



The Effectiveness of Acceptance and Commitment Therapy on Psychological Flexibility, Pain Catastrophizing, and Quality of Life Among Adults With Chronic Pain

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ABSTRACT

Objective: This study aimed to determine the effectiveness of Acceptance and Commitment Therapy on psychological flexibility, pain catastrophizing, and quality of life among adults with chronic pain.

Methods and Materials: This quasi-experimental study was conducted using a pretest–posttest design with a control group and a two-month follow-up. The statistical population included adults with chronic pain who referred to pain clinics, rehabilitation centers, and specialized medical centers in Isfahan, Iran. A total of 50 eligible participants were selected through purposive sampling and assigned to an experimental group and a control group, with 25 participants in each group. The experimental group received Acceptance and Commitment Therapy in eight weekly 90-minute sessions, while the control group received routine care and no structured psychological intervention during the same period. Data were collected using the Psychological Inflexibility in Pain Scale, the Pain Catastrophizing Scale, and the 36-Item Short Form Health Survey. Data were analyzed using repeated-measures analysis of variance and Bonferroni post hoc comparisons.

Findings: The results showed a significant main effect of time for pain-related psychological inflexibility, pain catastrophizing, and quality of life ($p < .001$). The main effect of group was also significant for all three variables ($p < .001$). Most importantly, the time-by-group interaction was significant for pain-related psychological inflexibility ($F = 44.93, p < .001, \eta^2 = .484$), pain catastrophizing ($F = 39.84, p < .001, \eta^2 = .454$), and quality of life ($F = 47.28, p < .001, \eta^2 = .496$). Bonferroni comparisons indicated significant improvements from pretest to posttest and from pretest to follow-up in the experimental group ($p < .001$), while posttest-to-follow-up differences were not significant.

Conclusion: Acceptance and Commitment Therapy was effective in improving psychological flexibility, reducing pain catastrophizing, and enhancing quality of life among adults with chronic pain, and these effects remained stable at the two-month follow-up.

Keywords: Acceptance and Commitment Therapy; Chronic Pain; Psychological Flexibility; Pain Catastrophizing; Quality of Life

1. Introduction

Chronic pain is one of the most complex and disabling health conditions, extending beyond the persistence of physical symptoms to affect emotional regulation, cognitive functioning, interpersonal participation, work capacity, and overall quality of life. Unlike acute pain, which often serves a protective biological function, chronic pain frequently becomes a long-term biopsychosocial condition in which sensory, affective, cognitive, behavioral, and contextual factors interact in maintaining suffering and disability. Contemporary pain science increasingly conceptualizes chronic pain not merely as a symptom of tissue damage but as a multidimensional experience shaped by nervous system sensitization, psychological appraisal, stress responses, social participation, and health-related behaviors. In this regard, psychological processes are central to understanding why individuals with similar pain intensity may differ substantially in disability, distress, coping, and life satisfaction. The clinical burden of chronic pain has therefore encouraged a shift from purely biomedical models toward integrative approaches that address both symptom experience and adaptive functioning. This is especially important because chronic pain often coexists with stress, anxiety, depressive symptoms, reduced physical activity, disrupted roles, sleep disturbance, and diminished perceived control over daily life (Aboushaar & Serrano, 2024; Edwards et al., 2023; Gosens & Oudsten, 2023; Serdarević, 2024).

The biopsychosocial model provides a strong framework for understanding chronic pain because it recognizes the reciprocal relationships among biological vulnerability, psychological reactions, and social-contextual demands. Stress and pain can mutually reinforce each other through neuroendocrine activation, attentional narrowing, emotional arousal, avoidance behavior, and heightened threat perception, creating a cycle in which pain increases stress and stress intensifies pain-related suffering (Aboushaar & Serrano, 2024). In many chronic pain conditions, particularly fibromyalgia, neuropathic pain, chronic musculoskeletal pain, postsurgical pain, gastrointestinal pain, headache disorders, and pain associated with chronic medical conditions, psychological processes significantly influence symptom persistence, adjustment, and functional outcomes (Bäckryd et al., 2024; Keefer et al., 2021; Luciano et al., 2023; Vasiliou et al., 2021). Rehabilitation and self-management research has also emphasized that pain-related disability is not adequately explained by pain intensity alone;

rather, beliefs about pain, fear of movement, catastrophic thinking, avoidance, emotional distress, and reduced engagement in valued activities are decisive factors in long-term adaptation (Damci et al., 2024; Foustoukos et al., 2024; Romero et al., 2025). Accordingly, effective intervention for chronic pain should not be limited to symptom suppression, but should also promote psychological resources, behavioral activation, self-management, and participation in meaningful life domains.

Among psychological factors involved in chronic pain, pain catastrophizing has received considerable attention as a maladaptive cognitive-emotional response that includes rumination about pain, magnification of pain-related threat, and perceived helplessness. Individuals with high pain catastrophizing tend to interpret pain as uncontrollable, dangerous, and overwhelming, which can amplify emotional distress, increase attention to pain sensations, reduce coping confidence, and intensify functional impairment. Catastrophizing is associated with poorer quality of life, greater pain-related disability, and more severe emotional burden across different chronic pain populations. In patients with cancer-related chronic pain, pain catastrophizing has been shown to interact with emotional and pain-related variables in shaping quality of life, suggesting that maladaptive appraisal can directly undermine adaptation even when medical factors are taken into account (Anagnostopoulos et al., 2022). Cognitive and existential factors have also been identified as important in the broader pain experience among cancer survivors, indicating that interpretation, meaning, fear, and perceived vulnerability are relevant to how persistent pain is experienced and managed (Kolokotroni & Anagnostopoulos, 2025). Similarly, research on endometriosis and other persistent pain-related conditions highlights the role of psychosomatic and psychological dimensions in the maintenance of suffering and impairment (Ledermann, 2023). Therefore, reducing catastrophic interpretations of pain is a key therapeutic objective in psychological interventions for chronic pain.

Psychological flexibility is another central construct in chronic pain adjustment. It refers to the capacity to remain in contact with the present moment, experience internal events without unnecessary avoidance, defuse from distressing thoughts, clarify personal values, and engage in committed action even in the presence of pain and emotional discomfort. In contrast, psychological inflexibility is characterized by experiential avoidance, cognitive fusion, behavioral restriction, and rigid attempts to control or escape unpleasant internal experiences. A growing body of

evidence suggests that psychological flexibility is strongly associated with better physical, emotional, and social functioning among individuals with chronic pain, whereas psychological inflexibility is linked to pain interference, emotional distress, and reduced quality of life (Fang & Ding, 2022). Studies on pain acceptance further show that acceptance is not passive resignation, but an active and adaptive stance that allows individuals to reduce the struggle with pain and increase participation in meaningful activities (Kim et al., 2020). Broader research has also emphasized the positive impact of psychological flexibility on coping, resilience, and well-being in the face of health-related challenges (Beaulieu et al., 2024; Roberts et al., 2025). In chronic pain populations, this construct is particularly important because complete pain elimination is often unrealistic; consequently, the ability to live meaningfully despite pain becomes a clinically valuable outcome.

Quality of life is a major outcome in chronic pain research because persistent pain frequently disrupts multiple dimensions of functioning, including physical mobility, role performance, emotional well-being, social relationships, vitality, and perceived health. Chronic pain can restrict daily routines, reduce independence, interfere with occupational and family responsibilities, and weaken the individual's sense of agency. Improvements in quality of life therefore require more than reductions in pain intensity; they require changes in how individuals relate to pain, manage distress, maintain activity, and pursue valued goals. Psychological and behavioral interventions aimed at improving self-management and functioning have shown promise in this regard. Multicomponent workshops for chronic pain have been reported to improve self-management and quality of life, suggesting that education, coping skills, and active engagement can enhance patient outcomes (Romero et al., 2025). Movement, mindfulness, and pain science interventions have also demonstrated improvements in well-being and physical function, further supporting the value of integrative interventions that address both mind and body (Prasad et al., 2025). In adolescent chronic musculoskeletal pain, resilience factors and physical activity engagement have been linked to functioning, indicating that adaptation to pain is closely related to psychological strengths and behavioral participation (Black et al., 2025). Similarly, psychological interventions have been recognized as important for improving quality of life in slowly progressive neuromuscular disorders, highlighting the broader relevance of psychological care in chronic and disabling conditions (Garmendia et al., 2023).

Acceptance and Commitment Therapy has emerged as one of the most relevant psychological approaches for chronic pain because it directly targets psychological flexibility, values-based action, and acceptance of internal experiences. ACT does not primarily aim to eliminate pain-related thoughts or sensations; instead, it helps individuals change their relationship with pain, reduce avoidance, disengage from unhelpful cognitive patterns, and move toward meaningful activities despite discomfort. This orientation is especially suitable for chronic pain, where persistent efforts to control or avoid pain may paradoxically increase distress, narrow behavior, and reduce quality of life. ACT-based models emphasize six interrelated processes: acceptance, cognitive defusion, contact with the present moment, self-as-context, values clarification, and committed action. These processes help individuals reduce the dominance of pain over behavior and develop more flexible responses to suffering. Reviews and clinical perspectives identify ACT as a theoretically coherent and empirically supported intervention for chronic pain management (Edwards et al., 2023; Edwards & Vowles, 2022). Meta-analytic evidence has further indicated that ACT can improve psychological outcomes and quality of life in patients with chronic pain, supporting its use as an intervention that targets both internal processes and functional adaptation (Lu et al., 2024). Evidence from central sensitization syndromes also suggests that ACT may be effective for conditions in which pain is strongly shaped by nervous system sensitivity and psychological regulation (Galvez-Sánchez et al., 2021).

Recent studies have expanded ACT research across diverse chronic pain contexts and delivery formats. Group ACT has shown preliminary utility among patients with intractable chronic pain in multidisciplinary pain settings, suggesting that ACT can be implemented in real-world clinical contexts where patients often present with complex and persistent symptoms (Sakai et al., 2023). ACT has also been applied transdiagnostically in cancer-related pain and survivorship, supporting its relevance beyond a single diagnostic group (Sakai et al., 2022). Protocols for ACT-based interventions in postsurgical pain and chemotherapy-induced peripheral neuropathy illustrate the growing interest in testing ACT for specific pain conditions through controlled designs (Castaño-Asins et al., 2023; Daniëlle et al., 2022). In addition, neurobiological research has begun to examine neural plasticity following ACT for chronic pain, suggesting that psychological intervention may be associated with changes in brain networks involved in pain

processing, regulation, and adaptation (Meier et al., 2020). These developments indicate that ACT is not only a psychotherapeutic method but also an approach aligned with contemporary biopsychosocial and neuroscientific models of chronic pain.

The increasing use of digital and remote interventions has also influenced chronic pain care. Smartphone-based multimodal chronic pain therapy, telerehabilitation for fibromyalgia, online ACT-based programs, and internet-based cognitive behavioral therapy for individuals with depression and chronic health conditions demonstrate that psychological and rehabilitation interventions are being adapted to improve access, adherence, and scalability (Adhikary et al., 2023; Daniëlle et al., 2022; Morcillo-Muñoz et al., 2022; Wu et al., 2023). Although digital delivery has important potential, face-to-face group interventions remain highly relevant, particularly where therapeutic interaction, group support, behavioral practice, and therapist-guided values clarification are needed. Studies of integrated psychotherapeutic interventions in fibromyalgia have highlighted the role of the therapeutic relationship in chronic pain management, indicating that relational and contextual aspects of treatment can influence engagement and outcomes (Pasini et al., 2023). Mindfulness and acceptance interventions have also been examined in caregivers and pediatric medical contexts, suggesting that acceptance-based processes may benefit not only patients but also families managing chronic illness and pain-related stress (Ruskin et al., 2021; Stiles-Shields et al., 2021). Mind-body approaches such as Qigong have similarly been conceptualized as biopsychosocial interventions for persistent postsurgical pain, further supporting the importance of psychological and behavioral regulation in pain adaptation (Osypiuk et al., 2020).

Despite the growing evidence supporting ACT and related psychological interventions for chronic pain, further empirical research remains necessary in different cultural and clinical contexts. Chronic pain is experienced within specific health systems, family structures, cultural beliefs, and patterns of help-seeking, all of which may affect psychological flexibility, catastrophizing, and quality of life. In many clinical settings, adults with chronic pain continue to receive predominantly biomedical care, while psychological interventions are underused or introduced only after prolonged disability. Moreover, although previous research has examined ACT in several chronic pain populations, more quasi-experimental studies are needed to evaluate its effectiveness in community and clinical samples,

particularly with simultaneous assessment of psychological flexibility, pain catastrophizing, and quality of life. These three variables are theoretically and clinically interconnected: psychological flexibility may enable individuals to reduce avoidance and re-engage with valued living; reduced catastrophizing may decrease pain-related threat and helplessness; and improved quality of life may reflect broader functional recovery. Therefore, examining these outcomes together can provide a more comprehensive understanding of how ACT may support adjustment in adults living with chronic pain.

The aim of this study was to examine the effectiveness of Acceptance and Commitment Therapy on psychological flexibility, pain catastrophizing, and quality of life among adults with chronic pain in Isfahan.

2. Methods and Materials

2.1. Study Design and Participants

This study was conducted using a quasi-experimental pretest–posttest design with a control group and follow-up assessment. The statistical population consisted of adults with chronic pain who referred to pain clinics, rehabilitation centers, and specialized medical centers in Isfahan, Iran. After initial screening, 50 eligible participants were selected through purposive sampling and randomly assigned to an experimental group and a control group, with 25 participants in each group. The inclusion criteria were being between 25 and 60 years of age, having a confirmed diagnosis of chronic non-malignant pain for at least six months based on medical records and physician confirmation, having sufficient literacy to complete the questionnaires, willingness to participate in all stages of the study, and not receiving another structured psychological intervention during the study period. The exclusion criteria included severe psychiatric disorders, substance dependence, major cognitive impairment, severe physical disability preventing participation in treatment sessions, absence from more than two therapy sessions, and withdrawal of informed consent. Participants in the experimental group received Acceptance and Commitment Therapy in eight weekly sessions, each lasting approximately 90 minutes, while the control group received no psychological intervention during the same period and remained on routine medical care. The intervention focused on increasing psychological flexibility through acceptance of internal experiences, cognitive defusion, contact with the present moment, clarification of personal values, committed action, and reduction of

experiential avoidance related to chronic pain. Before the intervention, all participants completed the pretest measures. The posttest was administered immediately after the intervention, and the follow-up assessment was conducted two months later. Ethical principles, including informed consent, voluntary participation, confidentiality of information, and the right to withdraw from the study at any time, were observed throughout the research process.

2.2. Measures

Psychological flexibility was assessed using the Psychological Inflexibility in Pain Scale. This instrument was developed to measure pain-related psychological inflexibility and is widely used in studies involving Acceptance and Commitment Therapy and chronic pain. The scale evaluates the extent to which individuals avoid pain-related experiences and become cognitively fused with pain-related thoughts. It contains items rated on a Likert-type scale, with higher scores indicating greater psychological inflexibility and lower scores indicating higher psychological flexibility. The scale includes dimensions such as avoidance and cognitive fusion, both of which are theoretically central to the ACT model. In the present study, psychological flexibility was interpreted through reductions in psychological inflexibility scores from pretest to posttest and follow-up. Previous studies have confirmed the validity and reliability of this instrument in chronic pain populations, and its internal consistency in the present study was evaluated using Cronbach's alpha.

Pain catastrophizing was measured using the Pain Catastrophizing Scale, developed by Sullivan, Bishop, and Pivik in 1995. This scale consists of 13 items and assesses exaggerated negative cognitive and emotional responses to actual or anticipated pain. The instrument includes three main dimensions: rumination, magnification, and helplessness. Respondents rate each item on a Likert-type scale ranging from low to high frequency of catastrophizing thoughts and feelings. The total score is obtained by summing all items, with higher scores indicating greater pain catastrophizing. The Pain Catastrophizing Scale is considered one of the most frequently used standardized tools for assessing maladaptive pain-related cognition among individuals with chronic pain. Its psychometric properties, including construct validity, convergent validity, and internal consistency, have been confirmed in previous clinical and non-clinical studies.

Quality of life was assessed using the 36-Item Short Form Health Survey. This questionnaire is a standard self-report instrument designed to evaluate health-related quality of life across physical and psychological domains. The scale includes 36 items and covers several dimensions, including physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. Scores are transformed so that higher values indicate better perceived quality of life. In the present study, the total quality-of-life score and relevant subscale scores were used to examine changes in participants' health-related functioning following the ACT intervention. The Short Form Health Survey has been widely applied in chronic illness and chronic pain research, and previous studies have supported its validity and reliability across different adult populations. In this study, the reliability of the scale was also examined using internal consistency coefficients.

2.3. Intervention

The Acceptance and Commitment Therapy protocol was implemented for the experimental group in eight weekly sessions, each lasting approximately 90 minutes, while the control group received routine care and no structured psychological intervention during the same period. The intervention was designed to improve psychological flexibility and reduce maladaptive responses to chronic pain through the core ACT processes of acceptance, cognitive defusion, present-moment awareness, self-as-context, values clarification, and committed action. In the first session, participants were introduced to the aims and structure of the program, group rules, confidentiality, and the ACT perspective on chronic pain, with emphasis on the distinction between pain and suffering. The second session focused on creative hopelessness and helped participants examine the costs of ineffective control strategies, avoidance behaviors, and repeated attempts to eliminate pain before engaging in life activities. The third session introduced acceptance as an alternative to experiential avoidance and included experiential exercises to help participants create space for unpleasant sensations, emotions, and thoughts without unnecessary struggle. The fourth session addressed cognitive defusion and trained participants to observe catastrophic pain-related thoughts as mental events rather than absolute truths. The fifth session focused on mindfulness and present-moment awareness to reduce

rumination, attentional fixation on pain, and automatic emotional reactions. The sixth session introduced self-as-context and helped participants develop a broader sense of self beyond pain, disability, and illness-related labels. The seventh session emphasized values clarification, during which participants identified personally meaningful life domains such as family, work, health, spirituality, social relationships, and personal growth. The final session focused on committed action, goal setting, relapse prevention, and the development of individualized action plans for continuing valued activities despite pain. Throughout the sessions, participants completed experiential exercises, group discussions, metaphors, mindfulness practices, and between-session assignments to apply ACT skills in daily life.

2.4. Data Analysis

Data were analyzed using SPSS software. Before conducting the main analyses, the accuracy of data entry, missing values, outliers, and distributional characteristics of the variables were examined. Descriptive statistics, including mean and standard deviation, were used to summarize participants' scores on psychological flexibility, pain catastrophizing, and quality of life at pretest, posttest, and follow-up. The normality of score distributions was assessed using the Shapiro–Wilk test, and the homogeneity of variances between the experimental and control groups was examined using Levene's test. The assumption of homogeneity of covariance matrices was assessed using Box's M test, and Mauchly's test of sphericity was used for repeated-measures comparisons across time. When the sphericity assumption was violated, the Greenhouse–Geisser correction was applied. To evaluate the effectiveness of Acceptance and Commitment Therapy, repeated-measures analysis of variance was conducted with time as the within-subject factor and group as the between-subject factor. The main effect of time, the main effect of group, and the interaction effect of time and group were examined for psychological flexibility, pain catastrophizing, and quality of life. A significant time-by-group interaction was interpreted as evidence that changes in the experimental

group differed from those observed in the control group across the measurement stages. Bonferroni post hoc comparisons were used to determine whether significant changes occurred between pretest and posttest, pretest and follow-up, and posttest and follow-up. The level of statistical significance was set at $p < .05$, and effect sizes were reported using partial eta squared to estimate the magnitude of the intervention effects.

3. Findings and Results

A total of 50 adults with chronic pain participated in the study and completed the pretest, posttest, and two-month follow-up assessments. Participants were assigned to the Acceptance and Commitment Therapy group and the control group, with 25 individuals in each group. The mean age of participants in the experimental group was 42.84 years with a standard deviation of 8.21, while the mean age of participants in the control group was 43.32 years with a standard deviation of 8.75. In terms of gender distribution, 14 participants in the experimental group were female and 11 were male, while 15 participants in the control group were female and 10 were male. The mean duration of chronic pain was 38.16 months in the experimental group and 39.52 months in the control group, indicating that most participants had experienced persistent pain for more than three years. The most frequently reported pain conditions included chronic low back pain, neck and shoulder pain, generalized musculoskeletal pain, and neuropathic pain. Regarding educational level, participants included individuals with secondary education, diploma or associate degrees, and university-level education. Baseline comparisons showed no statistically significant differences between the experimental and control groups in age, gender, pain duration, education level, or type of pain condition. Therefore, the two groups were considered demographically comparable before the intervention, which supports the interpretation that subsequent differences in psychological flexibility, pain catastrophizing, and quality of life were associated with the Acceptance and Commitment Therapy intervention rather than pre-existing demographic differences.

Table 1

Descriptive Statistics for Psychological Flexibility, Pain Catastrophizing, and Quality of Life Across Measurement Stages

Variable	Group	Pretest Mean ± SD	Posttest Mean ± SD	Follow-up Mean ± SD
Pain-related psychological inflexibility	Acceptance and Commitment Therapy	62.48 ± 8.31	45.36 ± 7.42	46.28 ± 7.76
Pain-related psychological inflexibility	Control	61.72 ± 8.64	60.08 ± 8.11	60.84 ± 8.35

Pain catastrophizing	Acceptance and Commitment Therapy	35.64 ± 6.28	23.12 ± 5.46	24.08 ± 5.61
Pain catastrophizing	Control	34.88 ± 6.43	33.96 ± 6.51	34.40 ± 6.36
Quality of life	Acceptance and Commitment Therapy	43.52 ± 9.36	61.88 ± 8.94	60.72 ± 9.11
Quality of life	Control	44.20 ± 9.01	45.36 ± 8.86	45.08 ± 8.74

As shown in Table 1, the two groups had relatively similar mean scores at the pretest stage across all study variables. The experimental group had a mean score of 62.48 for pain-related psychological inflexibility, while the control group had a mean score of 61.72, indicating that both groups began the study with comparable levels of pain-related avoidance, cognitive fusion, and difficulty responding flexibly to chronic pain experiences. After the intervention, the mean score of psychological inflexibility in the experimental group decreased to 45.36 and remained relatively stable at 46.28 during the two-month follow-up. This reduction indicates an improvement in psychological flexibility, as lower psychological inflexibility scores reflect greater acceptance, cognitive defusion, and adaptive engagement with valued activities despite pain. In contrast, the control group showed only minimal change from pretest to posttest and follow-up, suggesting that routine care alone did not produce meaningful improvement in pain-related

psychological flexibility. A similar pattern was observed for pain catastrophizing. The experimental group showed a clear reduction from 35.64 at pretest to 23.12 at posttest, with the effect largely maintained at follow-up. This suggests that participants who received Acceptance and Commitment Therapy experienced fewer catastrophic thoughts, less rumination about pain, reduced magnification of pain-related threat, and lower feelings of helplessness. In comparison, the control group remained relatively stable across all three stages. For quality of life, the experimental group improved from a pretest mean of 43.52 to a posttest mean of 61.88, with the improvement maintained at follow-up. This finding indicates that the intervention was associated not only with psychological change but also with broader improvement in perceived health-related functioning. The control group showed only a slight and clinically limited change in quality of life across time.

Table 2

Repeated-Measures Analysis of Variance for the Effects of Time, Group, and Time-by-Group Interaction

Variable	Effect	F	df	p-value	Partial Eta Squared
Pain-related psychological inflexibility	Time	58.42	1.65, 79.11	< .001	.549
Pain-related psychological inflexibility	Group	18.67	1, 48	< .001	.280
Pain-related psychological inflexibility	Time × Group	44.93	1.65, 79.11	< .001	.484
Pain catastrophizing	Time	51.76	1.70, 81.53	< .001	.519
Pain catastrophizing	Group	15.22	1, 48	< .001	.241
Pain catastrophizing	Time × Group	39.84	1.70, 81.53	< .001	.454
Quality of life	Time	62.31	1.72, 82.44	< .001	.565
Quality of life	Group	16.84	1, 48	< .001	.260
Quality of life	Time × Group	47.28	1.72, 82.44	< .001	.496

The results of the repeated-measures analysis of variance are presented in Table 2. Before conducting the main analysis, statistical assumptions were examined. The Shapiro–Wilk test indicated that the distributions of the main variables did not significantly deviate from normality. Levene’s test confirmed the homogeneity of variances between the experimental and control groups at the measurement stages. Because the assumption of sphericity was not fully met for all repeated comparisons, Greenhouse–Geisser corrected values were used where necessary. The repeated-measures analysis showed a significant main effect of time for pain-related psychological inflexibility, pain

catastrophizing, and quality of life, indicating that the scores changed significantly across pretest, posttest, and follow-up. The main effect of group was also significant for all three variables, showing that the experimental and control groups differed significantly when their overall scores across time were compared. Most importantly, the interaction effect of time and group was statistically significant for all outcomes. The significant time-by-group interaction for pain-related psychological inflexibility indicates that the reduction in inflexibility was substantially greater in the Acceptance and Commitment Therapy group than in the control group. This finding supports the effectiveness of ACT in improving

psychological flexibility among adults with chronic pain. The significant interaction effect for pain catastrophizing also demonstrates that participants in the experimental group experienced a greater reduction in catastrophic pain-related cognition than participants in the control group. Furthermore, the significant interaction effect for quality of

life indicates that the improvement in health-related quality of life was meaningfully stronger among participants who received the ACT intervention. The partial eta squared values were in the moderate-to-large range, suggesting that the intervention had substantial effects on the psychological and quality-of-life outcomes assessed in this study.

Table 3

Bonferroni Post Hoc Comparisons for the Experimental Group Across Measurement Stages

Variable	Comparison	Improvement Mean Difference	Standard Error	p-value
Pain-related psychological inflexibility	Pretest to posttest	17.12	1.74	< .001
Pain-related psychological inflexibility	Pretest to follow-up	16.20	1.81	< .001
Pain-related psychological inflexibility	Posttest to follow-up	-0.92	0.86	.842
Pain catastrophizing	Pretest to posttest	12.52	1.39	< .001
Pain catastrophizing	Pretest to follow-up	11.56	1.44	< .001
Pain catastrophizing	Posttest to follow-up	-0.96	0.72	.771
Quality of life	Pretest to posttest	18.36	2.03	< .001
Quality of life	Pretest to follow-up	17.20	2.08	< .001
Quality of life	Posttest to follow-up	1.16	0.94	.694

Table 3 presents the Bonferroni post hoc comparisons for the experimental group. For pain-related psychological inflexibility, the comparison between pretest and posttest was statistically significant, showing that participants reported a marked reduction in psychological inflexibility after receiving Acceptance and Commitment Therapy. The comparison between pretest and follow-up was also significant, indicating that this improvement was maintained two months after the completion of the intervention. However, the comparison between posttest and follow-up was not statistically significant, suggesting that the gains achieved by the end of treatment remained stable over time and did not decline meaningfully during the follow-up period. For pain catastrophizing, the experimental group showed a significant reduction from pretest to posttest and from pretest to follow-up. This finding indicates that ACT helped participants reduce maladaptive cognitive responses to pain, including repetitive focus on pain, exaggerated appraisal of pain-related threat, and perceived inability to manage pain. The non-significant difference between posttest and follow-up indicates that the reduction in catastrophizing was preserved after the intervention. For quality of life, the experimental group demonstrated a significant increase from pretest to posttest and from pretest to follow-up. This improvement reflects better perceived functioning, greater emotional well-being, improved social functioning, and a more adaptive relationship with chronic pain. The absence of a significant difference between posttest and follow-up suggests that the improvement in

quality of life was not temporary and remained stable during the follow-up period. Overall, the post hoc findings confirm that Acceptance and Commitment Therapy produced significant and lasting improvements in psychological flexibility, pain catastrophizing, and quality of life among adults with chronic pain.

Overall, the findings of the study demonstrated that Acceptance and Commitment Therapy was effective in improving the psychological and health-related functioning of adults with chronic pain. Participants who received the intervention showed substantial reductions in pain-related psychological inflexibility and pain catastrophizing, together with a significant increase in quality of life. These changes were observed immediately after the intervention and remained stable at the two-month follow-up. In contrast, participants in the control group showed no meaningful improvement across the same period. The pattern of results suggests that Acceptance and Commitment Therapy can help individuals with chronic pain develop a more flexible and accepting relationship with pain, reduce the dominance of catastrophic thoughts, and increase engagement in valued life activities despite persistent physical discomfort. Therefore, the findings support the effectiveness of ACT as a psychological intervention for improving adjustment and quality of life among adults living with chronic pain.

4. Discussion

The present study examined the effectiveness of Acceptance and Commitment Therapy on psychological flexibility, pain catastrophizing, and quality of life among adults with chronic pain. The findings showed that participants who received ACT experienced a significant reduction in pain-related psychological inflexibility from pretest to posttest, and this improvement was maintained at the two-month follow-up. The control group, in contrast, showed no meaningful change across the same period. This pattern indicates that ACT was effective in helping individuals with chronic pain relate to their pain-related thoughts, emotions, and bodily sensations in a more flexible and adaptive manner. In the ACT model, psychological flexibility is considered a core therapeutic mechanism through which individuals learn to experience unpleasant internal events without excessive avoidance, cognitive fusion, or behavioral restriction. Therefore, the observed reduction in psychological inflexibility suggests that participants became more capable of accepting pain-related experiences, distancing themselves from distressing thoughts, remaining connected with the present moment, and engaging in valued activities despite persistent pain. This finding is consistent with previous evidence showing that psychological flexibility is strongly associated with better outcomes in chronic pain populations and that psychological inflexibility is related to poorer emotional and functional adjustment (Beaulieu et al., 2024; Fang & Ding, 2022; Roberts et al., 2025).

The improvement in psychological flexibility can be explained by the specific processes targeted in ACT. Chronic pain often leads individuals to organize their daily lives around the avoidance of discomfort, uncertainty, and pain-related threat. Although avoidance may provide short-term relief, over time it can restrict activity, increase disability, reduce social participation, and strengthen the psychological dominance of pain. ACT directly addresses this pattern by teaching patients that the primary problem is not necessarily the existence of pain, but the rigid struggle to control or eliminate pain before living meaningfully. Through acceptance, cognitive defusion, values clarification, and committed action, individuals learn to respond to pain with greater openness and behavioral flexibility. This explanation aligns with theoretical and clinical accounts of ACT for chronic pain, which emphasize that treatment aims to change the function of pain-related thoughts and sensations rather than eliminate them

completely (Edwards et al., 2023; Edwards & Vowles, 2022). The present finding is also compatible with research demonstrating that pain acceptance is associated with better psychosocial and physical functioning among individuals with chronic pain and spinal cord injury (Kim et al., 2020). Moreover, studies on mechanisms of change in ACT for headache disorders and neural plasticity following ACT suggest that acceptance-based interventions may influence both psychological regulation and broader patterns of pain processing (Meier et al., 2020; Vasiliou et al., 2021).

The second major finding was that ACT significantly reduced pain catastrophizing in the experimental group, with the effect remaining stable at follow-up. Pain catastrophizing is a maladaptive cognitive-emotional pattern characterized by repetitive focus on pain, exaggeration of pain-related threat, and feelings of helplessness. In chronic pain, catastrophizing can intensify distress, increase perceived pain severity, reinforce avoidance, and reduce the individual's sense of control. The reduction observed in the ACT group suggests that participants became less dominated by catastrophic interpretations of pain and more able to observe pain-related thoughts without treating them as literal truths. This result is consistent with previous studies emphasizing the role of pain catastrophizing in quality of life and chronic pain adaptation (Anagnostopoulos et al., 2022; Kolokotroni & Anagnostopoulos, 2025). It also corresponds with research showing that psychological and cognitive variables are important determinants of functioning in chronic pain conditions, including fibromyalgia, endometriosis, cancer-related pain, and gastrointestinal pain disorders (Keefer et al., 2021; Ledermann, 2023; Luciano et al., 2023).

From an ACT perspective, the reduction in catastrophizing may be attributed primarily to cognitive defusion and acceptance processes. Catastrophizing becomes clinically harmful when individuals become fused with thoughts such as "this pain will never end," "I cannot tolerate this," or "my life is completely controlled by pain." ACT does not require patients to dispute every catastrophic thought in a conventional cognitive restructuring manner; rather, it teaches them to notice thoughts as mental events and to reduce their behavioral control. When individuals learn to observe catastrophic thoughts without automatically obeying them, they may become more capable of choosing actions based on values rather than fear. This process can reduce rumination, helplessness, and avoidance. The present findings therefore support the idea that ACT can weaken the functional impact of catastrophic pain-related cognition.

This interpretation is in line with systematic and meta-analytic evidence showing that ACT improves psychological outcomes in chronic pain and central sensitization syndromes (Galvez-Sánchez et al., 2021; Lu et al., 2024). It is also supported by studies and protocols applying ACT to intractable chronic pain, postsurgical pain, cancer survivorship, and chemotherapy-induced peripheral neuropathy, where maladaptive pain appraisal and adjustment are central therapeutic targets (Castaño-Asins et al., 2023; Daniëlle et al., 2022; Sakai et al., 2023; Sakai et al., 2022).

The third major finding was that ACT significantly improved quality of life among adults with chronic pain, and this improvement was maintained during the follow-up period. Quality of life is a broad and clinically meaningful outcome because chronic pain affects not only pain intensity but also physical functioning, emotional well-being, social relationships, role performance, vitality, and perceived health. The increase in quality of life observed in the experimental group suggests that ACT helped participants move beyond a narrow focus on symptom control and toward more adaptive engagement with daily life. This finding is consistent with the ACT model, which assumes that meaningful improvement occurs when individuals begin to act in accordance with personally important values, even in the presence of pain. In this sense, quality of life improves not necessarily because pain has disappeared, but because the person's behavioral repertoire expands and pain becomes less central in determining life choices. This result is consistent with evidence that ACT has beneficial effects on quality of life in chronic pain populations (Lu et al., 2024). It is also aligned with studies showing that multicomponent chronic pain interventions, movement and mindfulness-based approaches, and self-management programs can improve well-being, functioning, and quality of life by targeting behavioral engagement and adaptive coping (Foustoukos et al., 2024; Prasad et al., 2025; Romero et al., 2025).

The improvement in quality of life may also be explained by the interaction between psychological flexibility and pain-related functioning. When people with chronic pain become less avoidant and less fused with pain-related thoughts, they may increase their participation in physical, social, occupational, and recreational activities. This increased participation can restore a sense of competence, autonomy, and meaning, all of which are closely related to quality of life. Previous research has similarly emphasized that resilience factors and physical activity engagement are

important for functioning in chronic musculoskeletal pain, and that psychological interventions can support quality of life in chronic and progressive health conditions (Black et al., 2025; Garmendia et al., 2023). The present finding is also consistent with biopsychosocial rehabilitation approaches for neuropathic pain and small fiber neuropathy, which emphasize that effective pain management should address physical, emotional, cognitive, and social dimensions simultaneously (Bäckryd et al., 2024; Damci et al., 2024). From this perspective, ACT may be considered a clinically useful psychological component within a broader biopsychosocial model of chronic pain care.

The findings also correspond with the growing literature on integrated and accessible psychological interventions for chronic pain. Several studies have emphasized that chronic pain management increasingly requires interventions that are flexible, patient-centered, and compatible with rehabilitation and medical care. Digital and remote interventions, including smartphone-based chronic pain therapy, telerehabilitation for fibromyalgia, online ACT programs, and internet-based cognitive behavioral therapy for individuals with chronic health conditions, have shown that psychological treatment principles can be adapted to diverse delivery formats (Adhikary et al., 2023; Morcillo-Muñoz et al., 2022; Wu et al., 2023). However, the findings of the present study suggest that face-to-face ACT remains highly valuable, especially when patients benefit from direct therapeutic interaction, experiential exercises, therapist-guided reflection, and group-based normalization of pain-related struggles. This is consistent with evidence emphasizing the importance of therapeutic relationship and integrated psychotherapeutic work in fibromyalgia and other chronic pain conditions (Pasini et al., 2023). It also aligns with broader acceptance and mindfulness-based interventions in chronic medical contexts, which suggest that acceptance-oriented processes can improve coping and adjustment among patients and families dealing with persistent health-related stress (Ruskin et al., 2021; Stiles-Shields et al., 2021).

5. Conclusion

Overall, the findings support the clinical relevance of ACT for adults with chronic pain by demonstrating simultaneous improvement in psychological flexibility, pain catastrophizing, and quality of life. These outcomes are theoretically connected: as psychological flexibility increases, individuals may become less controlled by pain-

related thoughts and emotions; as catastrophizing decreases, pain may be experienced as less threatening and overwhelming; and as behavioral engagement increases, quality of life may improve. This pattern is consistent with the biopsychosocial understanding of chronic pain, according to which pain-related suffering is maintained by reciprocal interactions among sensory experience, stress, cognition, emotion, behavior, and social functioning (Aboushaar & Serrano, 2024; Gosens & Oudsten, 2023; Serdarević, 2024). The results also complement research on mind-body and psychosocial interventions, such as Qigong-based biopsychosocial therapy, which highlights the importance of addressing chronic pain through approaches that integrate physical, emotional, and behavioral regulation (Osypiuk et al., 2020). Therefore, the present study adds to the existing evidence by showing that ACT can be effective in an adult chronic pain sample in Isfahan and that its effects can remain stable for at least two months after treatment.

6. Limitations & Suggestions

The present study had several limitations that should be considered when interpreting the findings. First, the sample size was relatively limited and included 50 adults with chronic pain from Isfahan, which may restrict the generalizability of the findings to broader populations, other regions, and patients with different cultural or clinical characteristics. Second, participants were selected through purposive sampling, and although they were assigned to experimental and control groups, the study was quasi-experimental rather than a fully randomized clinical trial. Third, the outcomes were assessed using self-report questionnaires, which may be influenced by response bias, social desirability, mood state, or participants' expectations regarding treatment. Fourth, chronic pain conditions were not analyzed separately by diagnosis, pain location, pain mechanism, or severity, while different pain conditions may respond differently to psychological interventions. Fifth, the follow-up period was limited to two months, and therefore the long-term durability of the intervention effects remains uncertain. Finally, the control group did not receive an active psychological comparison intervention, making it difficult to determine whether the observed effects were due specifically to ACT processes or partly to nonspecific therapeutic factors such as attention, group support, and expectation of improvement.

Future studies are recommended to examine the effectiveness of Acceptance and Commitment Therapy

using larger and more diverse samples across different clinical settings and geographic regions. Randomized controlled trials with active comparison groups should be conducted to compare ACT with other evidence-based interventions, such as cognitive behavioral therapy, mindfulness-based therapy, relaxation training, and multidisciplinary rehabilitation programs. Future research should also examine whether the effectiveness of ACT differs according to pain type, pain duration, gender, age, comorbid psychological symptoms, medication use, and baseline level of psychological inflexibility. Longer follow-up periods, such as six months and one year, are needed to determine whether treatment gains remain stable over time. In addition, future studies should investigate mediating and moderating mechanisms, particularly whether changes in psychological flexibility mediate reductions in catastrophizing and improvements in quality of life. The use of mixed-method designs, behavioral indicators, clinical interviews, pain diaries, and physiological or activity-based measures could provide a more comprehensive understanding of how ACT influences chronic pain adjustment.

In practice, the findings suggest that Acceptance and Commitment Therapy can be used as a beneficial psychological intervention for adults with chronic pain, particularly when the therapeutic goal is to improve functioning and quality of life rather than to focus only on pain elimination. Clinicians working in pain clinics, rehabilitation centers, hospitals, and community mental health settings may consider integrating ACT into multidisciplinary chronic pain care. Treatment programs should emphasize acceptance of pain-related experiences, cognitive defusion from catastrophic thoughts, clarification of personal values, and gradual engagement in meaningful activities. Health professionals should also educate patients that improvement in chronic pain does not always mean complete removal of pain, but may involve developing a more flexible and workable relationship with pain. Group-based ACT programs may be especially useful because they can reduce isolation, normalize patient experiences, and provide opportunities for shared practice. Integrating ACT with medical care, physical rehabilitation, and self-management education may help patients improve psychological adjustment, reduce the disabling effects of pain, and enhance daily functioning.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

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

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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