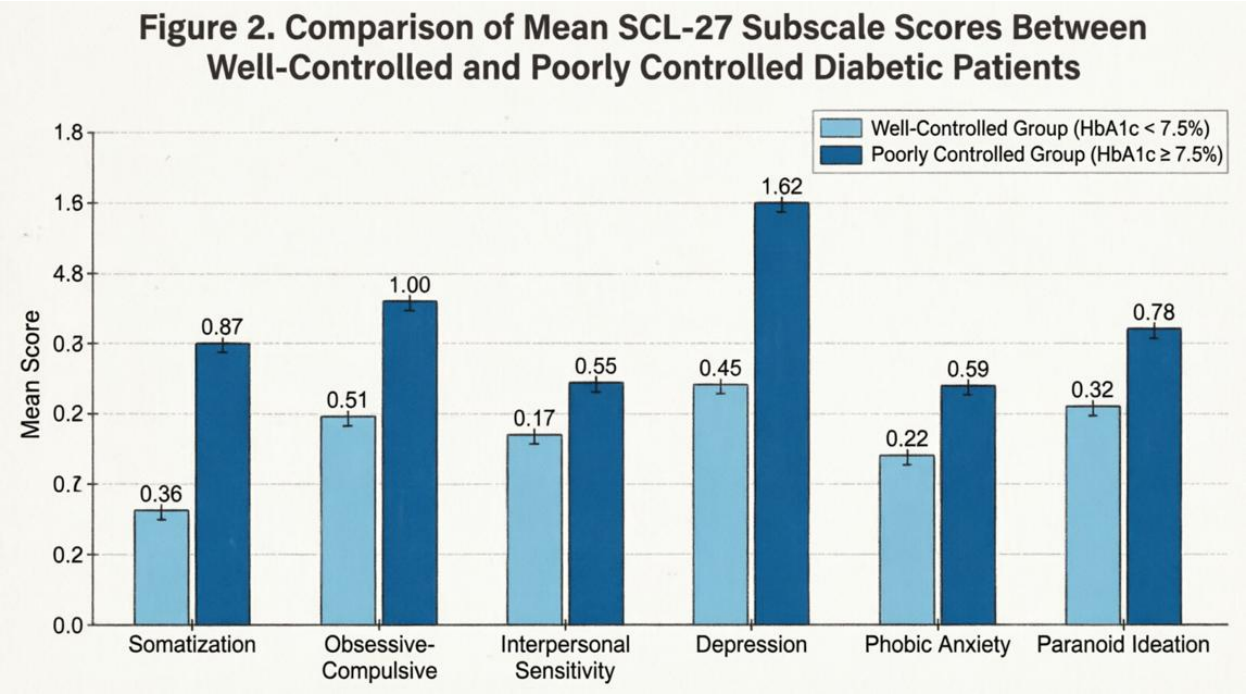

Figure 2. Comparison of Mean SCL-27 Subscale Scores Between Well-Controlled and Poorly Controlled Diabetic Patients. The bar chart illustrates significant differences in psychiatric symptomatology across six dimensions. Dark blue bars represent the poorly controlled group

(HbA1c ≥ 7.5%), showing markedly elevated scores, particularly in depression (mean = 1.62) and obsessive-compulsive traits (mean = 1.00), both exceeding the clinical threshold. Light blue bars represent the well-controlled group (HbA1c < 7.5%). Error bars indicate standard deviation. All comparisons yielded $p < 0.001$ after adjustment for cardiovascular history.

- **Depression:** The most pronounced difference was observed in depression scores (1.62 ± 0.14 in poorly controlled vs. 0.45 ± 0.46 in well-controlled, $p < 0.001$). Notably, the mean score in the poorly controlled group exceeded the clinical threshold of 1.0, indicating a pathological state.
- **Somatization and Obsessive-Compulsive Traits:** Both somatization (0.87 vs. 0.36, $p < 0.001$) and obsessive-compulsive symptoms (1.00 vs. 0.51, $p < 0.001$) were significantly higher in the poorly controlled group. The obsessive-compulsive mean score in the poorly controlled group also reached the clinical threshold.
- **Other Dimensions:** Interpersonal sensitivity, phobic anxiety, and paranoid ideation were all significantly elevated in the poorly controlled group ($p < 0.001$ for all).

3.3. Coping Strategies (Brief COPE)

Analysis of coping strategies revealed distinct patterns between the two groups (**Table 3**).

Table 3. Comparison of coping strategies (Brief COPE inventory) between well-controlled and poorly controlled diabetic patients.

Coping Strategy	Well-Controlled	Poorly Controlled	P-value	Adjusted P-value
Problem-Focused Coping				

Coping Strategy	Well-Controlled	Poorly Controlled	P-value	Adjusted P-value
Active Coping	5.53 ± 1.69	5.11 ± 1.31	0.161	0.092
Planning	5.30 ± 1.55	5.04 ± 1.57	0.385	0.400
Instrumental Support	5.34 ± 1.70	4.91 ± 1.75	0.197	0.253
Emotion-Focused Coping				
Acceptance	5.38 ± 1.61	4.94 ± 1.54	0.159	0.159
Emotional Support	4.75 ± 1.57	4.81 ± 1.69	0.858	0.765
Positive Reframing	5.49 ± 1.51	5.21 ± 1.55	0.344	0.625
Humor	2.83 ± 1.28	2.75 ± 1.12	0.748	0.961
Religion	4.34 ± 2.17	4.21 ± 2.71	0.728	0.616
Avoidance/Dysfunctional Coping				
Substance Use	**2.60 ± 1.26**	**3.42 ± 1.87**	**0.010**	**0.021**
Self-Blame	**4.68 ± 1.66**	**4.02 ± 1.51**	**0.035**	**0.028**
Denial	4.40 ± 1.60	4.55 ± 1.51	0.619	0.681
Behavioral Disengagement	4.32 ± 1.65	4.11 ± 1.54	0.505	0.451

Coping Strategy	Well-Controlled	Poorly Controlled	P-value	Adjusted P-value
Venting	5.09 ± 1.50	4.96 ± 1.84	0.686	0.259
Self-Distraction	6.32 ± 1.73	6.08 ± 1.69	0.461	0.127

Abbreviations: HbA1c, hemoglobin A1c; SD, standard deviation.

Note: Values are mean ± SD. Significant values ($p<0.05$) are in bold.

- **Problem-Focused and Emotion-Focused Coping:** No significant differences were found between groups in active coping, planning, positive reframing, acceptance, humor, religion, or seeking emotional support. This suggests that both groups utilize adaptive strategies to a similar extent.
- **Avoidance/Dysfunctional Coping:**
    - **Substance Use:** Patients with poor glycemic control reported significantly higher use of substances (alcohol/drugs) as a coping mechanism (3.42 ± 1.87) compared to the well-controlled group (2.60 ± 1.26, p = 0.021).
    - **Self-Blame:** Conversely, the well-controlled group reported significantly higher levels of self-blame (4.68 ± 1.66) compared to the poorly controlled group (4.02 ± 1.51, p = 0.028).
    - **Other Avoidant Strategies:** No significant differences were observed in denial, behavioral disengagement, or venting.

When aggregating coping styles into broader categories (problem-focused, emotion-focused, avoidance-oriented), no significant differences were found between the two groups, highlighting that the distinction lies in specific maladaptive behaviors rather than overall coping style preference.

4. Discussion

This study provides compelling evidence that poor glycemic control in T2DM is intricately linked with elevated psychiatric symptomatology and specific maladaptive coping mechanisms. Our findings align with and expand upon recent literature emphasizing the psychological burden of diabetes.

4.1. The Burden of Psychiatric Symptoms and the Impact of Confounders

The significantly higher scores in depression, somatization, and obsessive-compulsive traits among poorly controlled patients underscore the bidirectional nature of diabetes and mental health. The high depression score (mean 1.62) in the poorly controlled group is consistent with findings from Ethiopia, where severe psychological distress was strongly associated with poor glycemic control [8]. Depression can impair executive function and motivation, leading to neglect of self-care tasks such as medication adherence and dietary management [17].

The bidirectional relationship between depression and diabetes is mediated by complex biological mechanisms. Chronic hyperglycemia and insulin resistance contribute to neuroinflammation, oxidative stress, and dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, which are also central to the pathophysiology of depression [22]. The HPA axis dysfunction leads to elevated cortisol levels, which further exacerbates insulin resistance through increased hepatic gluconeogenesis and impaired glucose uptake in peripheral tissues [22, 23].

Conversely, depression activates inflammatory pathways characterized by elevated pro-inflammatory cytokines (IL-6, TNF-α) and C-reactive protein, which interfere with insulin signaling pathways and promote insulin resistance [22, 24]. Serotonin dysregulation plays a crucial role in this relationship, as serotonin modulates both mood and glucose metabolism. Serotonergic pathways influence insulin secretion, glucose uptake, and energy homeostasis through effects on the central nervous system and peripheral tissues [23].

Importantly, selective serotonin reuptake inhibitors (SSRIs) such as citalopram and escitalopram have demonstrated beneficial effects on glycemic control by modulating the HPA axis, increasing insulin sensitivity in hepatic and muscular tissues, and exerting antioxidant and anti-inflammatory effects [23]. These medications may reduce HbA1c and fasting blood glucose levels through normalization of neural connectivity in regions such as the hippocampus and nucleus accumbens, which are involved in both mood regulation and metabolic control [23]. This biological evidence supports our findings and highlights the importance of integrated treatment approaches addressing both psychiatric symptoms and metabolic dysfunction in diabetes management.

Crucially, our study identified a significant disparity in cardiovascular disease history between the two groups (41.5% in poorly controlled vs. 18.9% in well-controlled, $p = 0.011$). Cardiovascular complications are a major source of physical and psychological burden in diabetes [20]. To ensure the robustness of our findings, we applied an adjusted statistical model controlling for cardiovascular disease history. Even after this adjustment, the differences in all six SCL-27 dimensions remained highly significant (Adjusted $p < 0.001$). This indicates that the elevated psychiatric symptoms in poorly controlled patients are not merely a byproduct of having more severe physical complications (like cardiovascular disease), but are independently

associated with poor glycemic control itself. This finding strongly reinforces the necessity of routine psychiatric screening in all diabetic patients, regardless of their physical complication status.

4.2. Coping Strategies: The Paradox of Self-Blame and Substance Use

A novel and critical finding in this study is the differential use of specific avoidant coping strategies, which persisted even after adjusting for cardiovascular comorbidity. Substance use was significantly higher in the poorly controlled group (Adjusted $p = 0.021$). This aligns with the concept of "action crisis" and goal obstruction, where patients facing persistent barriers to glycemic control may resort to dysfunctional coping mechanisms like substance abuse to escape negative emotions [12]. Substance use not only fails to address the root cause of stress but also directly interferes with metabolic stability and medication efficacy.

Conversely, self-blame was significantly higher in the well-controlled group (Adjusted $p = 0.028$). While self-blame is typically categorized as a maladaptive, emotion-focused strategy associated with distress [12], its association with better glycemic control in this cohort warrants nuanced interpretation. In the context of diabetes, "self-blame" may partially overlap with "responsibility acceptance" or an internal locus of control. Patients who are highly vigilant about their diet and medication may attribute any minor fluctuation in glucose to their own actions ("I ate too much," "I missed a dose"). This internal attribution, even if framed as self-blame, may drive stricter adherence and thus better glycemic outcomes. This contrasts with patients who may externalize blame or disengage entirely, leading to poorer control and higher substance use. This finding echo research suggesting that while excessive self-criticism is harmful, a sense of personal responsibility is crucial for diabetes self-management [19].

4.3. Comparison with Global Literature and the Complex Interplay of Coping Factors

Interestingly, when aggregating coping styles into broader categories (problem-focused, emotion-focused, and avoidance-oriented), no significant differences were found between the two groups. Rather than indicating a similar baseline knowledge of these strategies—which cannot be directly inferred from self-reported usage scales—it is more plausible that the deployment of coping mechanisms is highly context-dependent. Coping strategies are often utilized subconsciously, and a diabetic patient's feelings and behaviors are likely influenced by a complex interaction of environmental, psychosocial, and internal factors, including individual personality traits and genetic predispositions. Therefore, the critical distinction between the groups lies not in their awareness of coping methods, but in how this complex interplay drives the reliance on specific maladaptive behaviors (such as substance use) under severe metabolic and psychological stress.

Our results resonate with broader literature indicating that the deployment of coping mechanisms is not merely a reflection of an individual's baseline knowledge, but rather a complex, often subconscious process shaped by a dynamic interplay of environmental, psychosocial, and internal factors [25, 27]. For instance, recent evidence highlights that patients' coping behaviors are deeply rooted in their broader life circumstances, including occupational demands, financial constraints, and the availability of social support, which collectively dictate their capacity to execute adaptive self-care [27]. Furthermore, coping is heavily influenced by individual personality traits, cultural contexts, and genetic predispositions, meaning that individuals may adopt vastly different strategies under metabolic and psychological stress regardless of their clinical profile [25, 26]. Therefore, the absence of broad differences in problem-focused coping between our groups suggests that while the potential for adaptive coping exists, its actual

execution is frequently disrupted by the overwhelming burden of psychiatric symptoms and the reliance on specific maladaptive behaviors, such as substance use, particularly in the poorly controlled group [12, 25]." **(Figure 3)**

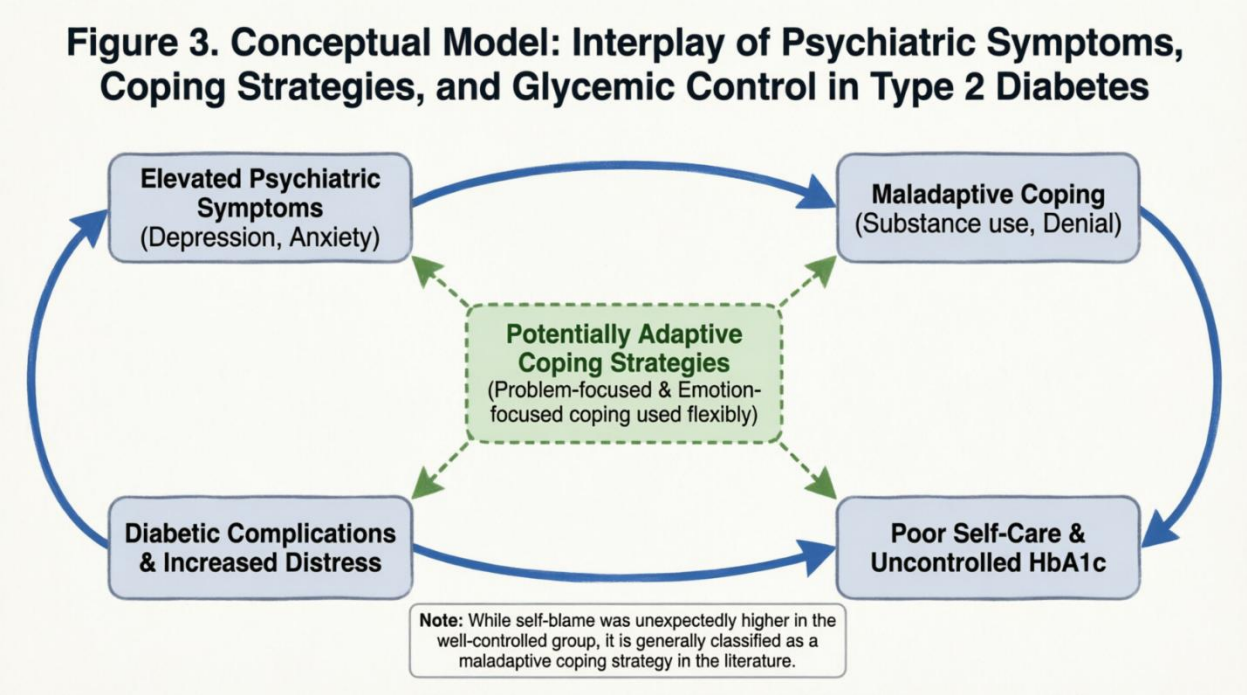

Figure 3. Conceptual Model: Interplay of Psychiatric Symptoms, Coping Strategies, and Glycemic Control in Type 2 Diabetes. This diagram illustrates the bidirectional relationships between psychiatric symptomatology (depression, somatization, obsessive-compulsive traits, anxiety), coping mechanisms, self-care behaviors, and glycemic outcomes. The outer cycle (solid arrows) represents a vicious cycle wherein elevated psychiatric symptoms promote maladaptive coping strategies (e.g., substance use, behavioral disengagement, denial), leading to poor self-care, uncontrolled HbA1c (≥ 7.5%), diabetic complications (cardiovascular disease, neuropathy), and increased diabetes distress, which in turn exacerbate psychiatric symptoms. The central green box (dashed arrows) represents potentially adaptive coping strategies (problem-focused coping and emotion-focused coping used flexibly according to situational demands), which may interrupt this cycle and promote better glycemic control. **Note: While self-blame was unexpectedly higher in the well-controlled group in our study, it is generally classified as a maladaptive coping strategy in the literature and should not be categorized as an adaptive coping mechanism.** This model underscores the necessity of integrated psychological and metabolic interventions in diabetes management.

5. Clinical Implications

The findings suggest that standard diabetes care, which focuses primarily on biochemical parameters, is insufficient.

1. **Routine Psychiatric Screening:** Given the high levels of depression and somatization in poorly controlled patients, routine screening using tools like SCL-27 or DDS-17 should be integrated into endocrinology clinics.
2. **Targeted Interventions for Substance Use:** Healthcare providers should specifically screen for substance use as a coping mechanism in patients with poor glycemic control. Interventions should focus on replacing substance use with healthier adaptive coping strategies.
3. **Reframing Self-Blame:** Rather than simply discouraging self-blame, clinicians should help patients distinguish between destructive self-criticism and constructive responsibility. Cognitive Behavioral Therapy (CBT) can help patients reframe negative self-talk into actionable problem-solving steps [21].
4. **Holistic Care Models:** Integrating mental health professionals into diabetes care teams can address the "diabetes distress" that fuels poor self-care.

6. Limitations

This study has several limitations. First, the cross-sectional design prevents causal inferences; we cannot determine whether psychiatric symptoms cause poor control or vice versa. Second, the sample size was relatively small (n=106), limiting the generalizability of the findings. Third, the reliance on self-reported questionnaires may introduce bias, although validated tools were used.

Finally, the study was conducted in a single referral center, which may limit cultural generalizability.

7. Conclusion

This study demonstrates that patients with poorly controlled T2DM suffer from significantly higher levels of psychiatric symptomatology, particularly depression and somatization, compared to those with well-controlled disease. While adaptive coping strategies were similar across groups, poorly controlled patients were more likely to use substance use as a maladaptive coping mechanism. Interestingly, self-blame was higher in the well-controlled group, suggesting a complex relationship between internal locus of control and sence of responsibility with glycemic outcomes. These findings underscore the urgent need for integrated care models that address both the psychological and behavioral dimensions of diabetes management. Future longitudinal studies are recommended to explore the causal pathways between specific coping mechanisms and long-term glycemic trajectories.

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences, approval number: IR.TUMS.IKHC.REC.1400.419. All participants provided written informed consent before inclusion. Consent for publication All authors have approved the final version of the manuscript and agreed to its publication. Any individual data is anonymized, and no identifiable information is shared.

Availability of data and materials

The datasets created and examined in this study are not publicly available because of patient confidentiality and institutional restrictions. However, they may be requested from the corresponding author.

Competing Interests

The authors state that they have no competing interests or conflicts of interest.

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Authors' Contributions

S.E. Sh. and M. H. came up with and designed the study. M.R., F. E., A. E., and M. Ch. handled data collection and laboratory analyses. M.Ch. conducted the statistical analysis. M. R. and S.E Sh. wrote the manuscript. All authors contributed to the critical review of the manuscript, interpreted the findings, and approved the final version for submission. All authors take responsibility for the integrity and accuracy of the work.

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