



# The Effectiveness of Cognitive-Behavioral Therapy on Pain Intensity, Childhood Trauma, Perfectionism, and Psychological Flexibility in Patients with Chronic Pain

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## ABSTRACT

Chronic pain can significantly impact an individual's health status and quality of life, leading to a decrease in health-related quality of life. This study aimed to determine the effectiveness of cognitive-behavioral therapy (CBT) on pain intensity, childhood trauma, perfectionism, and psychological flexibility in patients with chronic pain. This applied and quasi-experimental study employed a pre-test, post-test, and follow-up design with a control group. The statistical population included all chronic pain patients attending pain clinics in Tehran, totaling 198 individuals. From this population, 50 patients were selected through purposive sampling based on inclusion and exclusion criteria and randomly assigned to either the CBT group (25 individuals) or the control group (25 individuals). Data were collected using the West Haven-Yale Multidimensional Pain Inventory (Kerns et al., 1985), the Childhood Trauma Questionnaire (Bernstein et al., 2003), the Multidimensional Perfectionism Scale (Frost et al., 1990), and the Acceptance and Action Questionnaire (Bond et al., 2011). CBT for chronic pain was conducted in seven 60-minute group sessions over two months, based on the treatment package (Kelly Lamb, 2018). Data were analyzed using repeated measures ANOVA with SPSS.22 software. The results indicated that CBT was effective on pain intensity ( $P<0.001$ ), childhood trauma ( $P<0.001$ ), perfectionism ( $P<0.001$ ), and psychological flexibility ( $P<0.001$ ) in patients with chronic pain. It can be concluded that CBT is effective on pain intensity, childhood trauma, perfectionism, and psychological flexibility in patients with chronic pain. This therapy can be used to reduce the psychological problems of individuals suffering from chronic pain.

**Keywords:** Cognitive-behavioral therapy, pain intensity, childhood trauma, perfectionism, psychological flexibility, chronic pain.

## 1. Introduction

Pain is one of the most common problems that prompt people to seek medical care. The International Association for the Study of Pain defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" (1). Pain is categorized into acute and chronic types based on duration. Acute pain is briefly described as pain with a rapid onset and short duration, serving a protective role by alerting a person to harm and prompting avoidance movements from harmful stimuli (2). Chronic pain syndrome is a common problem due to its complex nature, unclear etiology, and poor response to treatment, posing significant challenges for therapists (3).

Research findings support the need to acknowledge the impact of psychological variables on chronic pain from perspectives such as the psychological flexibility model (4). Our results indicate that reducing pain intensity alone is not always sufficient to ensure successful activity levels in chronic pain patients; thus, reducing maladaptive perfectionism is essential due to its direct relationship with activity avoidance, regardless of contextual variables considered (5, 6). Psychological flexibility is the ability to be open, aware, focused on the present moment, and persistent in behavior aligned with values and goals, or to change behaviors that are inconsistent with values and goals. The psychological flexibility structure is acceptance-based, offering an alternative to avoidance, which only increases physical disability and psychological distress (7).

Perfectionism in adolescents with chronic pain and their parents is indirectly related to pain-related fear and catastrophizing, which affects pain-related dysfunction. Findings support clinical observations that parent and adolescent perfectionism is a psychological factor that should be considered in the treatment of chronic pain in children. Studies show multiple associations between perfectionism, pain, and other physical health consequences in adulthood. This research highlights the role of perfectionism in pain, pain-related distress, and pain-related dysfunction (8). The psychological domain is one aspect of the biopsychosocial model, and the link between psychological factors/personality traits and mental health is confirmed. Since perfectionism is associated with greater psychological distress, perfectionist children with chronic

pain are more vulnerable to the negative consequences of pain. Factors such as rumination, catastrophizing, and avoidant coping styles are common among perfectionists. Perfectionism and its cognitive/behavioral correlates may be transdiagnostic processes or underlying factors that accelerate, maintain, and exacerbate the chronic pain experience in children (9, 10).

For individuals with more complex problems, individual work with a psychologist may be necessary to benefit from pain management programs. This includes patients with trauma histories, particularly post-traumatic stress disorder, where flashbacks and intrusive thoughts interfere with their ability to maintain present-focused attention. Recommended interventions for trauma include trauma-focused CBT and eye movement desensitization and reprocessing (EMDR). There is a growing understanding that trauma not only results from significant current life-threatening events but also past events such as childhood abuse and bullying can lead to similar traumatic manifestations. Identifying the presence of psychological trauma or other complex psychological manifestations is crucial for referring patients for assessment and intervention by a psychologist (11).

Chronic pain is associated with disability, mental health issues, and decreased quality of life, and it incurs substantial economic costs. Meta-analysis of randomized controlled trials supports the effectiveness of CBT-based pain management treatments. Evidence for contextual forms of CBT for chronic pain, such as acceptance and commitment therapy and mindfulness-based approaches, is also growing (12). Therefore, it is essential to consider variables that can play a protective role against stress; the lack of sufficient scientific resources on protective variables against stress in chronic pain patients is a gap this study addresses. The results of such a study will serve as a preliminary basis for further investigations and the design of appropriate interventions to improve the psychological problems of chronic pain patients. Thus, this study aimed to determine the effectiveness of CBT on pain intensity, childhood trauma, perfectionism, and psychological flexibility in patients with chronic pain.

## 2. Methods and Materials

## 2.1. Study Design and Participants

This applied and quasi-experimental study employed a pre-test, post-test, and follow-up design with a control group. The statistical population included all chronic pain patients attending pain clinics in Tehran, totaling 198 individuals. From this population, 50 patients were selected through purposive sampling based on inclusion and exclusion criteria and randomly assigned to either the CBT group (25 individuals) or the control group (25 individuals). The minimum sample size in quantitative and qualitative research designs (Collins & Onwuegbuzie, 2007, as cited in Delavar & Koushki, 2013) is considered to be 21 participants, with an additional 20% added for potential sample attrition, resulting in 25 participants per group, comprising two experimental groups and one control group. Inclusion criteria included Persian-speaking individuals aged over 18 and under 65 years with chronic low back pain, headaches, neck pain, cancer-related pain, muscular pains such as fibromyalgia, joint pains such as rheumatism, neuropathic pains such as sciatica, and diabetic neuropathy, with pain persisting for more than three months and a West Haven-Yale Multidimensional Pain Inventory score above 60. Exclusion criteria included participants' unwillingness to continue cooperation at any stage of the study, any acute or chronic illness that, according to the researcher, limits the patient's ability to participate in the study, and absences from more than two treatment sessions.

For this study, chronic pain clinics in Tehran were visited, and patients with chronic pain meeting the inclusion criteria were interviewed. After explaining the research objectives, relevant questionnaires, including the Chronic Pain Questionnaire, Childhood Trauma Questionnaire, Perfectionism Questionnaire, and Psychological Flexibility Questionnaire, were distributed. Patients with a chronic pain intensity score above 60 were included in the study. Following the review of the responses, online interviews were conducted with patients scoring above 60 on pain intensity. A total of 50 eligible patients were randomly assigned to the experimental and control groups, each consisting of 25 participants. The experimental group underwent seven weekly 60-minute online CBT sessions, while the control group only completed the questionnaires. Post-test questionnaires were filled out by both groups one week after the last treatment session, and follow-up

questionnaires were completed two months after treatment. Before implementation, the study's goals and conditions were explained to chronic pain patients, including informing them about the study's purpose and procedures and obtaining written consent. Participants were assured of the confidentiality of their personal information and informed that they would receive interpretations of the results if desired.

## 2.2. Measures

### 2.2.1. Pain Intensity

The West Haven-Yale Multidimensional Pain Questionnaire, developed by Kerns et al. in 1985, consists of 52 items and 12 components divided into three sections. It is administered using a Likert scale with 7 response options. Section 1 includes five components designed to assess critical dimensions of the chronic pain experience, including pain intensity. Section 2 evaluates the patient's perception of the extent to which their spouse or other significant individuals are concerned, distressed, or respond punitively to their pain behaviors and complaints. Section 3 assesses the patient's report of the frequency of involvement in four categories of daily activities. The reliability of this questionnaire, as shown by Asghari Moghadam and Golak (2004), indicated Cronbach's alpha coefficients for the subscales ranging from 0.77 to 0.92, with mean item-to-total correlations for each component ranging from 0.25 to 0.4. Thus, it can be concluded that all components of the WHYMPI have desirable reliability. The divergent validity of all components of the questionnaire was confirmed by comparing the correlation coefficients between each component and its constituent items with the correlation coefficients between the same component and other items of the questionnaire. Additionally, the divergent validity of all components was confirmed through comparisons of internal consistency coefficients (Cronbach's alpha) with inter-component correlations. Joulaiha et al. (2006) reported Cronbach's alpha coefficients for the functional interference and pain intensity subscales to be 0.92 and 0.8, respectively. This test was standardized among pain patients by Mirzamani, Safari, Halizadeh, and Sadidi. The reliability of the first section of the questionnaire with Cronbach's alpha was 0.86, for the second section 0.78, and for the third

section 0.75. Additionally, the test-retest reliability coefficient for this test was 0.95 (13).

### 2.2.2. *Childhood Trauma*

Developed by Bernstein, Stein, Newcomb, Walker, Pogge et al. (2003) to assess childhood trauma and maltreatment experiences. This questionnaire is a screening tool for identifying individuals with childhood abuse and neglect experiences. It can be used for both adults and adolescents and measures five types of childhood maltreatment: sexual abuse, physical abuse, emotional abuse, emotional neglect, and physical neglect. The questionnaire contains 28 questions, with 25 questions assessing the main components and 3 questions for identifying individuals who deny their childhood problems. In Bernstein et al. (2003) study, the Cronbach's alpha coefficients for the emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect dimensions were 0.87, 0.86, 0.95, 0.89, and 0.78, respectively. Concurrent validity with therapists' ratings of childhood traumas ranged from 0.59 to 0.78. In Iran, Ebrahimi, Dehkam, and Tagha Aslami (2013) reported Cronbach's alpha coefficients for the five components ranging from 0.81 to 0.98 (14).

### 2.2.3. *Perfectionism*

The Frost Multidimensional Perfectionism Scale (Frost et al., 1990) was designed to assess various dimensions of perfectionism. This 35-item questionnaire is rated on a 5-point Likert scale (1 to 5). It has six subscales: Concern over Mistakes, Personal Standards, Parental Expectations, Parental Criticism, Doubts about Actions, and Organization. The overall perfectionism score is obtained from the total of six subscales, except for Organization. Higher scores indicate higher levels of perfectionism in the respective domain. Frost et al. (1993) reported internal consistency coefficients for the subscales ranging from 0.73 to 0.93, with an overall internal consistency of 0.90. Researchers such as Hashemi and Latifian (2008) have reported satisfactory validity and reliability for the Iranian norms of this scale (Mohammadi & Jokar, 2010). The internal consistency coefficients for the entire scale and subscales were calculated as 0.83, and for the subscales 0.62, 0.82, 0.79, 0.67, and 0.71, respectively. Cronbach's alpha coefficient

was 0.65. Factor analysis was used to establish the validity of the test, with a KMO value of 0.67. The Chi-square value in Bartlett's test of sphericity was 290.021, significant at the 0.001 level. Convergent and divergent validity of the Frost Multidimensional Perfectionism Scale was demonstrated by significant positive correlations with the Brenner Perfectionism Scale (1980) and Jones' Irrational Beliefs Test (1968). The psychometric properties of the Frost Perfectionism Questionnaire showed that the Lisrel software outputs indicated acceptable fit and standardization of the questionnaire. The reliability of the Frost Multidimensional Perfectionism Scale using internal consistency methods was shown to have a Cronbach's alpha of 0.84 for the total score, consistent with other studies in this area (9).

### 2.2.4. *Psychological Flexibility*

The Acceptance and Action Questionnaire-II (AAQ-II) was developed by Bond et al. (2011). This 7-item questionnaire was prepared by Imani (2016). The original questionnaire was translated from English to Persian using the standard forward-backward translation method by two independent translators. Then, it was re-translated to English by two other translators. Finally, a coordinator combined the Persian and English translations to prepare the 7-item AAQ-II. In a preliminary study, 70 students from Tehran University of Medical Sciences participated to ensure they understood the items as intended by the questionnaire developer and had a consistent interpretation. Based on the preliminary study results, minor changes were made to the AAQ-II items, and its face validity was confirmed (9).

## 2.3. *Intervention*

### 2.3.1. *Cognitive Behavioral Therapy*

Cognitive-behavioral therapy (CBT) for chronic pain was conducted in seven 60-minute group sessions over two months based on the treatment package (15, 16).

#### Session 1: Introduction and Psychoeducation

In the first session, participants are introduced to the basics of cognitive-behavioral therapy (CBT) and its relevance to chronic pain management. The therapist explains the connection between thoughts, emotions, and behaviors, emphasizing how negative thought patterns can exacerbate pain. Participants receive an overview of the



treatment structure, including goals and expected outcomes. They are encouraged to share their pain experiences and set personal goals for the therapy. Psychoeducation about the nature of chronic pain, its psychological impact, and the importance of psychological flexibility is provided to help participants understand the biopsychosocial model of pain.

#### Session 2: Identifying Negative Thoughts

This session focuses on helping participants identify and understand their negative automatic thoughts related to pain and trauma. The therapist introduces cognitive restructuring techniques to challenge and modify these thoughts. Participants learn to recognize cognitive distortions such as catastrophizing and all-or-nothing thinking. Through guided exercises, they practice identifying negative thoughts and recording them in a thought diary. The session aims to increase awareness of how these thoughts influence their pain perception and emotional well-being.

#### Session 3: Thought-Stopping Techniques

Participants are introduced to thought-stopping techniques as a method to interrupt and manage intrusive, negative thoughts. The therapist demonstrates how to use this technique effectively and guides participants through practice exercises. The session also covers the importance of replacing negative thoughts with more balanced and realistic ones. Participants continue to use their thought diaries, now incorporating thought-stopping techniques to reduce rumination and cognitive distortions.

#### Session 4: Emotional Regulation and Relaxation Techniques

This session teaches participants strategies for emotional regulation, including relaxation techniques such as deep breathing, progressive muscle relaxation, and mindfulness. The therapist explains how stress and negative emotions can increase pain perception and demonstrates how relaxation can help mitigate these effects. Participants practice these techniques during the session and are encouraged to incorporate them into their daily routines. The goal is to equip participants with tools to manage their emotional responses to pain more effectively.

#### Session 5: Addressing Childhood Trauma

The focus of this session is on addressing and processing childhood trauma. Participants are guided through cognitive-behavioral techniques to confront and reframe traumatic memories. The therapist uses techniques such as exposure

therapy and cognitive processing therapy to help participants reduce the emotional impact of these memories. This session emphasizes the development of coping strategies to manage trauma-related distress and improve psychological flexibility.

#### Session 6: Challenging Perfectionism

In this session, participants explore the concept of perfectionism and its impact on their lives and pain management. The therapist helps participants identify perfectionistic thoughts and behaviors and understand how these contribute to stress and pain. Through cognitive restructuring exercises, participants learn to set realistic goals and develop self-compassion. The session also includes strategies for balancing high standards with self-acceptance and reducing self-critical thoughts.

#### Session 7: Enhancing Psychological Flexibility

The final session focuses on enhancing psychological flexibility, a key component of managing chronic pain. Participants review the skills and techniques learned throughout the therapy and discuss how to apply them in various life situations. The therapist introduces acceptance and commitment therapy (ACT) principles, emphasizing values-based living and committed action. Participants practice mindfulness exercises and learn to stay present despite pain and discomfort. The session concludes with a discussion on maintaining progress and preventing relapse, encouraging participants to continue using the skills they have acquired.

### 2.4. Data Analysis

Data were analyzed using MANOVA and repeated measures ANOVA. Assumptions for inferential tests were checked using Levene's test (for homogeneity of variances), Shapiro-Wilk test (for normality), regression homogeneity test, MBox test, and Mauchly's test of sphericity. Statistical analyses were performed using SPSS.22 software.

## 3. Findings and Results

The mean age (standard deviation) of participants in the cognitive-behavioral therapy (CBT) group was 40.11 (7.68), and in the control group, it was 38.52 (7.11). There was no significant difference in mean age between the groups.

**Table 1**

*Central Tendency and Dispersion Indices of Research Variables in Experimental and Control Groups*

Variable	Group	Pre-test Mean (SD)	Post-test Mean (SD)	Follow-up Mean (SD)
Pain Intensity	CBT	64.81 (13.53)	60.66 (11.67)	61.40 (12.57)
	Control	64.26 (13.23)	64.93 (13.93)	64.77 (13.02)
Childhood Trauma	CBT	58.59 (19.15)	53.11 (17.12)	52.80 (17.02)
	Control	58.60 (18.59)	58.53 (18.70)	58.46 (18.77)
Perfectionism	CBT	116.85 (20.69)	111.60 (18.18)	112.06 (18.38)
	Control	118.73 (21.27)	118.20 (21.26)	118.80 (21.20)
Psychological Flexibility	CBT	26.96 (8.29)	31.80 (4.31)	31.13 (4.42)
	Control	26.60 (9.13)	27.26 (9.40)	27.46 (8.96)

The results in [Table 1](#) show that the mean scores for pain intensity, childhood trauma, and perfectionism in the CBT group decreased in the post-test and follow-up stages compared to the pre-test, while psychological flexibility increased. To examine the significance of differences in pain intensity, childhood trauma, perfectionism, and psychological flexibility between the CBT and control groups, multivariate analysis of covariance (MANCOVA) was used. Prior to conducting the MANCOVA, the

assumptions were checked using Box's M and Levene's tests. Since Box's M test was not significant for any research variables (Box's M = 23.12, df = 20,  $p > 0.05$ ), the assumption of homogeneity of covariance matrices was met. Additionally, the non-significance of Levene's test for all variables indicated that the assumption of equal variances was met, with equal error variances for the dependent variable across all groups. The results of the MANCOVA are presented in [Table 2](#).

**Table 2**

*Results of Multivariate Analysis of Variance (MANOVA)*

Effect	Test Name	Value	F	Hypothesis df	Error df	Sig.	Eta <sup>2</sup>
Time	Pillai's Trace	0.85	76.80	2	27	0.001	0.85
	Wilks' Lambda	0.15	76.80	2	27	0.001	0.85
	Hotelling's Trace	5.68	76.80	2	27	0.001	0.85
	Roy's Largest Root	5.68	76.80	2	27	0.001	0.85
Time*Group	Pillai's Trace	0.79	53.23	2	27	0.001	0.79
	Wilks' Lambda	0.20	53.23	2	27	0.001	0.79
	Hotelling's Trace	3.94	53.23	2	27	0.001	0.79
	Roy's Largest Root	3.94	53.23	2	27	0.001	0.79

As shown in [Table 2](#), all test levels are significant at the 0.001 level, indicating significant differences between the CBT and control groups in terms of the effectiveness of cognitive-behavioral therapy on improving pain intensity. Wilks' Lambda test, with a value of 0.09 and F = 132.67, indicates a significant difference in the effectiveness of CBT

on improving pain intensity between the two groups at the 0.0001 significance level. The results of repeated measures ANOVA for comparing pre-test, post-test, and follow-up scores of pain intensity in the experimental and control groups are presented in [Table 3](#).

**Table 3**

*Repeated Measures ANOVA for Comparing Pre-test, Post-test, and Follow-up Scores of Research Variables in Experimental and Control Groups*

Scale	Source of Effect	Sum of Squares	df	Mean Square	F	Sig.	Eta <sup>2</sup>
Pain Intensity	Time	25.62	2	12.81	70.48	0.001	0.71
	Time*Group	12.86	2	6.43	35.39	0.001	0.55

Childhood Trauma	Group	114.40	1	114.40	44.08	0.001	0.45
	Time	170.60	1.45	117.57	175.61	0.001	0.86
	Time*Group	116.86	1.45	80.54	120.30	0.001	0.81
Perfectionism	Group	211.60	1	211.60	35.53	0.001	0.40
	Time	87.62	2	43.81	164.78	0.001	0.85
	Time*Group	37.48	2	18.74	70.50	0.001	0.71
Psychological Flexibility	Group	113.61	1	113.61	43.25	0.001	0.46
	Time	230.46	1.43	160.14	79.16	0.001	0.73
	Time*Group	150.02	1.43	104.24	51.53	0.001	0.64
	Group	118.17	1	118.17	38.86	0.001	0.39

The results in Table 3 indicate that the repeated measures ANOVA for within-group (time) and between-group effects is significant. This means that the effects of time and group are significant, and the interaction between group and time

is also significant. For pairwise comparisons, Bonferroni post-hoc tests were used, and the results are presented in Table 4.

**Table 4**

*Results of Bonferroni Post-Hoc Tests for Comparing Research Variables*

Variable	Group	Stages	Post-test	Follow-up
Pain Intensity	Experimental	Pre-test	4.15*	3.41*
		Post-test	-	-0.74
Childhood Trauma	Experimental	Pre-test	5.48*	5.79*
		Post-test	-	0.31
Perfectionism	Experimental	Pre-test	5.25*	4.79*
		Post-test	-	-0.46
Psychological Flexibility	Experimental	Pre-test	-4.84*	-4.17*
		Post-test	-	0.67

\*p<0.01

The results in Table 4 show that the pain intensity scores in the experimental group during the post-test phase were lower than those in the control group, indicating that the CBT group had a higher effectiveness in improving pain intensity. Additionally, the results indicate a significant decrease in pain intensity during the follow-up phase in the CBT group compared to the control group. The childhood trauma scores in the experimental group during the post-test phase were lower than those in the control group, indicating that the CBT group had a higher effectiveness in improving childhood trauma. The results also indicate a significant decrease in childhood trauma during the follow-up phase in the CBT group compared to the control group. The perfectionism scores in the experimental group during the post-test phase were lower than those in the control group, indicating that the CBT group had a higher effectiveness in improving perfectionism. However, these results indicate that perfectionism did not significantly decrease during the follow-up phase in the CBT group compared to the control group. The psychological flexibility scores in the

experimental group during the post-test phase were higher than those in the control group, indicating that the CBT group had a higher effectiveness in improving psychological flexibility. However, these results indicate that psychological flexibility did not significantly increase during the follow-up phase in the CBT group compared to the control group.

#### 4. Discussion and Conclusion

This study aimed to determine the effectiveness of cognitive-behavioral therapy (CBT) on pain intensity, childhood trauma, perfectionism, and psychological flexibility in patients with chronic pain. The results indicated that CBT had a significant impact on childhood trauma in patients with chronic pain. These findings are consistent with the prior studies (5, 17).

In explaining this finding, it can be stated that childhood trauma affects emotional and social development during adolescence and adulthood. This includes the development

of negative cognitions about oneself and others, which can facilitate the formation of conditioned relationships between trauma-related stimuli and emotional distress, as well as underdeveloped emotional regulation. According to this model, when an individual can control their negative thoughts following traumatic events, the foundation for post-traumatic growth is established. Gonzalez-Robles et al. (2022) suggest that cognitive processing influences post-traumatic growth. Therefore, during several CBT sessions, children's negative thoughts were modified, and various techniques such as thought-stopping, identifying relationships between thoughts and feelings, and daily thought recording were taught to reduce rumination (18). Coping strategies like thought-stopping, which are used to counter cognitive distortions and worrying thoughts, prepare the individual for better cognitive processing. These techniques were emphasized in the educational sessions as they help children learn that they can be aware of and control their thoughts. This method diverts the attention of abused children from crisis-provoking thoughts to non-crisis ones (16).

The results also showed that CBT affected the perfectionism of patients with chronic pain. These findings align with the prior studies (19-21).

This finding can be explained by the fact that CBT interventions can reduce maladaptive attitudes, thereby improving perfectionism in individuals with pain disorders. Perfectionism is not considered a stable personality style but a psychological condition maintained by specific cognitions and behaviors (21). Since cognitive distortions and maladaptive attitudes contribute to the development and maintenance of perfectionism, such interventions improve the individual's symptoms. CBT interventions create conditions for exposure and response prevention in perfectionists, reducing fear of mistakes, anxiety, and depression symptoms, improving adaptability, challenging automatic dysfunctional perfectionistic thoughts, evaluating the validity of extreme and unrealistic thoughts, assessing the benefits and drawbacks of perfectionistic thoughts and underlying beliefs (20), generating a deep sense of satisfaction with performance, encouraging realistic goal-setting, increasing flexibility towards personal and external standards, and evaluating the individual's motivation for pursuing personal, academic, or professional goals (15).

These interventions combat absolutism in thoughts and reduce symptoms of perfectionism and guilt. CBT reduces cognitive distortions, particularly all-or-nothing thinking, overgeneralization, and mind-reading, which are crucial in creating guilt and extreme perfectionism.

The results indicated that CBT significantly impacted psychological flexibility in patients with chronic pain. These findings are consistent with the prior studies (6, 11).

This finding can be explained by the cognitive flexibility theory, which focuses on learning in complex and ill-structured domains. According to this theory, a successful learner (i.e., cognitively flexible) can easily reorganize and apply knowledge in response to diverse situational demands. Learners must understand the full complexity of issues and repeatedly explore the problem space to see how changes in variables and goals can alter the situation (11). How individuals achieve this depends on the method of knowledge representation (e.g., multiple conceptual dimensions rather than a single dimension) and the processes operating based on these representations (e.g., schema construction instead of complete schema retrieval). This theory relates largely to the transfer of knowledge and skills beyond initial learning situations, emphasizing presenting information from multiple perspectives and using numerous case studies (6). Efficient learning, according to this theory, is context-dependent and requires very specific instruction; additionally, cognitive flexibility theory highlights the importance of structured knowledge, providing learners with opportunities to develop their representations of information.

The main limitation of this study was the use of non-random sampling. Using a self-reporting questionnaire could introduce response bias. Other limitations include the temporal and spatial constraints, as this study was conducted on patients attending pain clinics in Tehran, which should be considered when generalizing the results. The semi-experimental design does not have the advantages of true experimental designs. Other events such as disease progression and economic issues occurring simultaneously with the independent variable were not controlled, and the lack of matching for intelligence and psychological maturity among participants could affect external validity. Future studies should use random sampling methods for better generalization of results.



## Authors' Contributions

P.A. conceptualized the study, designed the research methodology, and supervised the overall implementation of the study. S.K., the corresponding author, conducted the data analysis using repeated measures ANOVA, interpreted the results, and led the drafting and revising of the manuscript. H.T. assisted in the recruitment of participants, facilitated the CBT group sessions, and contributed to the data collection process. All authors participated in discussing the findings, critically reviewed the manuscript for important intellectual content, and approved the final version for publication.

## Declaration

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

## 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 placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki. Ethical approval was obtained from the

Research Ethics Committee (Approval date: 2023-01-25, Code: IR.IAU.CTB.REC.1401.143).

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