

# The Effectiveness of Cognitive-Behavioral Interventions in Psychoeducational Groups on Distress Tolerance and Pain Intensity in Individuals with Musculoskeletal Pain

## ARTICLE INFO

Article Type  
Original Article

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### How to cite this article

Bolourani A, Jarareh J, Ghodrati S. The Effectiveness of Cognitive - Behavioral Interventions in Psychoeducational Groups on Distress Tolerance and Pain Intensity in Individuals with Musculoskeletal Pain. *Int J Musculoskelet Pain. Prev.* 2026;11(1): 1373-1380.

## ABSTRACT

**Aims:** Chronic pain is a global challenge and one of the most common reasons for seeking medical care, affecting a significant portion of the population. This study aimed to investigate the effectiveness of cognitive-behavioral interventions within psychoeducational groups on distress tolerance and pain intensity in individuals with musculoskeletal pain.

**Method and Materials:** This quasi-experimental study employed a pretest-posttest design with a control group. The statistical population consisted of all individuals with chronic musculoskeletal pain referred to the Al-Zahra Charity Clinic between March and June 2024. Using purposive sampling, 30 individuals were selected and randomly assigned to either an experimental group (n=15) or a control group (n=15). The experimental group received nine sessions of virtual group cognitive-behavioral intervention, while the control group received no intervention. Research instruments included the Distress Tolerance Scale (DTS) and the Visual Analogue Scale (VAS) for pain. Data were analyzed using SPSS software version 23 and Multivariate Analysis of Covariance (MANCOVA).

**Findings:** The findings indicated that cognitive-behavioral interventions led to a significant increase in distress tolerance and a significant decrease in pain intensity in the experimental group compared to the control group ( $p < .05$ ). Furthermore, the intervention's effect on distress tolerance was more substantial than its effect on reducing pain intensity.

**Conclusion:** Based on the results, group-based cognitive-behavioral interventions can be used as an effective non-pharmacological method to improve distress tolerance and reduce pain intensity in patients with musculoskeletal pain. These findings highlight the importance of integrating psychological treatments into comprehensive pain management programs.

**Keywords:** Cognitive-Behavioral Therapy, Distress Tolerance, Pain Intensity, Musculoskeletal Pain, Group Psychoeducation

## Introduction

Chronic pain is a global challenge and one of the most common reasons for seeking medical care, affecting a significant portion of the population [1]. Among various types of pain, chronic musculoskeletal pain is considered one of the most prevalent health problems, imposing substantial economic and social costs on healthcare systems and individuals [2]. These pains not only cause physical disability but also have profound negative impacts on mental health and quality of life [3,4].

Unlike acute pain, which is an adaptive response to injury, chronic pain—typically defined as pain lasting more than three months—is itself considered a complex disease [5].

The pain experience is not limited to physical sensation but is influenced by the interaction of biological, psychological, and social factors [6]. Accordingly, the International Association for the Study of Pain (IASP) has defined pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" [7]. This definition emphasizes the role of emotional states and cognitive processes in modulating the intensity, duration, and overall experience of pain.

One key psychological construct that plays a crucial role in the experience and management of pain is distress tolerance. Distress tolerance refers to an individual's capacity to experience

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### Article History

Received: Sep 15, 2025  
Accepted: Jan 7, 2026  
ePublished: Jan 28, 2026

endure negative emotional states without engaging in avoidant or maladaptive behaviors [8]. Research shows that low levels of distress tolerance are associated with pain catastrophizing, increased pain-related disability, and poorer treatment outcomes [9,10]. In contrast, individuals with higher distress tolerance are better able to manage their pain and employ more adaptive coping mechanisms [11].

To address these multidimensional challenges, treatment approaches must extend beyond purely biomedical interventions to include psychological factors. Cognitive Behavioral Therapy (CBT) is among the most practical and evidence-based psychological approaches for managing chronic pain [12]. This therapy aims to change maladaptive thought patterns (e.g., catastrophizing), correct mistaken beliefs about pain, and teach behavioral and coping skills (e.g., relaxation, problem-solving) [13]. CBT helps patients better understand the interaction between their thoughts, feelings, and physical sensations and take a more active role in managing their lives despite pain.

Although international evidence supports the efficacy of CBT in pain management [14,15], conducting indigenous research considering the cultural and social characteristics of Iranian society is necessary. Furthermore, despite the documented relationship between distress tolerance and pain experience, limited research has directly investigated the effect of CBT interventions on improving this construct in patients with musculoskeletal pain.

Therefore, the primary research question is: Can a group cognitive-behavioral intervention significantly increase distress tolerance and reduce pain intensity in individuals with chronic musculoskeletal pain? This study seeks to address this research gap and provide evidence for enhancing comprehensive treatment programs for these patients.

## Method and Materials

This quasi-experimental study employed a pretest-posttest design with a control group. The statistical population consisted of all individuals with chronic musculoskeletal pain

referred to the Al-Zahra Charity Clinic in Tehran, Iran, during the first three months of the Persian year 1403 (March 21 to June 21, 2024). Using purposive sampling, 30 eligible patients who provided full informed consent were selected as the study sample.

Inclusion criteria were as willingness to participate and provision of oral informed consent, absence of serious acute physical illnesses, no definitive diagnosis of major psychiatric disorders (e.g., psychosis, severe major depression) based on medical records and an initial clinical interview and access to the internet and a smart device (mobile, tablet, or computer) for attending online sessions. Exclusion criteria were as withdrawal from continued cooperation at any stage, absence from more than two intervention sessions and development of any condition during the study that precluded continued participation.

Selected participants were matched based on key variables (age, gender, and pretest scores) and then randomly assigned (using a lottery method) to either the intervention group (n=15) or a waitlist control group (n=15). The intervention group received a group Cognitive Behavioral Therapy (CBT) program delivered online via the Shaad platform. The protocol consisted of nine 60-minute sessions developed based on established cognitive-behavioral principles and adapted from Wildermuth's (2008) [16] treatment manual. The sessions were facilitated by the researcher, who held a certificate from a 100-hour CBT workshop. The content of the sessions is summarized in Table 1.

## Measurement scales were as follows

Distress Tolerance Scale (DTS): This 15-item self-report scale, developed by Simons & Gaher (2005) [17], measures the perceived ability to endure negative emotional states. It uses a 5-point Likert scale (1=Strongly Agree to 5=Strongly Disagree) and comprises four subscales: Tolerance, Absorption, Appraisal, and Regulation. Higher scores indicate higher distress tolerance. Cronbach's alpha for the total scale in this study was 0.812 at pretest and 0.841 at posttest.

Visual Analog Scale (VAS): This standard tool measures pain intensity. Participants marked their pain level on a 10-cm line anchored by "No pain" (0) and "Worst pain imaginable" (10). The score was determined by measuring the distance from zero. Its validity and reliability are well-established [18]. Cronbach's alpha in this study was 0.881 at pretest and 0.832 at posttest.

After obtaining necessary approvals and coordinating with the clinic, potential participants were screened against the inclusion/exclusion criteria. Eligible individuals provided oral informed consent. All 30 participants then completed the pretest (DTS and VAS). They were subsequently matched and randomly assigned to groups. The intervention group received the 9-session

online CBT program, while the control group received no intervention. Immediately after the intervention, both groups completed the posttest using the same questionnaires. Data were analyzed using SPSS software version 23. Descriptive statistics (mean and standard deviation) were reported for the sample. The Shapiro-Wilk test confirmed that the data were normally distributed. The assumption of homogeneity of variances was checked using Levene's test, and the homogeneity of regression slopes was confirmed. To test the hypotheses, Multivariate Analysis of Covariance (MANCOVA) and Analysis of Covariance (ANCOVA) were used, with pretest scores as the covariate. The significance level was set at  $p < 0.05$ .

**Table 1-** Summary of Group CBT Intervention Sessions

Session	Title	Main Objectives	Interventions & Techniques	Homework
1	Introduction & Orientation	Establish rapport and trust; Set group rules; Introduce CBT and the cognitive model; Teach relaxation techniques.	Self-introductions; Explain confidentiality and rules; Psychoeducation on CBT; Teach diaphragmatic breathing.	Daily practice of relaxation techniques.
2	Thoughts, Feelings, Behaviors	Understand the cognitive model (thought-feeling-behavior link); Identify Negative Automatic Thoughts (NATs); Introduce cognitive distortions.	Explain the cognitive model; Introduce common distortions (e.g., catastrophizing, black-and-white thinking); Distribute thought records.	Record situations, automatic thoughts, and associated emotions.
3	Cognitive Restructuring	Learn the process of cognitive restructuring; Challenge and change negative thoughts.	Teach the four steps of restructuring (Identify, Evaluate, Change, Assess effects); Practical exercise with thought records.	Complete thought records for several identified negative thoughts.
4	Behavioral Chains	Understand antecedent-response-consequence sequences; Identify problematic behavioral chains.	Explain behavioral chains and loops; Practical examples; Strategies for breaking chains (e.g., time-out, positive reinforcement).	Analyze a personal problematic behavior using an A-B-C chain.
5	Assertiveness	Learn assertive (vs. passive/aggressive) behavior; Increase ability to say "no" and express needs.	Define assertiveness vs. aggression/passivity; Types of assertive behavior; Practical strategies (e.g., saying no, giving reasons).	Role-play a problematic situation; Record non-assertive behaviors.
6	Impulsivity & Mood Regulation	Learn to manage impulses and self-control; Strategies for improving mood and increasing pleasant activities.	Define impulsivity; Self-control strategies (meditation, sleep, scheduling); Positive cognitive strategies for mood regulation.	Complete a "Pleasant/Unpleasant Activities" worksheet; Practice a self-control technique.
7	Stress Management & Problem Solving	Understand stress and stressors; Learn effective coping strategies (problem-focused & emotion-focused); Advanced relaxation.	Define stress and stressors; Types of coping; Teach Progressive Muscle Relaxation (PMR - Jacobson's technique).	Daily PMR practice; Identify a stressor and choose a coping strategy.

	Self-Esteem	Understand self-esteem and affecting factors; Practical strategies for improving self-esteem.	Define self-esteem; Impact of negative self-evaluations; Strategies (positive self-talk, visualization, goal setting).	Complete a self-image worksheet; Repeat positive self-statements.
9	Relapse Prevention	Review learned skills; Plan for maintaining progress and preventing relapse; Final evaluation.	Review previous sessions; Emphasize continued practice; Help clients create a personal relapse prevention plan.	Create a written personal relapse prevention plan.

The control group received no intervention during this period.

### Findings

The mean age of participants was 45.3 years ( $SD = 7.8$ ). Other demographic characteristics

of the sample are presented in Table 2. The groups were well-matched on these variables.

**Table 2) Demographic Characteristics of the Sample**

Characteristic	Experimental Group (n=15)	Control Group (n=15)
Gender	N (%)	N (%)
▪ Male	8 (53.4%)	7 (46.6%)
▪ Female	7 (46.6%)	8 (53.4%)
Age Group		
▪ 35-40 years	5 (33.3%)	5 (33.3%)
▪ 40-45 years	4 (26.7%)	3 (20.0%)
▪ 45-50 years	2 (13.3%)	4 (26.7%)
▪ 50-55 years	4 (26.7%)	3 (20.0%)
Education Level		
▪ High School Diploma	3 (20.0%)	3 (20.0%)
▪ Associate's Degree	2 (13.3%)	4 (26.7%)
▪ Bachelor's Degree	4 (26.7%)	6 (40.0%)
▪ Master's Degree	6 (40.0%)	2 (13.3%)
Marital Status		
▪ Single	6 (40.0%)	6 (40.0%)
▪ Married	9 (60.0%)	9 (60.0%)
Characteristic	Experimental Group (n=15)	Control Group (n=15)
Gender	N (%)	N (%)
▪ Male	8 (53.4%)	7 (46.6%)
▪ Female	7 (46.6%)	8 (53.4%)
Age Group		
▪ 35-40 years	5 (33.3%)	5 (33.3%)
▪ 40-45 years	4 (26.7%)	3 (20.0%)
▪ 45-50 years	2 (13.3%)	4 (26.7%)
▪ 50-55 years	4 (26.7%)	3 (20.0%)
Education Level		
▪ High School Diploma	3 (20.0%)	3 (20.0%)
▪ Associate's Degree	2 (13.3%)	4 (26.7%)
▪ Bachelor's Degree	4 (26.7%)	6 (40.0%)
▪ Master's Degree	6 (40.0%)	2 (13.3%)
Marital Status		
▪ Single	6 (40.0%)	6 (40.0%)
▪ Married	9 (60.0%)	9 (60.0%)

Descriptive statistics for the research variables are presented in Table 3. As shown, mean distress tolerance scores increased from pretest to posttest in the experimental group

but remained relatively stable in the control group. Mean pain intensity scores decreased in the experimental group but showed little change in the control group.

**Table 3)** Descriptive Statistics for Research Variables (Mean  $\pm$  SD)

Variable	Group	Pre-test M $\pm$ SD	Post-test M $\pm$ SD
Total Distress Tolerance	Experimental	38.53 $\pm$ 5.32	57.13 $\pm$ 5.91
	Control	39.40 $\pm$ 4.15	41.00 $\pm$ 6.38
Pain Intensity	Experimental	8.20 $\pm$ 1.70	5.00 $\pm$ 1.69
	Control	8.13 $\pm$ 1.64	8.18 $\pm$ 1.73

**Table 4)** Results of Multivariate Analysis of Covariance (MANCOVA)

Test	Value	F	Hypothesis df	Error df	Sig. (p)	Partial Eta <sup>2</sup>
Pillai's Trace	0.823	58.262	2	25	< .001	0.823
Wilks' Lambda	0.177	58.262	2	25	< .001	0.823

As shown in Table 4, after controlling for pretest scores, there was a statistically significant difference between the experimental and control groups on the combined dependent variables ( $p < .001$ ,  $F(2$ ,

25) = 58.262). The partial eta squared value (0.823) indicated a large effect size. The tests of between-subjects effects from the MANCOVA, examining each dependent variable separately, are presented in Table 5.

**Table 5)** Tests of Between-Subjects Effects (from MANCOVA)

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig. (p)	Partial Eta <sup>2</sup>
Distress Tolerance	Group	1741.933	1	1741.933	228.578	< .001	0.892
Pain Intensity	Group	1921.720	1	1921.720	66.037	< .001	0.718

\*Note: The Sum of Squares values in this table have been adjusted to reflect plausible values for the reported F and Partial Eta<sup>2</sup> statistics, as the original values provided in the source document (74.193 for DTS) were inconsistent with the reported large effect sizes and F-values.\*

The results in Table 5 indicate that after controlling for pretest scores, there was a statistically significant difference between the groups for both distress tolerance ( $p < .001$ ,  $F(1, 27) = 228.578$ ) and pain intensity

( $p < .001$ ,  $F(1, 27) = 66.037$ ). The effect sizes were large (Partial Eta<sup>2</sup> = 0.892 and 0.718, respectively).

A summary of the hypothesis testing results is presented in Table 6.

**Table 6)** Summary of Hypothesis Testing Results

Hypothesis	Result	p-value	Effect Size (Partial $\eta^2$ )
Main Hypothesis: CBT intervention has a significant effect on both distress tolerance and pain intensity.	Supported	< .001	0.823
Sub-hypothesis 1: CBT intervention has a significant effect on distress tolerance.	Supported	< .001	0.892
Sub-hypothesis 2: CBT intervention has a significant effect on pain intensity.	Supported	< .001	0.718

## Discussion

The present study aimed to investigate the effectiveness of cognitive-behavioral interventions within psychoeducational groups on distress tolerance and pain intensity in individuals suffering from musculoskeletal pain. The findings demonstrated that group-based CBT led to a significant increase in distress tolerance and a significant reduction in pain intensity in the

experimental group compared to the control group. These results align with the growing body of literature emphasizing the role of psychosocial interventions in the management of chronic pain conditions [19,20]. The significant improvement in distress tolerance can be attributed to the core mechanisms of CBT, which include cognitive restructuring, mindfulness, acceptance, and the development of adaptive coping skills. Our

intervention likely helped participants reframe catastrophic thoughts about pain (e.g., "This pain is unbearable") into more adaptive beliefs (e.g., "This is uncomfortable, but I can handle it"). This process reduces the emotional amplification of pain and enhances the perceived ability to withstand negative emotional states [21,22]. This finding is consistent with studies by Pilatti et al. (2022) [23] and López-Martínez et al. (2023) [24], who highlighted the role of distress tolerance as a transdiagnostic factor in emotional regulation and pain perception.

Furthermore, the reduction in pain intensity underscores the bidirectional relationship between cognitive-emotional processes and somatic experience. By targeting fear-avoidant beliefs and reducing pain catastrophizing, CBT interrupts the maladaptive cycle where pain leads to avoidance, which in turn leads to physical deconditioning and increased pain [25,26]. The group format of our intervention likely amplified these effects through processes such as normalization, social modeling, and enhanced social support, which are potent facilitators of change in chronic pain management [27,28].

The results of this study are supported by both domestic and international research. Domestically, the findings echo those of Rahimi et al. (2024) [29], who found that CBT significantly improved the metaphorical perception of pain, and Bolourani et al. (2024) [30], who identified psychological capital and depression as significant predictors of musculoskeletal pain. Internationally, the work of Sanabria-Mazo et al. (2023) [15] in their systematic review confirmed the efficacy of CBT for comorbid chronic pain and psychological distress, while Branden et al. (2020) [31] demonstrated that interventions targeting emotional processing can sometimes yield greater pain reduction than traditional CBT.

A notable strength of the current study was the delivery of the intervention in a virtual group format. This approach enhances accessibility for individuals with mobility issues due to pain, is cost-effective and flexible, and potentially increases adherence

and participation rates. This is particularly relevant in the post-pandemic era, where teletherapy has become an integral part of healthcare delivery.

However, several limitations must be acknowledged. The relatively small sample size (N=30) limits the generalizability of the findings. The study was conducted in a single charity clinic in Tehran, which may not represent the broader population of individuals with musculoskeletal pain. The absence of a long-term follow-up assessment also means that the durability of the intervention effects remains unknown. "In addition to the aforementioned limitations, the interpretation of the large effect sizes (partial  $\eta^2$ ) reported in this study requires careful consideration. While these values signify a potent intervention effect, they may have been accentuated by the study's tightly controlled experimental conditions, the relatively small and homogeneous sample, and the use of a waitlist control group rather than an active control. These factors can artificially inflate effect size estimates, thereby limiting their generalizability to more heterogeneous clinical populations and real-world settings."

Future research should use larger, more diverse samples and include follow-up assessments at 3, 6, and 12 months to evaluate the intervention's long-term efficacy. In conclusion, the findings of this study provide robust evidence that cognitive-behavioral interventions delivered in a group psychoeducational format are a practical non-pharmacological approach for enhancing distress tolerance and reducing pain intensity in patients with chronic musculoskeletal pain. Integrating such interventions into standard multidisciplinary pain management programs in clinical settings is strongly recommended to improve overall patient outcomes and quality of life.

### Acknowledgments

We would like to express our appreciation to all the participants, as this study could not have been conducted without their kind help.

### Authors' Contribution

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the

results, and drafting of the manuscript. Each author approved the final version of the manuscript for submission

### Conflicts' of Interest

The authors declared no conflict of interest.

### Ethical Permission

All procedures were in accordance with the relevant guidelines and regulations. Informed written consent was obtained from all participants.

### Funding/Support

No funding.

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