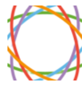
KMANPUB  Health Nexus Vol. 4 No. 2 (2026): 1-10

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Effectiveness of Acceptance and Commitment Therapy on Pain Catastrophizing, Pain Self-Efficacy, and Psychological Flexibility in Individuals with Chronic Pain: A Quasi-Experimental Study

Fatemeh Moqbeli[1], Fateme Mohebi Rezaei[2], Elnaz Seyyedbaglou[3], Parisa Fatahi[4], Javad Adeldoust[5], Mohammad Amin Roustaei Hossein Abad[6*]

[1] M.Sc. in Clinical Psychology, School of Medicine, Kashan University of Medical Sciences, Kashan, Iran
[2] M.Sc. in Clinical Psychology, Islamic Azad University of Medical Sciences, Ardabil, Iran
[3] M.Sc. in General Psychology, Faculty of Educational Sciences and Psychology, University of Tabriz, Tabriz, Iran
[4] M.Sc. in Clinical Psychology, Department of Clinical Psychology, Faculty of Educational Sciences and Psychology, Alzahra University, Tehran, Iran
[5] M.Sc. in Family Counseling, Fayz al-Islam University, Khomeinishahr, Isfahan, Iran
[6] M.Sc. in General Psychology, Department of Psychology, Faculty of Literature and Humanities, Malayer University, Malayer, Iran

*** Corresponding author email address**: aminroostaie1376@gmail.com

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A B S T R A C T

Chronic pain is a persistent biopsychosocial condition in which pain-related thoughts, behavioral avoidance, emotional distress, and perceived coping ability can interact to maintain disability and suffering. Acceptance and Commitment Therapy (ACT) is designed to increase psychological flexibility and help individuals engage in valued action even when pain and distress are present. This study examined the effectiveness of ACT on pain catastrophizing, pain self-efficacy, and psychological flexibility in adults with chronic pain. A quasi-experimental pretest-posttest control group design with a two-month follow-up was used. Thirty adults with chronic pain were recruited through online platforms and purposively selected according to eligibility criteria. Participants were randomly assigned to an ACT group (n = 15) or a control group (n = 15). The ACT group received eight weekly 90-minute online group sessions, whereas the control group received no intervention during the active study period. Measures included the Pain Catastrophizing Scale, Pain Self-Efficacy Questionnaire, and Acceptance and Action Questionnaire-II. Data were analyzed using repeated-measures ANOVA and Bonferroni comparisons. The ACT group showed marked improvement from pretest to posttest and follow-up. Pain catastrophizing decreased from 37.80 to 26.07 at posttest and 26.80 at follow-up. Pain self-efficacy increased from 30.40 to 42.27 at posttest and 43.47 at follow-up. Psychological flexibility improved as AAQ-II scores decreased from 31.33 to 19.80 at posttest and 19.20 at follow-up. Significant time, group, and time by group effects were reported for all outcomes. ACT was associated with sustained reductions in pain catastrophizing and improvements in pain self-efficacy and psychological flexibility among individuals with chronic pain. Larger randomized trials with active controls and longer follow-up periods are recommended.

Keywords: *Acceptance and Commitment Therapy; chronic pain; pain catastrophizing; pain self-efficacy; psychological flexibility; online intervention*

1. Introduction

Pain is now widely understood as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage (1). When pain persists or recurs for longer than three months,

it is commonly classified as chronic pain, a condition that may become a central clinical problem rather than a simple warning signal (2). Chronic pain is therefore best understood within a biopsychosocial framework in which nociceptive processes, emotional distress, beliefs about pain, behavioral avoidance, disability, and social context interact over time (3). This multidimensional view is especially important because the severity of suffering and impairment is often not fully explained by biomedical findings alone. Among the psychological variables that influence chronic pain, pain catastrophizing is one of the most consistent and clinically important. Catastrophizing refers to an exaggerated negative orientation toward actual or anticipated pain and includes rumination, magnification, and helplessness (4). Individuals who catastrophize tend to focus excessively on pain, interpret it as highly threatening, and experience reduced confidence in their ability to manage it. This cognitive-emotional pattern can increase distress, reinforce avoidance, and worsen pain-related disability. Consequently, catastrophizing is not merely a description of pain-related thinking; it is a modifiable process that can influence how people respond to pain and whether they continue meaningful activity.

Pain self-efficacy represents a more adaptive psychological factor. Based on Bandura's self-efficacy theory, it refers to confidence in one's ability to perform activities and manage life demands despite pain (5). The Pain Self-Efficacy Questionnaire was developed to assess this domain specifically in people with chronic pain (6). Higher pain self-efficacy is generally associated with greater activity engagement and better adjustment, whereas low self-efficacy may contribute to helplessness, withdrawal, and excessive reliance on avoidance-based coping. In clinical terms, increasing self-efficacy means helping patients discover that they can continue valued behavior even when pain has not disappeared. Psychological flexibility is another central construct in contemporary behavioral approaches to chronic pain. It refers to the capacity to remain in contact with present-moment experience and to choose behavior in line with personal values, even in the presence of difficult thoughts, emotions, sensations, or memories (7). In chronic pain, psychological inflexibility commonly appears as experiential avoidance, cognitive fusion with pain-related thoughts, narrow attention to symptoms, and reduction of valued activities. The Acceptance and Action Questionnaire-II (AAQ-II) is often used to assess psychological inflexibility and experiential avoidance, with higher scores reflecting poorer flexibility (8). Meta-analytic evidence shows that psychological flexibility and inflexibility are meaningfully related to pain intensity, distress, disability, and quality of life in chronic pain populations (9).

Acceptance and Commitment Therapy (ACT) was developed to strengthen psychological flexibility through six interrelated processes: acceptance, cognitive defusion, present-moment awareness, self-as-context, values clarification, and committed action (10). Unlike interventions that focus primarily on eliminating pain-related thoughts or sensations, ACT helps individuals change their relationship with internal experiences. For chronic pain, this means learning to notice pain and pain-related thoughts without becoming dominated by them, while re-engaging in personally meaningful activities. This model is highly relevant to chronic pain because the goal of treatment is often not complete pain elimination but improved functioning, reduced struggle with pain, and greater life engagement. Empirical support for ACT in chronic pain has grown substantially. Early acceptance-based studies suggested that increased acceptance of pain was associated with better functioning and reduced distress (11, 12). Later randomized and comparative trials found that ACT can improve important psychological and functional outcomes in people with chronic pain (13). Systematic reviews and meta-analyses have also supported the usefulness of ACT and other acceptance-based interventions for reducing distress and improving adjustment in chronic pain populations (14-17). More recent evidence has emphasized that ACT-related change may operate through increases in psychological flexibility and reductions in catastrophizing (11, 18, 19). The present study examined whether an eight-session online ACT group intervention could reduce pain catastrophizing and improve pain self-efficacy and psychological flexibility in individuals with chronic pain. The study was framed as a quasi-experimental clinical investigation, and the interpretation of findings was limited to the reported numerical results.

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2. Methods and Materials

2.1. Study Design and Participants

This study used a quasi-experimental pretest-posttest control group design with a two-month follow-up. The statistical population consisted of adults with chronic pain who were recruited through social media platforms and online announcements. Chronic pain was defined as pain lasting more than three months, consistent with international definitions (2). Thirty eligible participants were selected using purposive sampling and then randomly assigned to an experimental group receiving ACT (n = 15) or a control group (n = 15). The sample size was modest but acceptable for a preliminary quasi-experimental study.

Inclusion criteria were: age above 18 years, experience of chronic pain for more than three months, willingness to participate, access to the internet and a device suitable for online sessions, and absence of concurrent psychological treatment during the study period. Exclusion criteria were absence from more than two ACT sessions, unwillingness to continue participation, and failure to complete the study measures or essential therapeutic assignments. The control group did not receive psychological intervention during the active study period. To address ethical concerns, the ACT intervention was offered to control participants after completion of the follow-up assessment.

The ACT intervention was delivered in an online group format through eight weekly 90-minute sessions. The protocol was adapted from established ACT principles and clinical processes described by Hayes et al. (2012). Sessions introduced psychoeducation about internal experiences, creative hopelessness, acceptance, willingness, cognitive defusion, mindfulness, self-as-context, values clarification, and committed action. Homework assignments encouraged participants to apply ACT skills between sessions (10). As shown before Table 1, the intervention was structured to move from recognizing ineffective control strategies to practicing values-based behavior in the presence of pain.

Table 1

Summary of the eight-session ACT intervention protocol

Session	Main focus	Core ACT process
1	Group orientation, confidentiality, treatment goals, psychoeducation on thoughts, emotions, bodily sensations, memories, and pain-related reactions; pretest administration.	Orientation and present-moment awareness
2	Review of homework and identification of ineffective control and avoidance strategies; use of creative hopelessness and control-related metaphors.	Creative hopelessness
3	Further exploration of control as the problem; use of metaphors such as the child tantrum and polygraph machine to demonstrate the paradox of emotional control.	Acceptance versus control
4	Introduction of willingness and acceptance; discussion of clean pain and dirty pain; practice with willingness exercises and homework.	Acceptance and willingness
5	Cognitive defusion exercises using chessboard and bus metaphors; introduction of self-as-context and committed behavioral intentions.	Defusion and self-as-context
6	Mindfulness and observing-self exercises; use of train and beggar metaphors; initial identification of personal values.	Present moment and values
7	Translation of values into behavioral goals; tree planting and bubble metaphors; development of values-based action plans.	Values and committed action
8	Integration of ACT processes, review of personal changes, relapse prevention, posttest completion, and termination.	Integration and maintenance

2.2. Measures

Pain catastrophizing was assessed with the Pain Catastrophizing Scale (PCS), developed by Sullivan et al. (1995). The PCS includes 13 items and assesses rumination, magnification, and helplessness in response to pain. Total scores range from 0 to 52, with higher scores indicating greater catastrophic thinking. In the present study, Cronbach's alpha was .87, indicating good internal consistency. Pain self-efficacy was measured using the Pain Self-Efficacy Questionnaire (PSEQ), developed by Nicholas (2007) (6). The PSEQ contains 10 items rated on a 7-point scale, with total scores ranging from 0 to 60. Higher scores indicate stronger confidence in performing activities despite pain. In the present study, Cronbach's alpha was .86. Psychological flexibility was assessed using the Acceptance and Action Questionnaire-II (AAQ-II), developed by Bond et al. (2011) (8). The AAQ-II includes 7 items rated on a 7-point scale. Higher scores indicate

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greater psychological inflexibility and experiential avoidance; therefore, lower post-intervention scores reflect improvement in psychological flexibility. In the present study, Cronbach's alpha was .71.

2.3. Data Analysis

Data were analyzed using repeated-measures analysis of variance within the General Linear Model framework. The design included one between-subject factor, group (ACT vs. control), and one within-subject factor, time (pretest, posttest, and two-month follow-up). The main effects of time and group, as well as the time by group interaction, were examined for pain catastrophizing, pain self-efficacy, and psychological flexibility. Bonferroni-adjusted pairwise comparisons were used to evaluate differences between measurement occasions. Effect sizes were reported as eta-squared values. The numerical findings presented below retain the reported results of the study and do not alter the outcome pattern.

3. Findings and Results

A total of 30 individuals with chronic pain participated in the study and were assigned to the ACT group (n = 15) or control group (n = 15). In the ACT group, 7 participants were female (46.7%) and 8 were male (53.3%). In the control group, 5 participants were female (33.3%) and 10 were male (66.7%). Marital status was identical across groups: 2 participants were single (13.3%) and 13 were married (86.7%) in each group. The mean age was 36.42 years (SD = 7.18) in the ACT group and 35.87 years (SD = 6.95) in the control group. These demographic characteristics are presented before Table 2.

Table 2

Demographic characteristics of participants by group

Characteristic	ACT group (n = 15)	Control group (n = 15)
Female, n (%)	7 (46.7%)	5 (33.3%)
Male, n (%)	8 (53.3%)	10 (66.7%)
Single, n (%)	2 (13.3%)	2 (13.3%)
Married, n (%)	13 (86.7%)	13 (86.7%)
Age, M ± SD	36.42 ± 7.18	35.87 ± 6.95

As summarized before Table 3, the descriptive results showed a clinically meaningful pattern of improvement in the ACT group across all three outcomes. For pain catastrophizing, the ACT group decreased from 37.80 at pretest to 26.07 at posttest, with the reduction largely maintained at follow-up (26.80). This represents a mean reduction of 11.73 points from pretest to posttest and 11.00 points from pretest to follow-up. In contrast, the control group showed no comparable improvement. Its mean pain catastrophizing score increased from 38.67 to 39.73 at posttest and then decreased to 37.47 at follow-up, indicating only a small net change.

For pain self-efficacy, the ACT group improved from 30.40 at pretest to 42.27 at posttest and 43.47 at follow-up. The mean increase was 11.87 points at posttest and 13.07 points at follow-up. The control group remained essentially stable, moving from 30.33 at pretest to 30.20 at posttest and 31.20 at follow-up. For psychological flexibility, lower AAQ-II scores indicate improvement. The ACT group decreased from 31.33 at pretest to 19.80 at posttest and 19.20 at follow-up, whereas the control group remained close to baseline. Thus, the descriptive pattern consistently favored ACT.

Table 3

Means, standard deviations, and mean changes across time

Outcome	Group	Pretest M ± SD	Posttest M ± SD	Follow-up M ± SD	Pre-post change	Pre-follow-up change
Pain catastrophizing	ACT	37.80 ± 5.17	26.07 ± 4.69	26.80 ± 4.52	-11.73	-11.00
Pain	Control	38.67 ± 5.06	39.73 ± 3.95	37.47 ± 5.48	+1.06	-1.20

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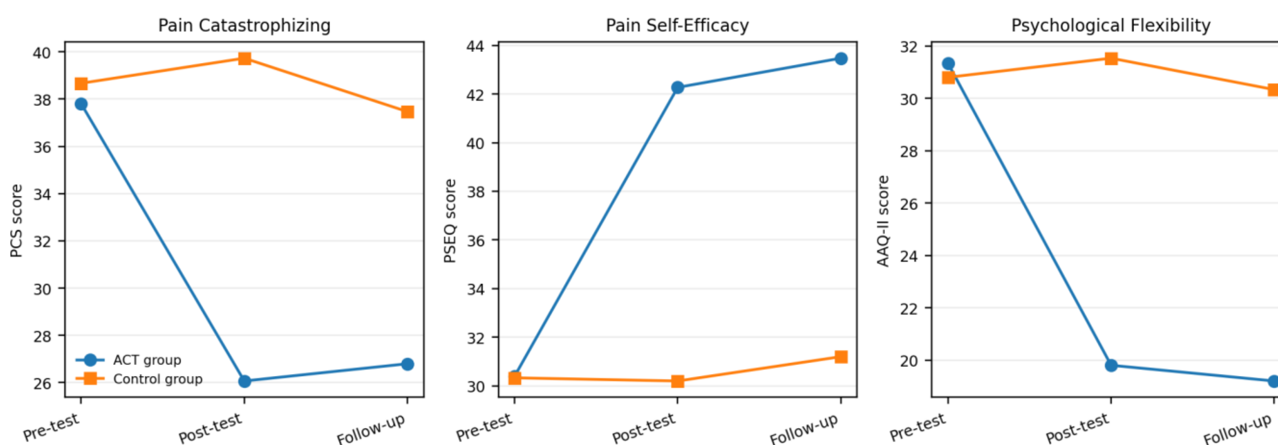
catastrophizing						
Pain self-efficacy	ACT	30.40 ± 4.35	42.27 ± 4.86	43.47 ± 5.52	+11.87	+13.07
Pain self-efficacy	Control	30.33 ± 4.43	30.20 ± 4.85	31.20 ± 4.87	-0.13	+0.87
Psychological flexibility (AAQ-II)	ACT	31.33 ± 2.22	19.80 ± 3.80	19.20 ± 5.33	-11.53	-12.13
Psychological flexibility (AAQ-II)	Control	30.80 ± 2.27	31.53 ± 4.43	30.33 ± 3.33	+0.73	-0.47

Note. For pain catastrophizing and AAQ-II psychological inflexibility, negative change scores indicate improvement. For pain self-efficacy, positive change scores indicate improvement.

The trajectories displayed before Figure 1 visually confirm the same pattern. The ACT group showed a sharp reduction in pain catastrophizing, a substantial increase in pain self-efficacy, and a marked reduction in AAQ-II scores, indicating improved psychological flexibility. The control group showed only small fluctuations around baseline values.

Figure 1

Mean scores for pain catastrophizing, pain self-efficacy, and psychological flexibility across pretest, posttest, and follow-up



Note. Lower AAQ-II scores indicate lower psychological inflexibility and therefore greater psychological flexibility.

As reported before Table 4, the repeated-measures ANOVA results showed significant main effects of time, significant main effects of group, and significant time by group interactions for all three outcomes. For pain catastrophizing, the time effect was significant, $F = 57.24$, $\eta^2 = .67$; the group effect was significant, $F = 27.01$, $\eta^2 = .49$; and the time by group interaction was significant, $F = 58.08$, $\eta^2 = .67$. This interaction indicates that the reduction in catastrophizing over time differed substantially between the ACT and control groups. For pain self-efficacy, the time effect was significant, $F = 79.03$, $\eta^2 = .73$; the group effect was significant, $F = 25.04$, $\eta^2 = .47$; and the time by group interaction was significant, $F = 68.75$, $\eta^2 = .71$. These findings indicate that the increase in self-efficacy was specifically associated with the ACT group rather than general passage of time. For psychological flexibility, the time effect was significant, $F = 47.64$, $\eta^2 = .63$; the group effect was significant, $F = 45.68$, $\eta^2 = .62$; and the interaction was significant, $F = 49.06$, $\eta^2 = .63$. Because lower AAQ-II scores reflect lower psychological inflexibility, this finding supports a significant improvement in psychological flexibility in the ACT group.

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Table 4

Repeated-measures ANOVA and Bonferroni pairwise comparisons

Outcome	Analysis	Statistic / comparison	F or MD	p	η² / interpretation
Pain catastrophizing	ANOVA	Time	57.24	.001	.67
Pain catastrophizing	ANOVA	Time × Group	58.08	.001	.67
Pain catastrophizing	ANOVA	Group	27.01	.001	.49
Pain catastrophizing	Bonferroni	Pretest → Posttest	-5.33	< .001	Significant
Pain catastrophizing	Bonferroni	Pretest → Follow-up	-6.10	< .001	Significant
Pain catastrophizing	Bonferroni	Posttest ↔ Follow-up	0.76	.788	Not significant
Pain self-efficacy	ANOVA	Time	79.03	.001	.73
Pain self-efficacy	ANOVA	Time × Group	68.75	.001	.71
Pain self-efficacy	ANOVA	Group	25.04	.001	.47
Pain self-efficacy	Bonferroni	Pretest → Posttest	+5.86	< .001	Significant
Pain self-efficacy	Bonferroni	Pretest → Follow-up	+6.96	< .001	Significant
Pain self-efficacy	Bonferroni	Posttest ↔ Follow-up	1.10	.199	Not significant
Psychological flexibility	ANOVA	Time	47.64	.001	.63
Psychological flexibility	ANOVA	Time × Group	49.06	.001	.63
Psychological flexibility	ANOVA	Group	45.68	.001	.62
Psychological flexibility	Bonferroni	Pretest → Posttest	-5.40	< .001	Significant
Psychological flexibility	Bonferroni	Pretest → Follow-up	-6.30	< .001	Significant
Psychological flexibility	Bonferroni	Posttest ↔ Follow-up	-0.90	.696	Not significant

Note. MD = mean difference; η^2 = eta-squared. For psychological flexibility, AAQ-II scores were used; therefore, negative mean differences indicate improvement.

The Bonferroni comparisons indicated significant changes from pretest to posttest and from pretest to follow-up for all outcomes, whereas posttest-to-follow-up differences were not significant. This suggests that the improvements observed after the ACT intervention were maintained over the two-month follow-up period. Overall, the results support the effectiveness of ACT for reducing pain catastrophizing and psychological inflexibility and for increasing pain self-efficacy in individuals with chronic pain.

4. Discussion

The present study examined the effectiveness of an eight-session online ACT intervention on pain catastrophizing, pain self-efficacy, and psychological flexibility in individuals with chronic pain. The results showed a consistent and theoretically coherent pattern. Compared with the control group, participants who received ACT reported lower pain catastrophizing, higher pain self-efficacy, and lower AAQ-II scores, indicating greater psychological flexibility. These improvements were observed at posttest and were largely maintained at the two-month follow-up. The significant time by group interactions across all outcomes suggest that the pattern of change was not simply due to repeated assessment or time, but was associated with participation in the ACT intervention. The reduction in pain catastrophizing is consistent with the ACT model. ACT does not primarily attempt to dispute every negative pain-related thought; instead, it teaches clients to observe thoughts as mental events and reduce literal fusion with them (7, 10). When individuals learn cognitive defusion, thoughts such as "I cannot tolerate this pain" or "my pain will ruin everything" may become less behaviorally dominant. The decrease in catastrophizing in this study is therefore understandable: participants may have learned to relate differently to pain-related predictions, worries, and helplessness. This interpretation is consistent with previous evidence suggesting that catastrophizing can change during ACT and may function as an associated mechanism of improvement in chronic pain treatment (19).

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The increase in pain self-efficacy is also clinically important. Although ACT does not define treatment success as complete symptom control, it encourages committed action in valued life domains despite the presence of pain. Through gradual behavioral engagement, participants may discover that they can perform meaningful activities even when pain is still present. These successful experiences can strengthen perceived coping ability. This mechanism is compatible with Bandura's (1997) theory, in which mastery experiences are an important source of self-efficacy (5). The present findings also align with the rationale of the PSEQ, which emphasizes confidence in functioning despite pain rather than confidence in eliminating pain completely (6).

The improvement in psychological flexibility represents the central process targeted by ACT. Psychological flexibility is a broad regulatory capacity that includes openness to internal experience, flexible attention to the present moment, and values-based action (10). In this study, AAQ-II scores decreased substantially in the ACT group, indicating reduced psychological inflexibility and experiential avoidance. The result is consistent with meta-analytic evidence that psychological flexibility is closely associated with better functioning and lower distress in chronic pain populations (9, 18). It is also consistent with the broader ACT literature showing that increasing psychological flexibility is a key pathway through which ACT may improve mental and physical health outcomes (14). From a clinical perspective, the simultaneous improvement in all three outcomes suggests that ACT may influence a network of related psychological processes. Pain catastrophizing, low self-efficacy, and psychological inflexibility can reinforce each other. A person who catastrophizes may avoid activity, and avoidance can reduce opportunities for mastery, thereby weakening self-efficacy. Low self-efficacy can then make pain-related thoughts more believable and threatening. ACT may interrupt this cycle by helping individuals accept internal experiences, step back from catastrophic thoughts, and take small values-based actions. As engagement increases, self-efficacy may improve and catastrophic interpretations may lose strength.

The findings are consistent with previous reviews and meta-analyses of ACT for chronic pain. Veehof et al. (2011, 2016) reported that acceptance- and mindfulness-based interventions can improve pain-related psychological outcomes (16, 17). Hughes et al. (2017) concluded that ACT is effective for chronic pain when compared with control conditions (15). More recent reviews have suggested that ACT can improve outcomes such as distress, functioning, pain-related interference, and psychological flexibility, although the quality and certainty of evidence vary across studies (11). The current study contributes to this literature by examining ACT in an online group format and by including follow-up data, even though the sample size was small. The online delivery format is also notable. Chronic pain may limit transportation, mobility, and attendance in face-to-face sessions. Online ACT can reduce these barriers and may be particularly useful for participants who experience fatigue or live far from specialized services. At the same time, online delivery requires careful attention to engagement, privacy, homework completion, and therapist monitoring. In the current study, the maintenance of gains at follow-up suggests that participants were able to apply ACT processes beyond the sessions; however, future studies should measure adherence, session attendance, homework completion, and therapeutic alliance to clarify how online delivery affects treatment response.

The study has several limitations that should be considered when interpreting the findings. First, the sample size was small, with only 15 participants in each group, which limits statistical power and generalizability. Second, purposive sampling through online platforms may have introduced selection bias because participants with internet access, higher motivation, or greater familiarity with online communication may be overrepresented. Third, the control group received no active psychological intervention during the study period, so the results may partly reflect nonspecific factors such as attention, expectation, group support, and structured engagement. Fourth, all outcomes were assessed using self-report questionnaires, which may be influenced by response bias or social desirability. Fifth, although the two-month follow-up is useful, longer follow-up periods are needed to evaluate durability over six months or one year.

Future research should use larger randomized controlled trials with active comparison conditions, such as CBT,

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mindfulness-based interventions, pain education, or supportive counseling. It would also be useful to include objective or clinician-rated indicators of functioning, medication use, disability, and quality of life. Mediation analyses could test whether increases in psychological flexibility explain reductions in catastrophizing and increases in self-efficacy. Future studies should also examine whether baseline characteristics, such as pain duration, pain diagnosis, depression, anxiety, and initial flexibility, moderate ACT response. In culturally diverse samples, qualitative interviews may help clarify how participants understand acceptance, values, and committed action in relation to pain.

Overall, the findings support the usefulness of ACT as a psychological intervention for chronic pain. The intervention was associated with meaningful and sustained improvement in pain catastrophizing, pain self-efficacy, and psychological flexibility. These results are clinically relevant because ACT targets processes that are central to long-term pain adjustment rather than focusing only on symptom elimination. By helping individuals relate differently to pain and re-engage with valued life activities, ACT may improve functioning and psychological adaptation in people living with chronic pain.

5. Conclusion

This quasi-experimental study found that eight sessions of online ACT were associated with significant improvements in psychological outcomes among individuals with chronic pain. The ACT group showed decreased pain catastrophizing, increased pain self-efficacy, and increased psychological flexibility, and these effects were maintained at the two-month follow-up. The findings suggest that ACT may be a useful and accessible intervention for chronic pain populations, particularly when treatment goals emphasize functioning, acceptance, and values-based living. Because of the small sample and passive control condition, the findings should be interpreted as promising rather than definitive. Stronger randomized trials are needed to confirm efficacy and clarify mechanisms of change.

Authors' Contributions

Fatemeh Moqbeli contributed to conceptualization, study design, and manuscript drafting. Fateme Mohebi Rezaei contributed to literature review, intervention planning, and methodological refinement. Elnaz Seyyedbaglou contributed to data organization and interpretation of psychological flexibility outcomes. Parisa Fatahi contributed to clinical interpretation, discussion writing, and revision of the manuscript. Javad Adeldoust contributed to participant coordination, intervention documentation, and review of the methods section. Mohammad Amin Roustaei Hossein Abadi contributed to supervision, final editing, correspondence, and approval of the final manuscript. All authors reviewed and approved the final version of the article.

Declaration

Artificial intelligence tools were used only to support English-language editing, academic structuring, and formatting. The study design, data collection, statistical results, interpretation, and final scientific responsibility remain with the authors. No participant data were generated, fabricated, or altered by artificial intelligence.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study was conducted in accordance with ethical principles for research involving human participants. Participants received information about the purpose of the study, the voluntary nature of participation, confidentiality of responses, and their right to withdraw at any stage without penalty. Informed consent was obtained before participation. Because the intervention was delivered online, attention was given to privacy, respectful communication, and responsible handling of questionnaire data. The control group was offered access to the ACT intervention after the completion of the study period. If an institutional ethics approval code is available, it should be inserted in this section before submission.

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