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Effectiveness of a Continuous Care Model for Treatment Adherence Based on the ACT Approach on Perceived Stress in Patients with Diabetes

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A B S T R A C T

This study aimed to determine the effectiveness of a continuous care model for treatment adherence based on Acceptance and Commitment Therapy (ACT) in reducing perceived stress among patients with diabetes. This quasi-experimental study employed a pretest–posttest control-group design with a two-month follow-up. The statistical population consisted of patients with type 1 or type 2 diabetes living in Isfahan, Iran, in 2024. Thirty eligible participants were selected through purposive sampling and randomly assigned to an experimental group (n = 15) and a control group (n = 15). The experimental group received eight weekly 90-minute sessions of an ACT-based continuous care intervention focused on acceptance, mindfulness, emotional and cognitive experiences, lifestyle adjustment, adherence barriers, coping strategies, and maintenance planning, while the control group received no psychological intervention. Perceived stress was assessed using the Perceived Stress Scale at pretest, posttest, and two-month follow-up. Data were analyzed in SPSS version 26 using mixed repeated-measures analysis of variance after examination of normality, homogeneity of variance, and sphericity assumptions. The mixed ANOVA showed a significant main effect of time on perceived stress, $F = 68.10$, $p < .001$, partial $\eta^2 = .709$. The time-by-group interaction was also statistically significant, $F = 61.20$, $p < .001$, partial $\eta^2 = .686$, indicating that changes in perceived stress across the three assessment stages differed significantly between the experimental and control groups. In addition, the between-subjects effect of group was significant, $F = 24.04$, $p < .001$, partial $\eta^2 = .462$. These findings indicated a substantial intervention-related reduction in perceived stress that was largely maintained at follow-up. The ACT-based continuous care model appears to be an effective psychological intervention for reducing perceived stress in patients with diabetes, with effects that persisted for at least two months after treatment.

Keywords: *Acceptance and Commitment Therapy, Continuous Care Model, Diabetes Mellitus, Perceived Stress, Treatment Adherence*

1. Introduction

Diabetes mellitus is one of the most consequential chronic diseases confronting contemporary health systems because its effects extend beyond metabolic dysregulation to encompass cardiovascular, neurological, renal, ophthalmological, psychological, social, and economic dimensions of health. Effective management requires continuous monitoring, sustained behavioral modification, adherence to pharmacological and nonpharmacological recommendations, and active participation by patients in daily self-care. The burden of diabetes is therefore not confined to its direct physiological consequences but also includes the persistent demands imposed on patients, their families, and healthcare services. Diabetes-related morbidity and mortality remain strongly influenced by long-term complications, particularly cardiovascular outcomes, which continue to represent a major source of adverse clinical events among individuals with both type 1 and type 2 diabetes (Rosengren & Dikaiou, 2023). At the same time, diabetes imposes substantial economic costs through medical expenditures, productivity losses, disability, and the long-term treatment of preventable complications (Parker et al., 2024). The prevalence of diabetes in different populations, including Iranian adults, further emphasizes the need for interventions that extend beyond biomedical treatment and address psychological and behavioral determinants of successful disease management (Dehghani et al., 2023).

The complexity of diabetes management is consistent with a biopsychosocial understanding of chronic illness. From this perspective, biological disease processes interact continuously with psychological functioning, social relationships, behavioral patterns, cultural beliefs, socioeconomic circumstances, and the healthcare environment. Contemporary healthcare increasingly recognizes that focusing exclusively on pathophysiology may be insufficient for patients whose outcomes depend heavily on self-management, motivation, adaptation, and sustained engagement with treatment (Seyed Alitabar, 2025b). Cultural interpretations of illness, the meaning attributed to physical symptoms, family expectations, health beliefs, and socially shaped responses to distress may also influence how patients experience and manage chronic conditions (Seyed Alitabar, 2025a). These considerations are particularly relevant to diabetes because treatment is largely implemented outside healthcare settings and depends on daily decisions concerning medication use, diet, physical activity, glucose monitoring, medical follow-up, and responses to fluctuations in symptoms.

The biological consequences of poor diabetes management can also develop gradually and may not always be immediately apparent to patients. Chronic hyperglycemia can contribute to multisystem damage, including cardiovascular, hepatic, renal, neurological, and microvascular complications. Research on diabetic organ injury has illustrated the underlying biological complexity of disease-related tissue damage and the importance of detecting pathological changes before severe clinical consequences emerge (Chen et al., 2023). Such findings reinforce the importance of sustained treatment adherence because diabetes management is not limited to symptom relief; it is fundamentally preventive, aiming to reduce cumulative metabolic damage and delay or prevent complications. Nevertheless, patients are required to maintain demanding self-management behaviors over years or decades, often in the absence of immediate reinforcement. This discrepancy between the delayed benefits of adherence and the immediate burden of self-care may contribute to frustration, emotional exhaustion, inconsistent treatment behaviors, and diminished motivation.

Treatment adherence is therefore a central component of diabetes care. Adherence encompasses the degree to which a person's behavior corresponds with agreed recommendations regarding medication, dietary practices, exercise, monitoring, medical appointments, and other components of disease management. In diabetes, adherence is rarely determined by knowledge alone. Patients may understand the importance of recommended behaviors but still experience difficulty sustaining them because of emotional distress, fatigue, competing responsibilities, negative beliefs, fear of complications, social pressures, financial barriers, low self-efficacy, or avoidance of illness-related experiences. Psychological difficulties may thus become closely intertwined with treatment behavior. The relevance of psychological interventions in diabetes has been increasingly acknowledged, although evidence across specific complications and treatment contexts remains variable. For example, psychological interventions have been investigated in relation to diabetic foot ulcers and their recurrence, demonstrating the clinical rationale for addressing psychological and behavioral processes alongside physical treatment (McGloin et al., 2021). Likewise, the intersection between metabolic risk and mental health has been emphasized in research examining preventive interventions for type 2 diabetes among adults

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with mental disorders, particularly in settings where healthcare resources and integrated care may be limited (Mishu et al., 2021).

Among the psychological factors relevant to diabetes management, perceived stress is particularly important. Perceived stress refers to an individual's appraisal of the extent to which life circumstances are unpredictable, uncontrollable, or overwhelming. It is not simply a measure of exposure to stressful events but reflects how individuals interpret demands relative to their perceived coping resources. Chronic disease can heighten perceived stress because patients face repeated treatment decisions, uncertainty regarding future complications, concerns about physical functioning, changes in lifestyle, financial pressures, and the possibility of disease progression. In diabetes, stress may also interfere with self-regulation and reduce the likelihood of consistent engagement in complex self-care behaviors. Longitudinal evidence has suggested that psychological stress may itself be associated with subsequent risk for type 2 diabetes, highlighting a potentially bidirectional relationship between stress and metabolic health (Putri & Rustam, 2021). More broadly, research conducted in populations exposed to major environmental adversity has shown that perceived stress is closely connected with health status and may be shaped by protective psychosocial factors, reinforcing the importance of subjective appraisal and coping resources in health outcomes (Maltseva, 2024).

Accurate assessment of perceived stress is therefore essential when evaluating psychological interventions for chronic illness. The Perceived Stress Scale has been widely used for this purpose because it assesses the subjective experience of unpredictability, lack of control, and overload rather than focusing exclusively on specific external stressors. Psychometric evaluation of the 10-item Persian version has supported its validity and reliability in Iranian populations, including clinical samples, providing a suitable instrument for assessing perceived stress in Persian-speaking patients (Sharif-Nia et al., 2024). The availability of a psychometrically supported measure is especially important in intervention research because changes in perceived stress may reflect meaningful improvements in how patients relate to chronic illness demands even when the external circumstances of the disease remain unchanged.

One therapeutic framework that may be particularly suitable for reducing perceived stress and supporting treatment adherence is Acceptance and Commitment Therapy (ACT). ACT is a contextual behavioral approach that aims to increase psychological flexibility rather than attempting to eliminate all unpleasant thoughts, emotions, or bodily sensations. Psychological flexibility involves the capacity to remain in contact with present-moment experiences while choosing behaviors that are consistent with personally meaningful values. ACT typically emphasizes acceptance, cognitive defusion, present-moment awareness, self-as-context, values clarification, and committed action. These processes may be highly relevant to chronic disease because patients often encounter experiences that cannot be fully removed, including fear of complications, frustration about restrictions, uncertainty about the future, painful physical symptoms, and recurring treatment demands. Rather than making adherence contingent on the absence of distress, ACT encourages individuals to acknowledge difficult internal experiences while continuing to engage in valued health-related behavior.

The application of ACT to treatment non-adherence has received specific theoretical attention. Graham and colleagues proposed that non-adherence can be understood partly in terms of psychological inflexibility, experiential avoidance, and attempts to escape or control distressing thoughts and emotions associated with treatment (Graham et al., 2022). From this perspective, patients may avoid medications, monitoring, appointments, dietary restrictions, or other healthcare behaviors not because they lack information but because these behaviors evoke unpleasant emotions, reminders of illness, fear, frustration, or perceived loss of autonomy. ACT may help individuals recognize these internal experiences without allowing them to dictate behavior, while strengthening values-based commitment to health and long-term functioning. This conceptualization is particularly compatible with diabetes management, in which adherence often requires repeated action despite discomfort, inconvenience, uncertainty, and delayed rewards.

Evidence from different clinical populations supports the broader potential of ACT to reduce psychological distress and improve adaptive functioning. ACT-based interventions have demonstrated beneficial effects among women experiencing psychological difficulties, indicating that acceptance, values clarification, and committed action can contribute to improved psychological adjustment (Adiloğlu, 2023). In infertile women, ACT has also been associated with improvements in coping styles and reductions in perceived stress, suggesting that the approach may be useful in health-related contexts characterized by uncertainty, emotional burden, and repeated treatment demands

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(Ahmadian et al., 2022). Similarly, preliminary randomized evidence among parents of children with cancer has indicated the feasibility of ACT for reducing psychological distress and improving quality of life among individuals facing sustained health-related stressors (Jin et al., 2023). Although these populations differ from patients with diabetes, the findings collectively support the proposition that psychological flexibility may represent a transdiagnostic mechanism relevant to coping with chronic and demanding health circumstances.

ACT has also been adapted for individuals with complex neurological and rehabilitation needs. The development of BrainACT for people with acquired brain injury illustrates how ACT principles can be structured around the specific cognitive, emotional, and behavioral challenges of a clinical population while retaining the core processes of acceptance, mindfulness, values, and committed action (Rauwenhoff et al., 2023). This adaptability is important for diabetes interventions because treatment adherence is influenced by multiple interacting factors rather than a single psychological symptom. An intervention designed for diabetes may therefore need to integrate ACT principles with education, self-management support, continuing care, problem solving, and attention to social and contextual barriers.

Within diabetes specifically, emerging evidence suggests that ACT may improve both psychological and self-management outcomes. A comparison of emotion-focused therapy and ACT among women with type 2 diabetes found beneficial effects on emotional self-regulation and diabetes-management self-efficacy, indicating that ACT may strengthen patients' perceived ability to manage disease-related demands (Bigdeli et al., 2023). Self-efficacy is especially relevant because effective diabetes care depends on patients' confidence in their capacity to implement complex behaviors repeatedly and under changing conditions. ACT may contribute to this process by reducing the dominance of distressing thoughts and emotions over behavior and by orienting patients toward personally meaningful reasons for maintaining self-care.

More direct evidence has also linked ACT with reduced stress and improved adherence among patients with diabetes. Rahimi and colleagues reported that ACT was effective in improving perceived stress, chronic pain, and treatment adherence among older adults with diabetes (Rahimi et al., 2023). This finding is particularly important because it suggests that ACT may simultaneously influence psychological distress and adherence-related behavior rather than treating these outcomes as entirely separate domains. If patients become more willing to experience discomfort and less governed by avoidant coping, they may be better able to follow treatment recommendations even when those recommendations are inconvenient or emotionally difficult. The reduction of perceived stress may further support adherence by improving emotional regulation, attention, decision-making, and daily planning.

Recent studies have additionally explored ACT delivered through alternative formats. A brief online ACT intervention for adults with type 1 diabetes demonstrated preliminary feasibility and potential psychological benefits, suggesting that ACT principles can be adapted to the practical realities of chronic disease care and may remain useful even when delivered in relatively brief formats (Stefanescu et al., 2024). This is relevant to modern diabetes care, where healthcare systems increasingly seek interventions that are accessible, scalable, and compatible with ongoing medical treatment. Nevertheless, brief or online interventions may not fully address the continuing-care needs of patients who require sustained support for translating psychological skills into everyday adherence behaviors.

A continuous care model may offer an important framework for addressing this gap. Continuous care emphasizes an ongoing, structured, and patient-centered process rather than a single educational encounter. In diabetes, continuous care can support repeated assessment of needs, reinforcement of self-management behaviors, identification of barriers, problem solving, emotional support, and maintenance of treatment engagement over time. Integrating ACT with a continuous care orientation may be particularly advantageous because psychological flexibility skills require repeated practice and application in real-life situations. Patients may learn acceptance, mindfulness, cognitive defusion, and values-based action during intervention sessions while simultaneously applying these principles to medication use, diet, exercise, symptom monitoring, family interactions, and healthcare follow-up. Such integration is consistent with holistic models of chronic disease management that seek to address biological, psychological, behavioral, and social dimensions simultaneously (Seyed Alitabar, 2025b).

Despite the growing literature on ACT, several gaps remain. Many studies have examined ACT in populations other than patients with diabetes, while diabetes-focused studies have often targeted specific subgroups, psychological outcomes, or brief interventions. The extent to which an ACT-based continuous care model can reduce

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perceived stress among adults with diabetes therefore warrants further investigation. Moreover, intervention effects should not be evaluated only immediately after treatment. Because diabetes is a lifelong condition, the maintenance of psychological benefits is clinically important. Follow-up assessment can help determine whether reductions in perceived stress persist after structured sessions have ended and whether participants are able to continue using learned strategies independently.

The Iranian context also deserves specific attention. Diabetes is prevalent among Iranian adults (Dehghani et al., 2023), and patients may experience culturally and socially shaped expectations concerning illness, family roles, dietary practices, emotional expression, and healthcare engagement. A culturally responsive psychological intervention should therefore acknowledge both individual coping processes and the broader social environment in which self-management occurs (Seyed Alitabar, 2025a). An ACT-based continuous care intervention that addresses illness meaning, emotional experiences, physical difficulties, lifestyle adjustment, social and economic barriers, adherence challenges, coping strategies, and maintenance planning may provide a more integrated approach than interventions focused exclusively on symptom reduction or patient education.

Accordingly, the aim of the present study was to determine the effectiveness of an ACT-based continuous care model for treatment adherence in reducing perceived stress among patients with diabetes.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a quasi-experimental pretest–posttest control-group design with a two-month follow-up to investigate the effectiveness of a continuous care model for treatment adherence based on the Acceptance and Commitment Therapy (ACT) approach in reducing perceived stress among patients with diabetes. The target population consisted of patients diagnosed with type 1 or type 2 diabetes who were living in Isfahan, Iran, in 2024. Participants were recruited through purposive sampling according to the predetermined eligibility criteria. After initial screening, 30 eligible patients who provided written informed consent were enrolled in the study and randomly assigned to either the experimental group (n = 15) or the control group (n = 15). The inclusion criteria were a confirmed diagnosis of type 1 or type 2 diabetes, a minimum of three years since diagnosis, an age range of 20 to 45 years, willingness to participate and provision of informed consent, absence of an acute psychiatric disorder, and a minimum educational level equivalent to lower-secondary or high-school education to ensure adequate comprehension of the intervention content and research instruments. The exclusion criteria included unwillingness to continue cooperation during the study, simultaneous participation in another psychological or behavioral intervention, the presence or development of a severe psychiatric disorder requiring specialized treatment, absence from more than two intervention sessions, incomplete questionnaire data, and withdrawal of informed consent at any stage of the research. Participants in the experimental group received the ACT-based continuous care intervention in eight weekly 90-minute sessions over an eight-week period, whereas participants in the control group did not receive a psychological intervention during the study period and continued their routine medical care. Perceived stress was assessed at three measurement occasions: before the intervention as the pretest, immediately following completion of the intervention as the posttest, and two months after the intervention as the follow-up assessment. Ethical principles were observed throughout the study. Participants were informed about the aims, procedures, expected duration, and voluntary nature of participation before enrollment. Written informed consent was obtained from all participants, personal and research information was treated confidentially, and participants were informed that they could withdraw from the study at any time without penalty or disruption to their routine medical care. The researchers also sought to minimize potential psychological, social, physical, and financial harm, and all findings were reported on the basis of the data obtained from the participants.

2.2. Data Collection Tools

Perceived stress was measured using the Perceived Stress Scale (PSS), originally developed by Cohen, Kamarck, and Mermelstein in 1983 to evaluate the extent to which individuals perceive situations in their lives as unpredictable, uncontrollable, overwhelming, and stressful. The scale measures subjective appraisal of stress rather than exposure to specific stressful events and includes items addressing feelings of lack of control, emotional overload, perceived inability to cope effectively with difficulties, and confidence in managing everyday demands. Responses are rated on a five-point Likert scale ranging from 0 (never) to 4

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(very often). Positively worded items are reverse-scored according to the scoring instructions, after which item scores are summed to obtain an overall perceived stress score, with higher scores representing greater levels of perceived stress. The PSS has been extensively used in clinical and nonclinical populations and has demonstrated satisfactory psychometric properties across different cultural settings. Evidence regarding the Persian-language version has likewise indicated acceptable validity and reliability in Iranian clinical populations (Khalili et al., 2017), while more recent psychometric research on the Persian version of the PSS-10 has supported its construct validity and internal consistency (Sharif-Nia et al., 2024). In the present study, the internal consistency of the instrument was satisfactory, with a Cronbach's alpha coefficient of .879.

2.3. Intervention

The experimental group participated in an eight-session ACT-based continuous care program designed to strengthen treatment adherence while addressing the psychological, behavioral, interpersonal, and contextual challenges associated with living with diabetes. Each session lasted approximately 90 minutes and was conducted once weekly for eight consecutive weeks. The first session focused on orientation, establishment of therapeutic rapport, clarification of the goals and structure of the program, exploration of participants' experiences surrounding their diabetes diagnosis, identification of initial thoughts and emotional reactions, and introduction to acceptance of illness and the main principles of ACT; participants were asked to reflect in writing on their memories of diagnosis and their current emotional needs. The second session addressed emotional and cognitive experiences commonly associated with diabetes, including worry, anxiety, guilt, anger, diminished self-confidence, and fear about the future, while participants learned to recognize painful thoughts and emotions and were introduced to acceptance and present-moment awareness through brief mindfulness practice. The third session concentrated on physical difficulties and diabetes self-management, including fatigue, sleep disturbances, fluctuations in physical condition, limitations in daily functioning, nutrition, and physical activity, and participants developed a short self-care plan covering sleep, diet, and activity. The fourth session focused on adjustment to lifestyle changes following diagnosis, particularly changes in eating patterns and exercise, the distinction between previous and healthier behavioral patterns, adaptive responses to lifestyle restrictions, and strategies for managing situations in which participants were tempted to return to unhealthy habits. The fifth session addressed contextual barriers to effective diabetes management, including family interactions, economic pressures, cultural attitudes, misconceptions about diabetes, limitations in health literacy, and inadequate social support; participants identified their personal support networks and discussed their support needs with a family member or significant other. The sixth session concentrated on barriers and facilitators of treatment adherence, including depressive reactions, insufficient knowledge about diabetes management, inaccurate beliefs, limited use of support groups, and difficulties in obtaining professional assistance, while encouraging appropriate help-seeking, treatment follow-up, and use of educational and social resources. The seventh session emphasized coping strategies and emotional management through training in practical emotion regulation, problem solving, daily planning, personal responsibility for health, management of diabetes-related stress, and replacement of maladaptive responses with more adaptive behaviors; participants developed and implemented a structured plan for coping with a commonly experienced stressor. The final session was devoted to consolidation and maintenance of treatment gains, review of the strategies developed during previous sessions, reinforcement of psychological flexibility and resilience, discussion of quality of life and interpersonal relationships, and development of an individualized continuing-care and treatment-adherence plan. Participants were encouraged to identify potential future challenges, strategies for maintaining motivation, and specific weekly health-related goals for the following month. The posttest assessment was administered after completion of the final session, and arrangements were made for the two-month follow-up assessment.

2.4. Data Analysis

Data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics, including frequencies and percentages for categorical variables and means and standard deviations for continuous variables, were used to summarize participants' demographic characteristics and perceived stress scores across the three measurement occasions. Before conducting inferential analyses, the assumptions required for repeated-measures analysis were examined. The Shapiro–Wilk test was used to assess the normality of the distribution of perceived stress scores, and

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Levene's test was applied to examine the homogeneity of variances between the experimental and control groups. Mauchly's test of sphericity was used to determine whether the sphericity assumption for the repeated measurements was satisfied. When Mauchly's test indicated a violation of sphericity, Greenhouse–Geisser-adjusted degrees of freedom were used to obtain corrected significance tests. The effectiveness of the ACT-based continuous care intervention on perceived stress was evaluated using a mixed repeated-measures analysis of variance, with time consisting of three levels (pretest, posttest, and two-month follow-up) as the within-subject factor and group (experimental versus control) as the between-subject factor. The analysis examined the main effects of time and group as well as the time-by-group interaction, with particular emphasis on whether changes in perceived stress across the three assessment points differed significantly between the experimental and control groups. Statistical significance was evaluated at an alpha level of .05.

3. Findings and Results

The participants in the experimental and control groups were generally comparable in terms of their demographic characteristics. Participants ranged in age from 20 to 40 years, and the mean age did not differ significantly between the two groups, indicating adequate comparability with respect to age at baseline. The distribution of sex was also approximately similar between the experimental and control groups, with both men and women represented in each group. Likewise, the groups showed comparable distributions in marital status, including single and married participants, and in educational attainment, which included diploma, associate-level, and bachelor's-level education. Overall, no substantial demographic imbalance was observed between the two groups, suggesting that the experimental and control groups were sufficiently comparable in their baseline demographic characteristics.

Table 1

Means and Standard Deviations of Perceived Stress Across Groups and Assessment Stages

Outcome	Group	Pretest M	Pretest SD	Posttest M	Posttest SD	Follow-up M	Follow-up SD
Perceived stress	ACT-based continuous care model	49.80	4.05	38.60	3.63	39.50	3.66
Perceived stress	Control	49.60	4.90	49.20	5.42	49.60	5.40

As shown in Table 1, the mean perceived stress scores of the two groups were highly similar at pretest, with a mean of 49.80 (SD = 4.05) in the experimental group and 49.60 (SD = 4.90) in the control group. Following the intervention, the mean perceived stress score in the experimental group decreased considerably to 38.60 (SD = 3.63), whereas the control group's mean remained relatively unchanged at 49.20 (SD = 5.42). At the two-month follow-up, the mean perceived stress score in the experimental group was 39.50 (SD = 3.66), indicating that most of the reduction observed immediately after the intervention was maintained over time. In contrast, the control group's mean perceived stress score at follow-up was 49.60 (SD = 5.40), which was nearly identical to its pretest value. Thus, the descriptive findings showed a marked reduction in perceived stress following the ACT-based continuous care intervention, with the improvement largely maintained at the follow-up assessment.

Before conducting the mixed analysis of variance, the relevant statistical assumptions were examined. The Shapiro–Wilk test supported the approximate normality of perceived stress scores across the assessment stages, and Levene's tests did not indicate a problematic violation of the homogeneity of variance assumption between the experimental and control groups. Mauchly's test, however, indicated that the assumption of sphericity was violated; consequently, Greenhouse–Geisser-adjusted degrees of freedom were used in the within-subject analyses. Multivariate analyses likewise indicated statistically significant changes across assessment time and a significant interaction between assessment time and group. For the effect of assessment time, Pillai's trace was .57, Wilks' lambda was .005, Hotelling's trace was 191.50, and Roy's largest root was 191.50, with the reported multivariate test reaching statistical significance, $F = 135.20$, $p < .001$, partial $\eta^2 = .57$. For the time-by-group interaction, Pillai's trace was .53, Wilks' lambda was .023, Hotelling's trace was 41.70, and Roy's largest root was 41.70, with the effect also reaching statistical significance, $F = 29.40$, $p < .001$, partial $\eta^2 = .53$. These findings indicated that perceived stress changed significantly over the three measurement occasions

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and, more importantly, that the pattern of change differed substantially between the experimental and control groups.

Table 2

Mixed ANOVA Effects for Perceived Stress

Effect Type	Source	Sum of Squares	df	Mean Square	F	p	Partial η^2
Within-subjects	Time	614.60	1.02	597.40	68.10	< .001	.709
Within-subjects	Time × Group	552.06	1.02	536.50	61.20	< .001	.686
Between-subjects	Group	1210.00	1.00	1210.00	24.04	< .001	.462

As presented in Table 2, the mixed ANOVA revealed a statistically significant main effect of time on perceived stress, $F = 68.10$, $p < .001$, partial $\eta^2 = .709$, indicating that perceived stress scores changed significantly across the pretest, posttest, and two-month follow-up assessments. More importantly, the time-by-group interaction was statistically significant, $F = 61.20$, $p < .001$, partial $\eta^2 = .686$, demonstrating that the pattern of change in perceived stress over time differed significantly between the experimental and control groups. The magnitude of the interaction effect was large, showing that a substantial proportion of the variability in changes in perceived stress was associated with group membership across the measurement occasions. The between-subjects main effect of group was also statistically significant, $F = 24.04$, $p < .001$, partial $\eta^2 = .462$, indicating an overall difference in perceived stress between the experimental and control groups across the study period. Taken together with the descriptive results, these findings demonstrated that participants receiving the ACT-based continuous care model experienced a substantial reduction in perceived stress after the intervention and that this improvement was largely sustained at the two-month follow-up, whereas perceived stress remained relatively stable among participants in the control group.

4. Discussion

The present study investigated the effectiveness of a continuous care model for treatment adherence based on the Acceptance and Commitment Therapy (ACT) approach in reducing perceived stress among patients with diabetes. The findings showed a clear and clinically meaningful reduction in perceived stress among participants who received the ACT-based continuous care intervention. At baseline, the experimental and control groups had almost identical perceived stress scores, indicating that the two groups were comparable before the intervention. Following eight weekly intervention sessions, perceived stress decreased substantially in the experimental group, whereas the control group showed virtually no meaningful change. This reduction remained largely stable at the two-month follow-up, suggesting that the beneficial effects of the intervention were not limited to the immediate post-intervention period. The mixed analysis of variance further demonstrated significant effects of time, group, and particularly the time-by-group interaction, indicating that the pattern of change in perceived stress differed substantially between participants who received the intervention and those who did not. The large partial eta-squared values associated with these effects suggested that the intervention accounted for a considerable proportion of the observed changes in perceived stress.

These findings are consistent with previous research indicating that ACT can reduce perceived stress and improve adaptation in individuals facing persistent health-related challenges. Rahimi and colleagues reported that ACT was effective in reducing perceived stress and chronic pain while improving treatment adherence among older adults with diabetes (Rahimi et al., 2023). Their findings closely align with the present results because both studies demonstrate that an acceptance-based intervention can improve psychological outcomes in patients who must continuously cope with the demands of diabetes management. The present study extends this evidence by showing that ACT principles can be incorporated into a continuous care framework and can produce sustained reductions in perceived stress over a follow-up period. This finding is important because diabetes is a chronic condition requiring ongoing adaptation rather than a short-term response to an isolated stressor.

The findings are also supported by research conducted in other health-related populations. Ahmadian and colleagues found that ACT reduced perceived stress and improved coping styles among infertile women (Ahmadian et al., 2022). Although infertility and diabetes differ considerably in their medical characteristics, both conditions may involve chronic uncertainty, emotional burden, repeated treatment demands, and concerns regarding the future. ACT may be

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effective across these contexts because it does not primarily seek to remove difficult thoughts or emotions. Instead, it aims to change the individual's relationship with these internal experiences and to promote adaptive action in their presence. In patients with diabetes, distressing thoughts about disease progression, complications, dietary restrictions, medication dependence, or long-term health may not disappear completely. However, ACT may reduce the extent to which such experiences dominate behavior and interfere with self-management.

The results can be further understood through the central ACT concept of psychological flexibility. Psychological flexibility refers to the capacity to remain aware of present-moment experiences, including unpleasant thoughts and emotions, while continuing to behave in ways that are consistent with personal values and long-term goals. Graham and colleagues proposed that treatment non-adherence can be conceptualized partly as a consequence of psychological inflexibility and experiential avoidance (Graham et al., 2022). From this perspective, patients may fail to adhere to treatment not simply because of insufficient knowledge but because medical routines evoke anxiety, frustration, fatigue, shame, or reminders of illness. Avoiding these internal experiences may temporarily reduce distress but can undermine adherence and increase longer-term health risks. The intervention used in the present study directly addressed these processes by helping participants identify difficult thoughts and emotions, practice acceptance, develop present-moment awareness, clarify adaptive responses, and maintain health-related behaviors despite discomfort.

The significant reduction in perceived stress may therefore reflect a change in how participants evaluated and responded to diabetes-related demands rather than the elimination of those demands themselves. Diabetes treatment continued during the study, and participants remained responsible for medication, dietary regulation, physical activity, medical follow-up, and other self-management behaviors. Nevertheless, the intervention may have helped participants interpret these demands as more manageable and less overwhelming. This interpretation is consistent with the conceptual basis of perceived stress, which emphasizes subjective appraisal rather than the objective number of stressful events. The psychometric evidence supporting the Persian version of the Perceived Stress Scale further strengthens confidence that the observed changes represented meaningful differences in perceived stress within an Iranian clinical context (Sharif-Nia et al., 2024).

The present findings are also in line with the broader evidence suggesting that ACT can improve emotional regulation and self-management-related functioning in patients with diabetes. Bigdeli and colleagues reported that ACT improved emotional self-regulation and diabetes-management self-efficacy among women with type 2 diabetes (Bigdeli et al., 2023). These outcomes are closely related to perceived stress. Individuals who are better able to regulate emotional responses and who feel more capable of managing diabetes may be less likely to interpret everyday treatment demands as uncontrollable or overwhelming. Increased self-efficacy may also promote a greater sense of personal agency, which can reduce perceived helplessness and facilitate more effective coping. Therefore, the reduction in stress observed in the present study may have occurred partly because participants developed stronger confidence in their ability to manage both emotional and behavioral aspects of their illness.

The intervention's continuing-care structure may also have contributed to the maintenance of treatment effects. ACT skills such as mindfulness, acceptance, values clarification, and committed action are unlikely to become fully integrated after a single educational session. Repeated practice is required for these skills to influence everyday behavior. The eight-session intervention allowed participants to revisit psychological and behavioral challenges across several domains, including illness-related emotions, physical difficulties, lifestyle adjustment, family and social barriers, treatment adherence, coping strategies, and future maintenance. This structured repetition may have helped participants apply ACT principles to real-life diabetes management rather than treating them as abstract therapeutic concepts. The relatively stable follow-up scores suggest that participants may have continued using at least some of these strategies after the formal sessions ended.

The maintenance of improvement at follow-up is also consistent with the emphasis of ACT on transferable skills rather than therapist-dependent symptom management. Rauwenhoff and colleagues, in describing an ACT-based intervention for individuals with acquired brain injury, emphasized the adaptability of ACT processes to complex chronic conditions and rehabilitation contexts (Rauwenhoff et al., 2023). A similar principle may apply to diabetes. Once patients learn to notice distressing thoughts, accept difficult emotions, reconnect with personal values, and select value-consistent behaviors, these skills can potentially be applied

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to multiple situations beyond the intervention setting. The continuing-care component of the present intervention may have strengthened this transfer by encouraging participants to develop personal plans for self-care, problem solving, support seeking, and maintenance.

The findings are additionally compatible with evidence from brief and technology-supported ACT interventions. Stefanescu and colleagues reported promising preliminary effects of a brief online ACT program for adults with type 1 diabetes (Stefanescu et al., 2024). This suggests that ACT principles can be relevant to diabetes-related psychological adjustment across different delivery formats. However, the present findings may also indicate the potential benefit of a more structured and sustained approach when the goal is not only stress reduction but also the reinforcement of treatment adherence. Whereas brief interventions may improve accessibility, continuous care may provide greater opportunity to address contextual barriers, monitor progress, reinforce skills, and adapt treatment strategies to patients' evolving needs.

The results are also consistent with evidence that ACT can reduce psychological distress in other populations exposed to sustained health-related stress. Jin and colleagues found preliminary benefits of ACT for reducing psychological distress and improving quality of life among parents of children with cancer (Jin et al., 2023). Similarly, Adiloğlu reported positive outcomes of an ACT-based intervention among women experiencing psychological difficulties (Adiloğlu, 2023). Taken together, these studies suggest that ACT may have utility across conditions in which individuals must cope with circumstances that cannot be immediately controlled or eliminated. Diabetes fits this pattern because successful adaptation depends not only on changing external circumstances but also on developing a more flexible relationship with ongoing uncertainty, restrictions, and emotional discomfort.

The reduction in perceived stress observed in the present study may also have broader implications for diabetes management. Psychological stress has been associated with an increased long-term risk of type 2 diabetes, suggesting that stress and metabolic health may influence each other over time (Putri & Rustam, 2021). Perceived stress has also been linked more generally to health status and psychosocial resources, particularly under conditions of sustained adversity (Maltseva, 2024). For individuals already living with diabetes, elevated stress may interfere with sleep, concentration, planning, dietary regulation, physical activity, and medication adherence. Reducing perceived stress may therefore have benefits extending beyond subjective well-being. Although the present study did not directly assess metabolic outcomes, improved psychological functioning may create more favorable conditions for consistent self-management.

The importance of psychological support becomes even more apparent when diabetes is considered within a biopsychosocial framework. Diabetes is not merely a disorder of glucose metabolism; its course and management are shaped by emotional functioning, family relationships, social support, cultural beliefs, financial resources, healthcare access, and everyday behavior. Seyed Alitabar emphasized the importance of moving beyond narrowly biomedical approaches toward integrated models of healthcare that account for psychological and social influences on illness (Seyed Alitabar, 2025b). Cultural meanings surrounding health and illness may further shape how individuals understand bodily symptoms, accept treatment, communicate distress, and seek support (Seyed Alitabar, 2025a). The present intervention was compatible with this broader perspective because it addressed emotional, physical, behavioral, social, cultural, and economic barriers alongside treatment adherence.

Such integration is especially relevant given the substantial burden of diabetes and its complications. Diabetes remains associated with serious cardiovascular consequences in both type 1 and type 2 disease (Rosengren & Dikaiou, 2023), while ongoing research continues to demonstrate the complexity of diabetes-related organ injury and the potential for progressive tissue damage (Chen et al., 2023). These risks make sustained adherence to treatment recommendations particularly important. The economic burden of diabetes is also considerable, reflecting direct healthcare expenditures as well as productivity losses and costs related to complications (Parker et al., 2024). Although psychological interventions cannot replace medical treatment, interventions that improve patients' ability to cope with disease demands and remain engaged in treatment may contribute to more comprehensive chronic disease management.

The relevance of this approach may be particularly pronounced in the Iranian context, where diabetes represents a substantial public health concern. Epidemiological evidence has documented the prevalence of diabetes and its associated factors among Iranian adults (Dehghani et al., 2023). Effective management therefore requires interventions that are feasible within local healthcare systems and responsive to the psychological and cultural

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experiences of patients. The use of an ACT-based continuous care model may be advantageous because it can be integrated with existing medical care without requiring that patients first eliminate distress before engaging in self-management. Instead, patients can be encouraged to act in accordance with health-related values while acknowledging the presence of anxiety, frustration, fatigue, or other difficult experiences.

The present findings should also be interpreted alongside the wider literature on psychological interventions in diabetes. McGloin and colleagues examined psychological interventions in relation to diabetic foot ulcers and recurrence prevention, highlighting both the relevance of psychological care and the need for stronger evidence in specific diabetes-related outcomes (McGloin et al., 2021). Similarly, Mishu and colleagues emphasized the importance of behavioral and psychological approaches when considering diabetes prevention among adults with mental disorders, particularly in low- and middle-income settings (Mishu et al., 2021). These reviews underscore the fact that psychological and metabolic health cannot always be effectively separated. The present study contributes to this body of evidence by demonstrating that an ACT-informed continuous care intervention may reduce perceived stress in patients who are already living with diabetes.

5. Conclusion

Overall, the findings suggest that the ACT-based continuous care model may have reduced perceived stress through several mutually reinforcing mechanisms. Acceptance may have decreased the struggle against unavoidable disease-related experiences; mindfulness may have reduced excessive preoccupation with future complications and past difficulties; cognitive defusion may have weakened the influence of distressing thoughts on behavior; values clarification may have strengthened personal motivation for health-related action; and committed action may have promoted sustained engagement in self-care despite emotional discomfort. In addition, the continuous care structure may have reinforced these processes through repeated practice, support, problem solving, and maintenance planning. The persistence of improvement at the two-month follow-up suggests that the intervention may have promoted more durable changes in coping rather than merely producing short-term emotional relief.

A number of limitations should be considered when interpreting these findings. First, the sample size was relatively small, with only 30 participants divided equally between the experimental and control groups, which may limit statistical power and the generalizability of the findings. Second, purposive sampling was used to recruit participants, which may have introduced selection bias because individuals willing to participate in a psychological intervention may differ from other patients with diabetes in motivation, treatment engagement, or psychological readiness. Third, the study was conducted among patients living in Isfahan, and the findings may not be directly generalizable to individuals from other geographical, cultural, or socioeconomic settings. Fourth, perceived stress was assessed using a self-report measure and may therefore have been influenced by response tendencies or participants' expectations regarding the intervention. Fifth, the follow-up period was limited to two months and does not establish whether the observed benefits remain stable over longer periods. Finally, the study focused specifically on perceived stress and did not assess potentially relevant clinical or behavioral outcomes such as glycemic control, medication adherence, dietary adherence, physical activity, diabetes distress, quality of life, or healthcare utilization.

Future research should replicate the present study using larger and more diverse samples and, where possible, fully randomized controlled designs. Studies involving participants from several cities or healthcare centers would provide stronger evidence regarding generalizability. Longer follow-up periods, such as six months or one year, are recommended to determine whether improvements in perceived stress are maintained over time. Future research should also incorporate objective clinical indicators, including glycated hemoglobin, fasting blood glucose, medication-use data, or other indices of diabetes control, alongside psychological outcomes. Investigating mediating mechanisms such as psychological flexibility, experiential avoidance, self-efficacy, emotion regulation, mindfulness, and values-based action would help clarify how the intervention produces its effects. Comparative studies could also examine whether ACT-based continuous care is more effective than standard diabetes education, cognitive-behavioral therapy, mindfulness-based interventions, or other adherence-enhancing approaches. Research comparing face-to-face, online, and hybrid formats may further identify scalable approaches suitable for routine chronic disease care.

From a practical perspective, healthcare professionals working with patients with diabetes should consider incorporating structured psychological support into routine disease management rather than focusing exclusively on

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biomedical indicators. Nurses, psychologists, diabetes educators, and other members of multidisciplinary teams can be trained to identify patients experiencing elevated perceived stress and difficulties with treatment adherence and to provide brief ACT-informed strategies within continuing-care programs. Interventions should include attention to acceptance of illness, awareness of stress-related thoughts and emotions, values-based motivation, problem solving, support seeking, and realistic planning for diet, medication, physical activity, and medical follow-up. Periodic booster sessions or follow-up contacts may help patients maintain the skills acquired during treatment. Integrating these strategies into diabetes clinics may provide a practical means of strengthening psychological adaptation while supporting long-term engagement with treatment.

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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