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Predicting Psychological Distress based on Mindfulness and Resilience with the Mediation of Cognitive Flexibility in Diabetic Patients

Nahid Azimi Ghahveh Moghadam[1*], Reza Noori[2]
[1]MSC in Psychology, Department of Psychology, Torbat Jam Branch, Islamic Azad University, Torbat Jam, Iran.
[2]Assistant professor, Department of Psychiatry, School of Medicine, Zabol University of Medical Sciences, Zabol, Iran.

Abstract

Objective: The present study aimed to predict psychological distress based on mindfulness and resilience with the mediation of cognitive flexibility in diabetic patients.

Materials and Methods: This study is descriptive-correlational in nature and was conducted using structural equation modeling. The statistical population consisted of all diabetic patients visiting hospitals in Mashhad city. Using purposive and volunteer sampling methods, 115 individuals were selected as the sample. Participants completed The Kessler Psychological Distress Scale (K10), The Five Facet Mindfulness Questionnaire (FFMQ), The Connor-Davidson Resilience Scale (CD-RISC), and Cognitive Flexibility Inventory (CFI). Inferential statistics were employed, utilizing structural equation modeling (SEM), while inferential analysis evaluated hypotheses and assessed the structural relationships using SPSS version 22 and LISREL version 3.

Results: The descriptive results indicated the following scores for the study variables: psychological distress (M= 15.43± 10.81), mindfulness (M= 132.93± 36.30), resilience (M= 78.76± 15.95), and cognitive flexibility (M= 56.81± 20.91).The analyses confirmed significant relationships: resilience and mindfulness directly affect psychological distress and indirectly influence it through cognitive flexibility, with all effects being statistically significant ($P< 0.05$).

Conclusion: In conclusion, fostering mindfulness and resilience, alongside enhancing cognitive flexibility, offers a promising approach for alleviating psychological distress in patients with diabetes. Future studies should explore targeted intervention strategies to effectively strengthen these psychological resources, ultimately contributing to better disease management and quality of life.

Keywords: Psychological distress, Mindfulness, Resilience, Cognitive flexibility, Diabetic patients

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Corresponding Author:
Nahid Azimi Ghahveh Moghadam, MSC in Psychology, Department of Psychology, Torbat Jam Branch, Islamic Azad University, Torbat Jam, Iran.
Tel: (+98) 915 420 0434
Email: Nahid.Zuni@iau.ir
Orcid ID: 0009-0000-2073-1618

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Introduction

It is crucial for individuals with diabetes to manage their condition effectively through lifestyle modifications, medication adherence, regular monitoring of blood sugar levels, and seeking appropriate medical care. Early detection and intervention can help prevent or delay the onset of complications associated with diabetes (1-3). Additionally, raising awareness about diabetes prevention, management, and health care treatment is essential to reduce the burden of this disease on individuals and health care systems worldwide (4).

According to the American Diabetes Association, diabetes is classified into four clinical categories: Type 1, Type 2 and gestational diabetes (5). Types 1 and 2 are the most common forms. These hyperglycemic disorders are characterized by impaired metabolism of carbohydrates, fats, and proteins, along with complete or partial deficiency of insulin secretion in the body (6). Long-term complications of diabetes include cardiovascular issues, neurological problems, peripheral vascular damage, retinal damage leading to vision loss, kidney damage, autonomic nervous system impairment, depression, and amputation (7,8).

A study showed that diabetic patients, especially those with Type 2 diabetes, often experience significant levels of anxiety, depression, and psychological distress (9). Psychological factors related to the disease can influence disease management, quality of life, and physical complications (10). Further research indicates that distress increases the risk of developing psychological, social, and occupational disorders, leads to higher healthcare utilization, and exacerbates physical health problems (11). Individuals with low distress tolerance often respond poorly to negative emotions, engaging in behavioral dysregulation and adopting avoidance behaviors to alleviate emotional pain (12). The predictive variables for psychological distress in patients is high levels of mindfulness (13).

Mindfulness is defined as the process of paying non-judgmental attention to internal and external events occurring in the present moment (14). Internal events include thoughts, emotions, perceptions, and bodily sensations, while external events encompass environmental, situational, and interpersonal experiences (12). Mindfulness involves moment-to-moment awareness of current experiences, which helps create mental calmness and enhances resilience and tolerance to pain and physical or psychological stress related to blood sugar control (15). It also fosters a sense of control and tranquility in the face of stressors related to the illness, promoting acceptance and reducing negative thoughts (16).

Previous systematic reviews have examined the relationship between psychological distress and psychological resilience in chronic illness patients (17). Resilience prevents personal and occupational psychological issues and protects individuals against the psychological impacts of stressful events. It is also linked with positive emotions, serving a protective role against burnout and fatigue, and functions as a mechanism that moderates responses to high-risk situations (18). A comprehensive systematic review regarded resilience as the return to or achievement of a higher level of equilibrium in threatening situations, thereby facilitating successful adaptation in life (19).

The strengthening resilience can lead to reduced stress, increased adaptability, better mental health, and more effective conflict resolution strategies when facing environmental pressures (19,20).

Both mindfulness and resilience play a crucial role in managing type 2 diabetes effectively. Together, they reduce stress and anxiety, which are known to negatively impact blood sugar levels (13,15) On the other hand, for mindfulness and resilience to serve as predictors of psychological distress, other constructs may mediate this relationship. One such variable is cognitive flexibility. The study

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by Amin et al indicated that diabetic patients tend to have lower levels of cognitive flexibility compared to healthy individuals (21). Cognitive flexibility refers to the capacity to consider contradictory representations of the same object or event simultaneously, involving the ability to adapt behavioral strategies within an ever-changing environment (22). It signifies a unique mental ability to cope with unpredictable changes, which is especially relevant for diabetic patients managing daily challenges such as blood sugar regulation, lifestyle restrictions, and concerns about long-term complications. Psychological flexibility, closely related to cognitive flexibility, can reduce negative reactions and mental resistance by promoting acceptance of negative thoughts and feelings like fear, insecurity, or a sense of failure (23). This, in turn, can decrease reactions such as anxiety and depression, aiding patients in coping more effectively without damaging their mental health.

Psychological flexibility enables patients to find creative and adaptive ways to deal with stress and unexpected changes, leading to reduced distress, stress, and feelings of helplessness. It helps individuals focus on their core values and goals for example, maintaining an active lifestyle, adhering to medication and diet while managing negative emotions (21). Pain, discomfort, increased anxiety, and depression significantly impact the quality of life of diabetic patients and their families, affecting productivity and psychological well-being (24). Although physical management is primary, psychological factors such as anxiety, pessimism, and ineffective coping strategies are more influential on disease progression and can exacerbate psychological distress (10,11). Therefore, identifying the predictors of this distress is essential for developing effective interventions; however, no comprehensive research has been conducted in this specific area. Based on this foundation, the present study aims to predict psychological distress based on mindfulness and resilience with the mediation of cognitive flexibility in diabetic patients.

Materials and methods

This study employed a descriptive-correlational design conducted using structural equation modeling (SEM). The target population consisted of all diabetic patients attending clinics in Mashhad. A total of 115 participants were selected through convenience sampling based on voluntary participation. According to Kline (25), a minimum of 200 samples is recommended for robust structural analysis; however, if the number of model parameters is limited, smaller sample sizes may suffice. Inclusion criteria included a confirmed diagnosis of either Type 1 or Type 2 diabetes based on medical records or a healthcare provider's diagnosis, an age range between 25 and 65 years, duration of diabetes diagnosis of at least 6 months to ensure the disease was in a stable phase, and informed consent obtained through a signed consent form. Participants were required to have sufficient literacy or support to understand and complete the questionnaires, and they should not have severe psychiatric conditions such as major mental disorders, cognitive impairments, or substance abuse that could interfere with responses. Exclusion criteria involved voluntary withdrawal at any point, incomplete or inconsistent questionnaire responses, repeated absence or inability to be contacted for data collection, and any changes in clinical or mental health status, such as a new diagnosis of a psychological disorder, which could influence the outcomes. The procedure began with coordination with university officials to obtain necessary approvals and documentation, followed by distributing questionnaires at the treatment centers or hospitals. Patients received instructions, indicating that the completion process would take approximately 20 to 40 minutes overall, depending on the number and complexity of the instruments used. Standardized questionnaires assessing mindfulness, resilience, cognitive flexibility,

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and psychological distress, each taking about 5 to 15 minutes, were administered. These questionnaires were designed to be accessible; employing simple language aligned with participants' educational levels, and was administered in a calm, distraction-free environment to facilitate quick and accurate responses. Participants were encouraged to answer thoughtfully and at their own pace.

Throughout the data collection process, ethical considerations were strictly followed to ensure participants' rights and confidentiality. Informed consent was obtained after thoroughly explaining the purpose of the study. Participants who preferred not to disclose their names were assigned codes to maintain anonymity, and all responses and personal data were kept confidential. Participants had the right to withdraw at any time without repercussions, and clarifications were provided, when necessary, without influencing responses. If requested, summarized results could be shared with participants. Following data collection, the information was analyzed to examine the proposed relationships, ensuring that all procedures respected the rights, privacy, and well-being of the participants.

Data collection tools

The Kessler Psychological Distress Scale (K10)

The Kessler Psychological Distress Scale is a unidimensional, non-specific measure consisting of 10 items that evaluate psychological distress in generally healthy populations (26). Participants rate the frequency of experiencing each symptom over the past month on a 5-point Likert scale, ranging from 0 ("none of the time") to 4 ("all of the time"). Symptoms include, for example, "feeling tired out for no good reason" and "feeling sad or depressed." Higher scores indicate higher levels of psychological distress. Reliability in Iran was assessed with Cronbach¢s alpha= 0.84 and ICC= 0.77, respectively (27). In the present study, the scale showed excellent internal consistency, with a Cronbach's alpha of 0.85.

The Five Facet Mindfulness Questionnaire (FFMQ)

The Mindfulness Questionnaire by Baer et al. (28) is a 39-item self-report scale developed by Baer and colleagues. This questionnaire consists of 112 items across five components. Participants respond on a 5-point Likert scale, ranging from 1 ("Never" or "Very rarely") to 5 ("Almost always" or "Always"), indicating their level of agreement or disagreement with each statement. The total score range for this scale is from 39 to 195. A higher score reflects higher levels of mindfulness. The factors identified include observing, acting with awareness, non-judging of inner experience, describing, and non-reactivity. Internal consistency reliability results showed that the factors had acceptable coherence, with Cronbach's alpha coefficients ranging from 0.75 (for non-reactivity) to 0.91 (for describing). The relationships among factors were moderate and statistically significant, with correlation coefficients between 0.15 and 0.34 (28). Additionally, a study validating the reliability and validity of this questionnaire in Iran reported test-retest correlations for the FFMQ among Iranian students ranging from 0.57 (non-judging factor) to 0.84 (observing). Cronbach's alpha coefficients ranged from 0.55 (non-reactivity) to 0.83 (describing), indicating acceptable internal consistency (29).

The Connor-Davidson Resilience Scale (CD-RISC)

The Connor-Davidson Resilience Scale, developed by Connor and Davidson (30), comprises 25 items that are rated on a Likert scale ranging from zero (completely incorrect) to four (completely correct). For scoring: 0 for completely false, 1 for rarely, 2 for sometimes true, 3 for often true, and 4 for always true. Consequently, scores on this test can range from 0 to 100, with higher scores indicating higher resilience levels. The results of factor

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analysis show that there are five subscales in this test. The first subscale, perception of individual competence, consists of items 25, 24, 23, 17, 16, 12, 11, and 10. Trust in individual instincts to tolerate negative emotions subscale scores were 6-7-15-18-19-18-20. Positive acceptance of change and secure relationships subscale scores were 1-8-5-4-2-2. Control subscale scores were 22- 21-13. Spiritual effects subscale scores were 3-9. The reliability of this scale as measured by the Cronbach's alpha coefficient yielded a value of 0.85. Samani and his colleagues validated the Persian version of the questionnaire, finding a content validity ratio of 0.85 and a content validity index of 0.90 in their research. Additionally, they reported a Cronbach's alpha coefficient of 0.89 for the scale (31). Cronbach's alpha values indicated that the Cronbach's alpha coefficient for the resilience scale was 0.81.

Cognitive Flexibility Inventory (CFI)

The Cognitive Flexibility Inventory was developed by Dennis and Vander Wal (32). This scale is a brief self-report tool consisting of 20 questions designed to assess the type of cognitive flexibility necessary for an individual's success in facing challenges, as well as the ability to replace dysfunctional thoughts with more effective ones. The scoring method utilizes a 7-point Likert scale, ranging from 1 (I strongly disagree) to 7 (I strongly agree), and evaluates three aspects of cognitive flexibility: A. The perception of alternative solutions, B. The perception of controlling difficult situations, C.

The perception of alternative justifications. Dennis and Vander Wal (32) demonstrated that this inventory possesses an appropriate factorial structure, convergent validity, and concurrent validity. In an Iranian study, the reliability coefficients for the entire scale were found to be 0.56 using Cronbach's alpha and 0.61 with the Spearman-Brown bisection, indicating a satisfactory range (33). Furthermore, the reliability coefficients for the subscales, measured by Cronbach's alpha, were 0.60 for the perception of different options, 0.54 for the perception of controllability, and 0.49 for the perception of justification of behavior. Using the Spearman-Brown bisection, the coefficients were 0.46, 0.62, and 0.75, respectively.

Data analysis method

Data analysis in this study was conducted in two phases: descriptive and inferential statistics. Descriptive statistics involved summarizing the central tendency and dispersion of variables to understand the basic features of the data. Inferential statistics were employed to examine the causal relationships among latent and observed variables, utilizing structural equation modeling (SEM). This technique was essential because it allows testing complex hypothesized relationships in the proposed model.

Descriptive statistics summarized the data and provided insights about the sample, while inferential analysis evaluated hypotheses and assessed the structural relationships using SPSS version 22 and LISREL version 3. The hypotheses were tested with appropriate statistical methods to ensure accuracy and reliability in the findings, respecting the assumptions underpinning each technique.

Ethical considerations

Ethical approval was obtained by the Islamic Azad University Ethics Committee, Torbat Jam Branch, Iran (ethical code: IR.IAU.TJ.REC.1403.043).

Results

The mean age of the participants in this study was 42.81 years (SD= 13.79), with ages ranging from 11 to 60 years. Regarding marital status, 38% of the participants were single, while 62% were married. Based on frequency distribution, 43% of the respondents were women and 57% were men, indicating that the majority of participants were male. Additionally, only 1% of the participants were single, whereas 88% were married.

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The duration of illness among the participants varied from 1 to 14 years, with a mean duration of 7.58 years (SD= 3.86), reflecting moderate variability in the length of time since diagnosis.

Table 1 revealed considerable variability across all measured constructs. Skewness close to 0 indicates a symmetrical distribution. Positive skewness indicates a longer tail on the right (higher values), while negative skewness indicates a longer tail on the left (lower values). Positive kurtosis indicates a peaked distribution with heavy tails, while negative kurtosis suggests a flatter distribution with lighter tails. Most variables in this dataset show skewness and kurtosis values close to zero, implying that their distributions are approximately normal, which is beneficial for many statistical analyses.

The results show that the Goodness-of-Fit Index (GFI) for the tested research model. The reported values are GFI= 0.56 and Normed Fit Index (NFI)= 0.

The results show that the goodness-of-fit indices for the tested research model were evaluated. The GFI was 0.56 and NFI was 0.77. Although the NFI was close to an acceptable range, the GFI value, which is below the recommended threshold of 0.90, indicates that the model did not fit the data adequately and reflects a weak model fit. In addition, the Root Mean Square Residual (RMR) was 0.09, which is close to the acceptable limit but still not ideal. Overall, the values of GFI, NFI, and RMR suggest that the proposed model demonstrates a poor fit to the data.

Based on the results of Table 2, it can be concluded that resilience has a direct effect on psychological distress, as well as mindfulness and resilience on cognitive flexibility in diabetic patients. The critical value of the test exceeds 1.96, and the significance level of the test is less than 0.05, indicating a statistically significant relationship. Additionally, the indirect effects of mindfulness and resilience on psychological distress are significant. Therefore, it can be inferred that cognitive flexibility acts as a mediator in the relationship between mindfulness and resilience with psychological distress. As mindfulness and resilience increase, cognitive flexibility also increases, which in turn leads to a decrease in psychological distress.

Discussion

The present study aimed to predict psychological distress based on mindfulness and resilience with the mediation of cognitive flexibility in diabetic patients. This study provides compelling evidence that resilience, mindfulness, and cognitive flexibility are intricately linked to psychological distress in diabetic patients. The variability observed across the measured constructs demonstrates the heterogeneity within the sample, which enhances the robustness of the analysis and parallels findings in previous research. Most variables displayed near-normal distributions, supporting the validity of the applied statistical methods.

The correlation and mediation analyses reveal that resilience exerts both direct and indirect effects on psychological distress. These results align with prior studies emphasizing resilience as a vital protective factor against emotional distress in chronic illness populations (4,17). Specifically, increased resilience was associated with lower levels of distress, which corroborates the findings of (26-24), previous studies that identified resilience as a significant buffer against mental health struggles across different populations, including those with medical conditions.Consistent with previous research, both mindfulness and resilience appear to exert direct effects on reducing psychological distress, while cognitive flexibility functions as a crucial mediating factor in this relationship (10,17). Multiple studies have demonstrated that higher levels of mindfulness are associated with lower psychological distress and better self-management in individuals with chronic illnesses (13,15).

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Table 1. Variable descriptive statistics

Variable	Mean (± Standard Deviation)
Psychological distress	15.43 (± 10.81)
Observation	24.63 (± 6.92)
Description	25.33 (± 7.26)
Mindful action	28.82 (± 8.59)
Non-Judgment	28.80 (± 8.22)
Non-Reactivity	25.35 (± 6.72)
Mindfulness	132.93 (± 36.30)
Perceived personal competency	24.46 (± 5.53)
Trust in intuition & negative affect tolerance	24.37 (± 5.16)
Positive acceptance of change & secure relationships	14.75 (± 4.12)
Control	8.51 (± 3.24)
Spiritual influences	6.67 (± 1.99)
Resilience	78.76 (± 15.95)
Perception of various options	40.99 (± 16.83)
Control capability	30.12 (± 12.48)
Behavioral justification	7.31 (± 3.76)
Cognitive flexibility	56.81 (± 20.91)

Table 2. Direct and indirect effects of mindfulness and resilience on psychological distress with cognitive flexibility as a mediator

Path	Path coefficient	Standard error	t-statistic	*P*-value	Result
Cognitive flexibility→ Psychological distress	-0.367	0.107	3.439	0.001	Confirmed
Mindfulness→ Cognitive flexibility	0.567	0.064	8.862	0.000	Confirmed
Mindfulness → Psychological distress	-0.189	0.105	1.798	0.073	Rejected
Resilience→ Cognitive flexibility	0.196	0.072	2.703	0.007	Confirmed
Resilience→ Psychological distress	-0.319	0.076	4.215	0.000	Confirmed
Mindfulness→ Cognitive flexibility→ Psychological distress	-0.208	0.069	3.019	0.003	Confirmed
Parent-Child Conflict→ Cognitive flexibility→ Psychological distress	-0.072	0.037	2.437	0.043	Confirmed

Mindfulness-based interventions have been shown to effectively reduce depression, anxiety, and stress, which are key components of psychological distress in diabetic populations (15). Similarly, resilience serves as a protective factor that buffers the adverse psychological effects associated with chronic illness (4,17,24). Resilient individuals tend to adapt better to health challenges and are less likely to experience severe distress (26,24). As Patra et al. (13) As previous studies reported, mindfulness significantly predicts better self-management and lower depression and anxiety levels in individuals with type 2 diabetes. Similarly, Ee et al. (15) systematic reviews have confirmed that mindfulness-based interventions effectively reduce psychological distress and improve well-being, partly by enhancing cognitive and emotional regulation capacities. The mediating role of cognitive flexibility aligns with the conceptualization by Uddin (22), who described cognitive flexibility as a neural and psychological mechanism supporting adaptive responses under stress.

The significant indirect effects of mindfulness and resilience on psychological distress through cognitive flexibility suggest that these psychological resources facilitate better mental health outcomes by enabling individuals to reframe stressful situations, switch perspectives, and adopt adaptive coping strategies (19). This mechanism is consistent with the models proposed by Uddin (22), asserting that cognitive flexibility mediates the relationship between psychological resilience and emotional regulation, leading to reduced distress (22,23).

Cognitive flexibility, defined as the ability to adapt thinking and behavior in response to changing circumstances, has been identified as a pivotal mediator that enhances the beneficial effects of mindfulness and resilience. It enables individuals to reframe stressful

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situations and adopt adaptive coping strategies (22,23). The mediation analysis in our study supports this notion, revealing that cognitive flexibility significantly mediates the relationship between mindfulness, resilience, and psychological distress, consistent with prior literature emphasizing the importance of cognitive adaptability in managing stress (25,28).

Furthermore, these findings are consistent with broader research across different populations indicating that greater cognitive flexibility and resilience are associated with better mental health outcomes, including lower psychological distress (19,20). Interventions targeting these constructs may therefore improve cognitive flexibility, reduce distress, and promote overall well-being among diabetics. Literature supports that such interventions can lead to meaningful improvements; for example, mindfulness-based stress reduction (MBSR) programs have been shown to increase mindfulness and cognitive flexibility, thereby decreasing psychological distress (15). Similarly, strengthening resilience through psychological interventions has been demonstrated to decrease emotional disturbances in patients coping with chronic illnesses (24).

Limitations of the research

This study's limitations restrict the generalizability of findings. It was conducted solely with diabetic patients using self-report questionnaires, so the results may not apply to other diabetic populations or the general public. Since the use of convenience sampling can lead to biased results, it is noted as another limitation of the study. The findings are unlikely to be generalizable to the entire population of patients with type 2 diabetes and are applicable only under specific conditions and with certain limitations in mind. Specifically, the study population does not encompass all outpatient patients with type 2 diabetes; rather, it must consider limitations related to literacy, as well as visual and auditory impairments, which unfortunately were overlooked by the researchers in this study. Consequently, this significantly restricts the generalizability of the findings. Another limitation that should be addressed in future studies is the failure to control for confounding variables such as the type of diabetes, the duration of illness, and the age at diagnosis, all of which can contribute to bias.

Unexamined factors such as diabetes type, illness duration, and age at diagnosis further limit interpretation due to potential biases inherent in self-reported data. To improve patient well-being and societal health, treatment centers should implement group therapy, and family workshops should be organized. Mass media campaigns encouraging diabetes education are also warranted. Future research should use mixed methods (interviews and observations) for richer data, larger and more diverse samples for greater generalizability, and experimental or longitudinal designs to improve validity. Further investigation into positive psychology education, stress management, and self-care strategies, particularly mindfulness-based interventions to address psychological distress, could also benefit diabetic patients.

Conclusions

In summary, these findings reinforce the importance of incorporating psychological resources such as mindfulness and resilience into diabetes management. By enhancing cognitive flexibility, these factors collectively mitigate the adverse emotional effects of the disease, facilitating better psychological adjustment and overall well-being. Future research should consider longitudinal designs to examine causal pathways and test the efficacy of targeted interventions based on these mechanisms.

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Conflict of Interest

The writers do not have any competing interests.

Author contributions

N.A. GH.M: writing- original draft and analyzing data. R.N. supervision and conceptualization, N.A. GH.M: collecting the data and Conceptualization, R.N: Supervision and methodological contributions. All the authors critically revised the manuscript, agree to be fully accountable for the integrity and accuracy of the study, and read and approved the final manuscript.

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