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Comparison of the Effectiveness of Acceptance and Commitment Therapy and Cognitive Behavioral Therapy on Cognitive Flexibility and Pain Reduction in Patients with Chronic Pain: A Quasi-Experimental Study

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A B S T R A C T

Introduction: The complexity of chronic pain underscores the need to compare effective therapeutic approaches for pain reduction and enhancement of cognitive processes, particularly psychological interventions that can play a key role in managing this condition. The present study aimed to compare the efficacy of Acceptance and Commitment Therapy (ACT) and Cognitive-Behavioral Therapy (CBT) on cognitive flexibility and pain reduction in patients with chronic pain.

Materials & Methods: This quasi-experimental study employed a pretest–posttest–two-month follow-up design with a control group. The target population included patients with chronic pain (chronic low back pain, fibromyalgia, rheumatoid arthritis, migraine, and irritable bowel syndrome) who referred to educational, therapeutic, and research centers in Kermanshah, including Taleghani, Imam Reza, and Farabi hospitals in 2023. A total of 69 participants were selected using convenience sampling, which limits the generalizability of the findings. Participants were randomly assigned to two intervention groups and a control group (23 participants per group) using a random number table. The ACT group received eight sessions, the CBT group received eight sessions, and the control group received no intervention. Data were collected using the Cognitive Flexibility Inventory and the Von Korff Pain Severity Scale. Statistical analyses were performed using repeated-measures ANOVA and Bonferroni post hoc tests. The significance level was set at $p < 0.05$.

Results: The findings indicated that both ACT and CBT interventions significantly increased cognitive flexibility ($p < 0.001$). Additionally, pain severity significantly decreased in the intervention groups compared to the control group ($p < 0.001$). The test power was reported as 1, indicating high reliability of the findings. Furthermore, a statistically significant difference was observed between the two interventions, with ACT showing greater effectiveness in enhancing cognitive flexibility and reducing pain severity ($p < 0.001$).

Conclusion: Based on the present findings, ACT can be considered an effective psychological intervention in chronic pain clinics, contributing to improved cognitive functioning and pain management in patients.

Keywords: Cognitive flexibility, chronic pain, Cognitive-Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), pain severity

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Introduction

Pain is divided into two types based on the duration of occurrence (1). Chronic pain is pain

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that persists beyond the expected period of healing (2) and is considered to be at least three months for research and at least six months for clinical diagnosis (3). The prevalence of chronic pain during life has been reported to be between 11 and 55% and about 20 to 30% in adults (4). In addition to physical stress, this type of pain also exposes the individual to psychological and social problems, including depression, anxiety, substance use disorders, smoking dependence, and self-harming behaviors (5). According to the definition of the International Society for the Study of Pain, pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage (6). Among the factors affecting the adaptation of patients to chronic pain, cognitive flexibility is one of the key psychological and cognitive variables that enhances the individual's ability to manage pain and cope with psychosocial consequences (7).

Cognitive flexibility refers to the ability to quickly review thought strategies, shift attention, and select appropriate responses when faced with challenging situations (8). This characteristic allows an individual to recover from adverse experiences, overcome difficult situations, and achieve an initial or even higher level of balance, which is the basis for successful adaptation and maintaining efficiency in responding to new situations (9). Individuals with high cognitive flexibility are able to effectively confront problems and provide new solutions, while individuals with low flexibility have difficulty breaking away from previous thought patterns and find it difficult to adapt to new situations (10). Cognitive processing theories suggest that low flexibility can lead to getting stuck in catastrophic thinking, increased attention to pain, and the development of avoidance behaviors, which in turn increase the severity of pain and disability (11). Recent studies have also shown that psychological interventions aimed at enhancing cognitive flexibility can reduce pain intensity and improve psychological adjustment, pain tolerance, and quality of life in patients with chronic pain (12). Therefore, increasing cognitive flexibility is one of the main goals of psychological treatments in these patients.

In contrast, pain intensity is another key indicator in studies of chronic pain (13), and it indicates the degree of unpleasantness and distress of the pain experience (14). This indicator is influenced by cognitive and emotional mechanisms such as catastrophizing, selective attention, and emotion regulation (15). According to cognitive behavioral models, pain intensity is not only influenced by biological factors but also by negative beliefs, cognitive errors, and ineffective coping styles (16). The experience of pain in these patients is usually debilitating, and its reduction, as an important clinical goal, plays a fundamental role in improving daily functioning and psychological adjustment of patients (17). Despite significant advances in anatomy, physiology, and the development of new drugs, chronic pain remains a major health challenge (18). The limitations of pharmacological treatments and the persistence of pain in many patients suggest that chronic pain is not simply a physical problem but is also influenced by psychological, environmental, and social factors (19). This view has increased the need for psychological interventions, especially since research evidence suggests that psychological interventions can improve pain-related psychological outcomes (20). In this regard, acceptance and commitment therapy (21) and cognitive behavioral therapy (22) are effective approaches in managing psychological problems and improving the adjustment of patients with chronic pain.

Acceptance and commitment therapy is an evidence-based psychological approach that combines acceptance and mindfulness strategies

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with commitment and behavior change techniques to increase psychological flexibility (23). Psychological flexibility refers to the ability to consciously be present in the present moment and choose adaptive behaviors when faced with unpleasant thoughts, emotions, and sensations (24). Acceptance and commitment therapy, relying on six main processes of acceptance, cognitive dissonance, present-moment presence, self-context, values, and committed action, realigns the individual's relationship with pain and enables value-based behaviors even in the presence of pain (25). Research evidence shows that this therapy can reduce catastrophizing, disability, and anxiety caused by pain (26), increase cognitive flexibility (27–30), and reduce pain intensity in patients with chronic pain (31–32). Therefore, acceptance and commitment therapy is an effective intervention to improve the adaptation and functioning of patients with chronic pain by changing the way they deal with pain and improving their capacity to manage internal experiences. On the other hand, cognitive behavioral therapy focuses on modifying cognition as a factor influencing emotions and behaviors in patients with chronic pain (33). This approach is designed based on cognitive behavioral theories and aims to identify and restructure dysfunctional thoughts, reduce catastrophizing, and change avoidant behaviors (34). Cognitive behavioral therapy modulates the experience of pain by teaching coping skills, restructuring negative thoughts, and practicing behavioral strategies (35). Distinctive features of cognitive behavioral therapy include the simultaneous use of cognitive strategies, such as identifying cognitive distortions, restructuring anxiety-provoking thoughts, and strengthening coping self-talk, and behavioral strategies, such as exposure, role-playing, muscle relaxation training, training coping skills, and increasing self-efficacy (36-37). Research has shown that cognitive behavioral therapy increases patients' cognitive flexibility by reducing negative biases and providing alternative behavioral strategies, helping them to cope more adaptively with chronic pain (38–40). In addition, it reduces the intensity of perceived pain by restructuring dysfunctional thoughts and reducing avoidance of activities (41–44). Therefore, by improving dysfunctional beliefs and behaviors, this therapy is one of the effective interventions in reducing pain and promoting psychological adjustment and daily functioning of patients with chronic pain.

Considering the theoretical foundations and evidence of previous research, the present study aims to provide an operational and innovative approach to investigate and compare the effectiveness of acceptance and commitment therapy and cognitive behavioral therapy on cognitive flexibility and pain reduction in patients with chronic pain. The necessity of conducting this study arises from the high prevalence of chronic pain and its widespread impact on the quality of life and mental and physical functioning of individuals (45). Although both acceptance and commitment therapy and cognitive behavioral therapy are recognized as effective methods for pain control and psychological functioning, direct and long-term comparative studies of these treatments are limited; for example, Nozari et al. (46) reported few differences in treatment approach in a quasi-experimental study of women with fibromyalgia syndrome. A review of previous studies revealed that many studies had small samples or examined only one of the chronic pain conditions and outcomes, and in particular, studies that simultaneously assessed cognitive flexibility and pain intensity in patients with chronic pain were not found.

The existing research gap highlights the need for a quasi-experimental study. By assessing the short-term (post-test) and long-term (follow-up)

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effects of each treatment and directly comparing them, this study can provide the necessary evidence to select the optimal treatment method and design more effective interventions and lay the foundation for future research. Therefore, the hypotheses of the present study are (1) Acceptance and Commitment Therapy is effective on cognitive flexibility and pain reduction in patients with chronic pain, (2) Cognitive Behavioral Therapy is effective on cognitive flexibility and pain reduction in patients with chronic pain, and (3) there is a difference between the effectiveness of Acceptance and Commitment Therapy and Cognitive Behavioral Therapy on cognitive flexibility and pain reduction in patients with chronic pain. The results of the study can theoretically contribute to a better understanding of the therapeutic mechanisms and the role of cognitive flexibility in the management of chronic pain. Clinically, these findings provide the opportunity to design more effective interventions and train clinical therapists in the necessary skills and will serve as a basis for comparative studies and longer follow-ups in the field of chronic pain.

Materials and methods

The present study is a quasi-experimental study with a pretest-posttest design with a control group and a two-month follow-up. In this study, the statistical population of the study included patients with chronic pain, including chronic back pain, fibromyalgia, rheumatoid arthritis, migraine, and irritable bowel syndrome, who had been referred to educational, treatment, and research centers in Kermanshah (Taleghani, Imam Reza, and Farabi hospitals) in 1402. Using the available sampling method, patients with chronic pain had the inclusion and exclusion criteria, including a definitive diagnosis of one of the chronic pain disorders by a specialist, at least three months had passed since the onset of symptoms, age 25 to 55 years, minimum high school education, no concurrent psychological treatment, no use of psychiatric medications in the past three months, willingness and ability to participate in sessions, chronic physical diseases affecting pain, use of narcotic or psychotropic medications at the time of the study, absence of more than two sessions, failure to complete treatment assignments, and no more than two sessions. The samples were selected by completing the questionnaires or withdrawing from further cooperation. The sample size was determined using statistical power analysis in GPower software version 3.1 and considering a power of 90%, an effect size of 30%, a significance level of 0.05, and a confidence level of 95%. The initial sample size was 60 people. Considering the possibility of participants dropping out during the course, the final sample size was 69 people, who were randomly assigned using a random number table and through block design, into three groups of 23 people (two intervention groups and one control group). To control for confounding variables, information related to the type of disease and duration of illness was recorded and included as covariates in the statistical analysis stage. An attempt was also made to match the groups in terms of age, gender, marital status, and level of education as much as possible. After a full explanation of the research objectives, all participants signed an informed consent form, and their information was kept confidential. Then, therapeutic interventions were implemented as pre-test, post-test, and follow-up, so that all participants completed the Dennis and Vandrewall Cognitive Flexibility Questionnaire and Van Korff Pain Severity Questionnaire in a self-reported manner at the beginning of the study, 8 weeks after the completion of the therapeutic interventions, and 2 months after the completion of the therapeutic interventions. In this study, three questionnaires were used: demographic characteristics, the Dennis and Vandrewall Cognitive Flexibility

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Questionnaire, and the Dendonkorff Pain Severity Questionnaire.

1. Demographic characteristics questionnaire which included age, gender, education, marital status, type of disease and duration of illness.

2. Dennis and Vand Rowal Cognitive Flexibility Questionnaire

Nikkho and Hosseini evaluated and confirmed its validity and reliability in Iran (47). This questionnaire consists of 20 items and three subscales of alternatives, control, and alternatives to human behavior. Scoring is based on a seven-point Likert scale, and the total score is between 20 and 140; a higher score indicates greater cognitive flexibility. The reliability of this questionnaire has been reported with a Cronbach's alpha coefficient of between 0.79 and 0.84 (8).

3. Durdon Korff Severity Questionnaire

Shirazi Tehrani and colleagues evaluated and confirmed its validity and reliability in Iran (48). This questionnaire consists of seven items, each of which respondents rate the intensity of their experience on an 11-point scale (0 to 10). The resulting scores are calculated in three subscales of pain intensity, disability, and levels of disability and are converted into numerical values between 0 and 100 according to specific instructions. In addition, the classification of disability levels is based on pain intensity, disability score, and number of days of functional limitation, which varies from level zero (no disability) to level four (severe disability). In the final interpretation, the total scores of the questionnaire vary between 0 and 70 and are classified into low (score between 0 and 20), moderate (score between 20 and 35), and high (score above 35) levels of chronic pain based on the determined ranges. The reliability of this questionnaire was reported to be 0.91, and the validity of the instrument was confirmed through item validity and convergence (14). The reliability of the instruments in the present study was calculated using Cronbach's alpha. For the cognitive flexibility questionnaire, $\alpha = 0.83$ was obtained for the entire pre-test data, which indicated the desired reliability of the instrument in this sample. For the chronic pain severity questionnaire, $\alpha = 0.79$ was also calculated for the pre-test. These results were consistent with the reliability reported in previous studies and indicate appropriate intra-instrument stability of the instruments.

All therapy sessions were held in a group setting and weekly, each session lasting 90 minutes and including 8 sessions for each intervention. Each group consisted of 23 people, and the group composition was a mixture of men and women to create appropriate group interaction and dynamics. All therapy sessions for both intervention groups were conducted by an expert therapist who had received training in the implementation of acceptance and commitment therapy and cognitive behavioral therapy protocols before the study began and was familiar with the content of the sessions. The researcher was also present in all sessions as an observer and assistant to coordinate the implementation of the protocols and to control for the effects of therapist differences; the ratio of the main therapist to the participant was 1:23, and the ratio of the total therapist and observer to the participant was approximately 1:12. After the end of the follow-up phase, the control group also underwent acceptance and commitment therapy; the intervention was implemented with the same therapist, protocol, number, and duration of sessions as the experimental groups to provide them with the opportunity to receive the intervention from an ethical perspective. This ensures that the post-test and follow-up results of the control group are not affected by the treatment and that the interpretability of the initial results is maintained. Details of the

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content of the acceptance and commitment therapy and cognitive behavioral therapy sessions based on the standard protocols of Hizo et al. (23) and Robb (49) are presented in Table 1.

The data were analyzed using SPSS version 26 software, and a significance level of 0.05 was considered. First, the studied variables were described using descriptive analysis methods, including mean, standard deviation, number, and percentage. The necessary assumptions for the test were checked before performing the analysis. The normality of the data was checked with the Shapiro-Wilk test, and the results showed that the scores in the experimental and control groups and in the three stages of the study had a normal distribution ($p<0.05$). The Levene test for homogeneity of variances was not significant ($p<0.05$), and the results of the M-box test showed that the equality of the variance-covariance matrix was not significant ($p<0.05$). The assumption of sphericity was rejected by the Mauchly test ($p<0.05$), so the Greenhouse-Geisser adjustment was used to correct the results. For inferential analysis, two-way ANOVA with repeated measures was used to compare the effect of the intervention between groups and over time. Chi-square and one-way ANOVA were used to compare the demographic characteristics of the groups, and comparisons between groups were made with the Bonferroni post hoc test.

Table 1. Structure of Intervention Sessions in Acceptance and Commitment Therapy (ACT) and Cognitive.

Session	Acceptance and Commitment Therapy (ACT)	Cognitive Behavioral Therapy (CBT)
First	Introduction to the study objectives and intervention procedures, establishment of therapeutic rapport, clarification of agreements and participants' commitments.	Introduction to treatment goals and therapeutic contract, education on basic concepts of chronic pain, preparation of an individual problem list, training in relaxation techniques.
Second	Review of current pain coping strategies, identification of maladaptive behaviors, assignment of homework.	Explanation and identification of automatic thoughts related to pain, practice of cognitive restructuring, muscle relaxation, assignment of homework.
Third	Practice of accepting painful experiences and reducing resistance to them, providing feedback to participants, assignment of homework.	Identification of cognitive distortions and maladaptive thinking patterns, assignment of homework.
Fourth	Training in non-avoidance of painful experiences and mindful awareness, practice of acceptance and attention skills, assignment of homework.	Training in managing intrusive thoughts and pain-related anxiety, practice of relaxation and guided imagery, assignment of homework.
Fifth	Introduction of a three-dimensional behavioral model (behavior–emotion–psychological functioning), discussion of behavior change, assignment of homework.	Elicitation and review of automatic thoughts, practice of negative emotion regulation skills, assignment of homework.
Sixth	Practice of self-as-context (observing self), separation of sensory experiences from cognitive content, assignment of homework.	Cognitive-behavioral exercises for managing emotions and illness symptoms, problem-solving skills training, assignment of homework.
Seventh	Identification of personal values and enhancement of motivation for change, attention training exercises, assignment of homework.	Identification of maladaptive attitudes and negative perfectionism, practice of cognitive and behavioral change, assignment of homework.
Eighth	Training in committed action, setting value-based behavioral goals, session summary and post-test administration.	Termination phase practice, coping with related anxieties, session summary and post-test administration.

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Results

The demographic characteristics of the participants in the two intervention groups and one control group are reported in Table 2, and the results show that the groups are homogeneous in terms of baseline characteristics. Also, quantitative and qualitative variables related to chronic pain, which have been introduced as effective factors in previous studies, are presented in this table to confirm the initial homogeneity of the groups.

Table 2. Comparison of Demographic and Clinical Characteristics Among ACT, CBT, and Control Groups.

Variables	Subgroup	ACT Group (N=23)	CBT Group (N=23)	Control Group (N=23)	P-value
Age (Mean ± SD)	—	38.95 ± 8.13	37.13 ± 8.06	34.69 ± 7.64	0.198
Duration of Pain (Mean ± SD)	—	4.30 ± 0.76	3.78 ± 0.73	4.21 ± 1.16	0.122
Gender	Female	15 (65.2)	15 (65.2)	14 (60.9)	0.939
	Male	8 (34.8)	8 (34.8)	9 (39.1)	
Education Level	Diploma	2 (8.7)	3 (13.0)	3 (13.0)	0.966
	Bachelor's Degree	14 (60.9)	15 (65.2)	12 (52.2)	
	Master's Degree	5 (21.7)	4 (17.4)	6 (26.1)	
	PhD	2 (8.7)	1 (4.3)	2 (8.7)	
Type of Chronic Pain Condition	Chronic Low Back Pain	7 (30.4)	6 (26.1)	5 (21.7)	0.977
	Fibromyalgia	4 (17.4)	3 (13.0)	4 (17.4)	
	Rheumatoid Arthritis	5 (21.7)	6 (26.1)	7 (30.4)	
	Migraine	3 (13.0)	5 (21.7)	5 (21.7)	
	Irritable Bowel Syndrome	4 (17.4)	3 (13.0)	2 (8.7)	
Marital Status	Single	5 (21.7)	7 (30.4)	6 (26.1)	0.789
	Married	18 (78.3)	16 (69.6)	17 (73.9)	

Table 3. Comparison of Cognitive Flexibility and Pain Intensity Across Study Groups at Different Time Points.

Variables	Group	Pre-intervention (N=23) Mean ± SD	Post-intervention (N=23) Mean ± SD	2 Months Follow-up (N=23) Mean ± SD	P-value (within-group)
Cognitive Flexibility	ACT	33.65 ± 3.24	101.00 ± 4.29	100.52 ± 4.64	<0.001
	CBT	32.86 ± 3.94	90.21 ± 7.65	89.82 ± 7.68	<0.001
	Control	34.04 ± 3.53	34.26 ± 3.78	33.65 ± 3.37	0.243
P-value (between groups)		0.531	<0.001	<0.001	
Pain Intensity	ACT	63.39 ± 3.10	25.30 ± 3.12	25.43 ± 3.55	<0.001
	CBT	64.17 ± 2.74	34.65 ± 1.99	35.08 ± 2.04	<0.001
	Control	65.04 ± 2.36	64.69 ± 2.77	65.13 ± 2.34	0.381
P-value (between groups)		0.134	<0.001	<0.001	

According to Table 3, the mean scores of cognitive flexibility in the pre-intervention stage did not differ between the three groups. However, after the implementation of the

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interventions, a significant increase was observed in the two groups of acceptance and commitment therapy and cognitive behavioral therapy, while the control group did not change significantly. The results of the Bonferroni post hoc test showed that this increase was significant in both intervention groups (p<0.001) but not in the control group (p=0.243). In addition, the intergroup comparison showed that there was a significant difference between the groups in the post-test and follow-up stages, and the acceptance and commitment therapy group showed the highest score increase and the best performance compared to the other two groups (p < 0.001). A similar pattern was observed in the field of pain intensity. Pain intensity in the two groups, acceptance and commitment therapy and cognitive behavioral therapy, decreased significantly after the intervention and at the follow-up stage (p<0.001), while the control group did not show any change (p=0.381). Between-group comparison showed that both interventions were effective in reducing pain intensity, but pain reduction in the acceptance and commitment therapy group was greater and more sustainable than in the cognitive behavioral therapy and control groups (p < 0.001).

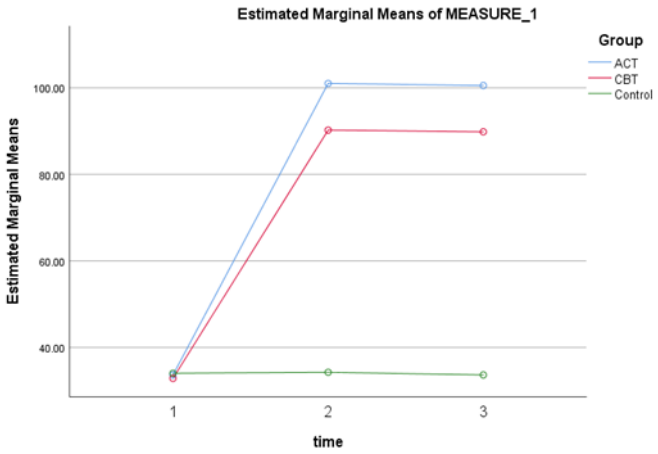


Figure 1. Profile plot diagram of group and time effects of cognitive flexibility in the intervention and control groups.

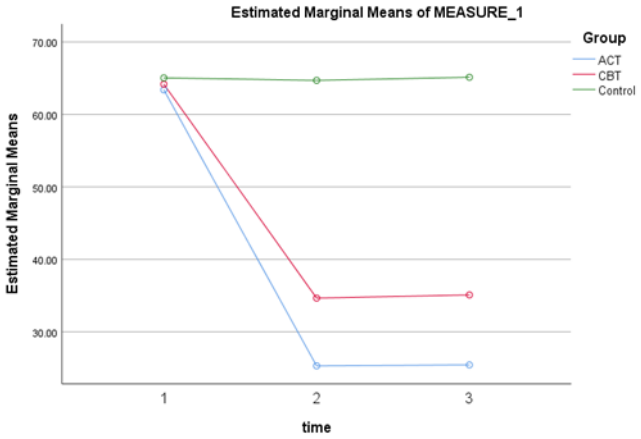


Figure 2. Profile plot diagram of group and time effects on pain intensity in the intervention and control groups.

Table 4. Results of two-way analysis of variance with repeated measures of cognitive flexibility and pain intensity at three time points for the intervention and control groups.

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Variables	Source of Variation	Sum of Squares	df	Mean Square	F	P-value	η^2	Power
Cognitive Flexibility	Time Effect	78,817.42	2	39,408.71	2960.89	<0.001	0.978	1.00
	Group Effect	78,081.85	2	39,040.92	824.80	<0.001	0.962	1.00
	Time × Group Interaction	40,330.55	4	10,082.63	757.33	<0.001	0.958	1.00
	Error	1,757.36	132	13.31	—	—	—	—
Pain Intensity	Time Effect	23,261.34	2	11,630.67	2254.06	<0.001	0.972	1.00
	Group Effect	27,154.96	2	13,577.48	1195.32	<0.001	0.973	1.00
	Time × Group Interaction	12,077.55	4	3,019.38	585.16	<0.001	0.947	1.00
	Error	681.10	132	5.16	—	—	—	—

According to Table 3, the mean scores of cognitive flexibility in the pre-intervention stage did not differ between the three groups. However, after the implementation of the interventions, a significant increase was observed in the two groups of acceptance and commitment therapy and cognitive behavioral therapy, while the control group did not change significantly. The results of the Bonferroni post hoc test showed that this increase was significant in both intervention groups ($p<0.001$) but not in the control group ($p=0.243$). In addition, the intergroup comparison showed that there was a significant difference between the groups in the post-test and follow-up stages, and the acceptance and commitment therapy group showed the highest score increase and the best performance compared to the other two groups ($p < 0.001$). A similar pattern was observed in the field of pain intensity. Pain intensity in the two groups, acceptance and commitment therapy and cognitive behavioral therapy, decreased significantly after the intervention and at the follow-up stage ($p<0.001$), while the control group did not show any change ($p=0.381$). Between-group comparison showed that both interventions were effective in reducing pain intensity, but pain reduction in the acceptance and commitment therapy group was greater and more sustainable than in the cognitive behavioral therapy and control groups ($p < 0.001$).

Discussion

The results of this study showed that both acceptance and commitment therapy and cognitive behavioral therapy interventions are effective in increasing cognitive flexibility and reducing pain intensity in patients with chronic pain, but the effect of acceptance and commitment therapy was statistically and clinically more stable and stronger than cognitive behavioral therapy. The mean scores of cognitive flexibility and pain intensity in the acceptance and commitment therapy group increased and decreased significantly from pre-test to post-test and follow-up, while the cognitive behavioral therapy group had fewer positive changes, and its effect decreased slightly at follow-up. The control group did not show any significant changes at any stage, confirming that the observed results were due to the interventions applied and that the interpretability of the initial findings was maintained. This finding is consistent with the results of the study by Pandelaniou et al. (2023), which emphasize that psychological interventions can improve the subjective experience of pain and patients' ability to manage painful conditions (6). At the same time, some inconsistent studies have also been reported. For example, Nozari et al. (2025)

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reported no significant difference between the effects of acceptance and commitment therapy and cognitive behavioral therapy in a study on patients with fibromyalgia (46). This inconsistency could be due to typological differences (including the sample being limited to women), high pain severity, diagnostic heterogeneity, or the short duration of the intervention. Also, Shahroui et al. (2025) found in a study of students with social anxiety that the two methods did not differ significantly in terms of their effects on cognitive flexibility (38), which is likely to reflect differences in the nature of the disorder, the age of the participants, and the cultural background. Importantly, no study was found that directly compared the two approaches of acceptance and commitment therapy and cognitive behavioral therapy on cognitive flexibility and pain intensity in patients with chronic pain; however, a review of relevant research suggests that both methods can affect these variables.

The difference in the effect of acceptance and commitment therapy compared to cognitive behavioral therapy can be attributed to the different nature of the acceptance and commitment therapy approach. Acceptance and commitment therapy focuses on accepting unpleasant experiences, reducing cognitive fusion, focusing on the self as a platform, and value-oriented behaviors (23). By learning to accept pain and negative thoughts rather than trying to control or eliminate them, patients increase their cognitive flexibility and demonstrate more constructive behaviors in daily life (26). This therapy also draws the individual's attention to the present moment and to the direct experience of thoughts and emotions through the use of mindfulness techniques and the activation of the observer self (25). A distinctive feature of acceptance and commitment therapy is that it emphasizes changing the individual's relationship with them rather than changing or eliminating thoughts and feelings (23). This goal is pursued through accepting experiences rather than avoiding them and mindfulness exercises to increase attention and awareness of thoughts, emotions, and desires (26). As a result, patients are able to display more adaptive responses, maintain their value-based behaviors, and enhance their ability to participate in personal and social activities. In contrast, cognitive behavioral therapy increases patients' ability to regulate their thoughts and behaviors in the face of pain by identifying and modifying dysfunctional thoughts, reducing catastrophizing, and teaching coping skills (33). However, the effect of cognitive behavioral therapy is often shorter-term because its main focus is on modifying the content and structure of thoughts and does not necessarily change the patient's relationship to the pain experience (35). This finding is consistent with Hayes' (2012) six-process model, which emphasizes that active acceptance and momentary awareness can enhance cognitive flexibility and improve quality of life (23). Accordingly, acceptance and commitment therapy was able to reduce patients' mental preoccupation with pain and, compared to cognitive behavioral therapy, improve cognitive flexibility and the ability to cope adaptively with pain.

The results of the effectiveness of acceptance and commitment therapy in the present study are consistent with previous evidence. For example, Yi et al. (2024) showed in a systematic review that acceptance and commitment therapy increased psychological flexibility and improved quality of life in patients with chronic pain (27). Also, Khoraminejad et al. (2025) reported in a quasi-experimental study that this therapy was able to significantly increase cognitive flexibility in men with epilepsy (28). The results of Macri et al. (2024) in a comprehensive meta-analysis also indicate that the therapeutic processes of this therapy, including acceptance, cognitive

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dissonance, and value orientation, directly affect the increase in cognitive flexibility (29). On the other hand, the findings related to the reduction in pain intensity were also consistent with the crystallizing studies of Mashhadi et al. (2025), who reported pain reduction in elderly women with rheumatoid arthritis (31), and the study of Campbell et al. (2025), who confirmed the effectiveness of acceptance and commitment therapy in reducing chronic pain in the elderly (32); however, it is important to note that cultural differences, individual characteristics, severity and type of pain, as well as the duration and quality of intervention implementation can play a role in the results of future research. This indicates that the consistency of the current results is not a definitive proof of the uniformity of the effectiveness of acceptance and commitment therapy in all populations, and further studies are still needed. In explaining the findings, it can be said that the main mechanisms of the effectiveness of acceptance and commitment therapy, including cognitive dissociation and reduced fusion with painful thoughts, active acceptance of unpleasant experiences, and distinction between the observer self and the pain experience, play a fundamental role in promoting cognitive flexibility (27). Through these processes, patients learn to perceive pain as a transient experience and not part of their identity and, at the same time, direct their conscious attention to value-oriented behaviors (32). These mechanisms increase the ability to cope adaptively and reduce pain perception by reducing mental involvement with pain, freeing up cognitive resources, and strengthening emotion regulation skills. Ultimately, acquiring these skills allows patients to continue their daily activities with higher quality and a greater sense of control in the presence of pain. This confirms the comprehensive and sustainable effectiveness of acceptance and commitment therapy in improving cognitive flexibility and reducing the severity of chronic pain. The results of the effectiveness of cognitive behavioral therapy in the present study are consistent with the findings of previous studies. Shahroui et al. (2025) showed that implementing cognitive behavioral therapy improves cognitive flexibility in students with social anxiety (38). Akerblom et al. (2021) also reported in an analytical study that cognitive behavioral therapy is one of the most important predictors of change in cognitive flexibility for patients with chronic pain (39). Also, Alizadeh et al. (2024) found that this treatment, in addition to reducing pain severity, leads to improved psychological flexibility and modulating the negative consequences of childhood trauma in patients with chronic pain (40). In the field of chronic physical illnesses, Abedi et al. (2023) confirmed the effectiveness of group cognitive behavioral therapy in increasing psychosocial adjustment and promoting cognitive flexibility in people with multiple sclerosis (41). On the other hand, more recent intervention studies such as the study by Hosogoshi et al. (2025), which presented the protocol of a controlled trial in Japan (42), and the study by Yokoyama et al. (2024), which examined changes in pain intensity after cognitive behavioral therapy (43), have provided further evidence on the effective role of cognitive behavioral therapy in modifying pain-related thought patterns. Also, Abdul Halim et al. (2024) showed in a randomized controlled trial that cognitive behavioral therapy over an eight-week period can significantly reduce pain intensity and functional indices in patients with chronic low back pain (44). However, it should be noted that cultural differences, severity and type of chronic pain, and the structure of the intervention implementation may play a role in the results of future studies. This indicates that although the consistency of the studies is significant, the generalization of the results should be done with caution and considering the diversity of the samples. In explaining the consistency of the results, it can be said that

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cognitive behavioral therapy, by identifying and modifying dysfunctional beliefs, reducing cognitive biases, teaching self-regulation skills, and increasing self-efficacy, provides the basis for greater flexibility in the processing of thoughts and emotional reactions (43). Also, by teaching behavioral skills such as gradual exposure, relaxation, and activity management, this therapy helps patients reduce maladaptive responses to pain and deal more actively with their symptoms (41). The set of these processes reduces the intensity of perceived pain, increases tolerance to it, and improves the psychological and daily functioning of patients.

A comprehensive review of the findings shows that acceptance and commitment therapy, due to its pain-acceptance nature, the development of psychological flexibility, and the reduction of catastrophizing, has been able to target patients' emotional regulation and attention in a deeper way, while cognitive behavioral therapy, despite its effectiveness, focuses more on modifying the content of thoughts, and this difference probably led to the less sustainable effects of cognitive behavioral therapy. Therefore, it can be concluded that acceptance and commitment therapy is a more effective approach in the long-term management of chronic pain, especially for patients who are faced with intrusive thoughts, helplessness, or severe emotional fluctuations. In addition to clearly answering the research question, these findings also have important clinical implications. First, therapists can prioritize acceptance and commitment therapy for patients with various types of chronic pain as an intervention with more sustainable effects. Second, increasing cognitive flexibility as one of the key mechanisms of pain reduction can be considered an important indicator in evaluating the treatment process. Third, the results showed that simply correcting cognitions is not enough, and strengthening acceptance and cognitive distancing can play a more decisive role in improving patients. The novelty of the research is also notable because, until this study was conducted, no study had directly compared the two approaches of acceptance and commitment therapy and cognitive behavioral therapy on cognitive flexibility and pain intensity in Iranian patients with various types of chronic pain. Therefore, this study was able to cover the gap in the research literature and provide a basis for selecting the appropriate treatment in pain clinics. The findings are also in line with a large part of the research literature, but the differences reported in some studies could be due to sample characteristics, pain severity, or treatment duration; this highlights the value of replication of the study in different populations. Overall, the present study shows that third-wave approaches, especially acceptance and commitment therapy, are more effective in managing chronic pain and can be recommended as primary psychological treatment options for patients with chronic pain.

Despite the valuable results of the present study, several limitations should be noted. First, the sample size was relatively small, which could affect the robustness of the results and the accuracy of statistical estimates. Although the effect sizes for the variables were reported to be very high in the analyses, it should be noted that in small samples, effect sizes may be exaggerated or sensitive to small changes in the data; therefore, generalization of these findings should be made with caution. Second, the research instruments were mainly self-reported, and there is a possibility of response errors, social desirability, or different interpretations of the items. In addition, there was no strict control for the use of analgesic and psychiatric medications, which could affect the severity of pain and cognitive status of the participants. Also, the lack of an active control group such as stress management training or supportive therapy, as well as the relatively short follow-up period, is among the limitations that can affect part of the

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internal validity of the study. In terms of external validity, the relatively limited age range, the location of the study, and the cultural characteristics of the sample make it prudent to generalize the results to larger or different populations. In particular, patterns of pain experience and expression, social roles, and attitudes toward psychological treatments can differ significantly across cultures. Given these limitations, it is suggested that future research be conducted with larger and more diverse samples and in the form of randomized controlled designs with long-term follow-up to allow for a more detailed examination of the sustainability of the effects of acceptance and commitment therapy and cognitive behavioral therapy. Additionally, the use of active control groups, careful recording and monitoring of medication use, and the use of objective indicators such as physiological markers, sleep patterns, or clinical observation can help increase the accuracy and validity of the results. In addition, it is suggested that these two treatment approaches be examined separately on specific pain groups such as fibromyalgia, neuropathic pain, or chronic headaches to determine which type of pain is more stable and effective.

Conclusion

The relative superiority and greater stability of acceptance and commitment therapy indicate that this approach can be used as an effective part of multimodal pain management programs in pain clinics. Training in acceptance and commitment therapy for chronic pain therapists can also help improve the quality of services and increase patients' ability to effectively manage pain. Also, the results' emphasis on the role of cognitive flexibility as a common mechanism of both treatments can be considered in the design of rehabilitation programs, disability prevention, and group interventions. Therefore, the present study, by providing a direct comparison of the two treatment approaches in a sample of Iranian patients with chronic pain, can help develop local evidence and improve the clinical application of psychological interventions in pain management.

Authors' Contribution

Conceptualization, Methodology, Validation, Formal Analysis, Investigation: MA, Resources, Software, Data Curation, Writing–Original Draft Preparation, Writing–Review & Editing, Visualization, Supervision, Project Administration: VA, SM, HS, ZM.

Ethical Considerations

This study was conducted with the approval of the Ethics Committee of Islamic Azad University, Ilam Branch and the ethical code IR.IAU.ILAM.REC.1402.042. The authors avoided data fabrication, falsification, plagiarism, and misconduct.

Conflict of Interest

The authors declare no conflict of interest.

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