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Effectiveness of Cognitive-Behavioral Therapy on Perceived Pain and Sleep Quality in Patients with Fibromyalgia

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ABSTRACT

Objective: The present study aimed to evaluate the effectiveness of cognitive-behavioral therapy (CBT) on perceived pain and sleep quality among patients with fibromyalgia.

Methods and Materials: This research employed a quasi-experimental design with a pretest–posttest format, a control group, and a three-month follow-up period. The statistical population consisted of all patients with fibromyalgia who referred to the rehabilitation clinic of Modarres Hospital in Tehran during 2023–2024. Using purposive sampling, 45 participants were selected and randomly assigned to three equal groups of 15. Data were collected using the Pain Perception Questionnaire (McGill, 2009) and the Pittsburgh Sleep Quality Index (Buysse et al., 1989). The CBT intervention was conducted across 10 weekly sessions, each lasting 90 minutes. Participants in the control group did not receive any psychological intervention during this period. Data analysis was performed using descriptive statistics and mixed analysis of variance (ANOVA) with repeated measures.

Findings: The findings indicated that CBT significantly reduced perceived pain ($F = 107.539$, $\eta^2 = 0.349$) and improved sleep quality ($F = 190.376$, $\eta^2 = 0.427$) in patients with fibromyalgia ($p < .05$).

Conclusion: The results support the efficacy of cognitive-behavioral therapy in alleviating perceived pain and enhancing sleep quality among individuals with fibromyalgia. These findings underscore the importance of psychological and behavioral factors in the management of fibromyalgia and highlight the potential of CBT as an effective complementary intervention to improve patients' overall functioning and quality of life.

Keywords: *cognitive-behavioral therapy, pain perception, sleep quality, fibromyalgia*

1. Introduction

Fibromyalgia syndrome (FMS) is a complex chronic disorder characterized by widespread musculoskeletal pain, sleep disturbance, fatigue, cognitive impairment, and emotional distress, affecting millions of individuals worldwide. Its multifaceted etiology involves neurobiological, psychological, and environmental mechanisms that interact to produce chronic pain and somatic hypersensitivity (Fors et al., 2024; Marshall et al., 2024). The global prevalence of fibromyalgia ranges from 2% to 4% in the general population and disproportionately affects women in middle adulthood, particularly between the ages of 40 and 60 (Fors et al., 2024). Despite its high burden, fibromyalgia remains one of the most misunderstood and diagnostically challenging chronic pain conditions, partly due to the absence of objective biomarkers and its overlap with psychiatric and stress-related disorders (Favretti et al., 2023; Ribatti et al., 2025). Research has demonstrated that FMS is closely linked with central sensitization, dysfunctional pain modulation, and disturbances in neuroendocrine and immune pathways (Erdrich & Harnett, 2025; Ribatti et al., 2025).

Emerging evidence highlights the role of small fiber pathology and aberrant neurotransmission in the pathophysiology of fibromyalgia, supporting a biopsychosocial perspective that integrates physiological and psychological factors (Marshall et al., 2024). Additionally, recent neuroimaging studies and molecular research have identified neuroinflammatory processes and dysregulated hypothalamic-pituitary-adrenal (HPA) axis activity as key mechanisms contributing to chronic pain perception and fatigue (Favretti et al., 2023; Küster et al., 2017). In line with these findings, disturbances in gut-brain communication have been increasingly recognized as relevant to FMS symptomatology, suggesting that microbial dysbiosis may influence neuroinflammation and pain signaling (Erdrich & Harnett, 2025). This has opened new directions for adjunctive treatments such as probiotic or prebiotic supplementation, which have shown promise in improving pain and fatigue symptoms in fibromyalgia (Aslan Çİn et al., 2024).

Given the multifactorial nature of fibromyalgia, effective management requires an integrative, multidisciplinary approach addressing both physical and psychological dimensions (Hudson et al., 2025). Pharmacologic treatments, including antidepressants and anticonvulsants, have shown modest efficacy in alleviating pain and improving sleep, yet their side effects and limited long-term benefits have led to increased attention toward nonpharmacologic interventions (Hudson et al., 2025; Pathak et al., 2025). Psychological interventions, especially cognitive-behavioral therapy (CBT), have emerged as highly effective in improving pain-related outcomes, psychological distress, and quality of life in fibromyalgia patients (Cojocaru et al., 2024; Sanabria-Mazo et al., 2023). CBT helps individuals reframe maladaptive cognitions related to pain, develop coping skills, and modify dysfunctional behavioral patterns that perpetuate symptom severity (Burns et al., 2025; Nakao et al., 2021).

Cognitive-behavioral therapy has consistently demonstrated efficacy in chronic pain management through mechanisms targeting maladaptive cognitive appraisal, pain catastrophizing, and emotional dysregulation (Alaiti et al., 2022). It also addresses comorbid psychological symptoms such as anxiety, depression, and insomnia, which are highly prevalent in FMS populations (Cojocaru et al., 2024). Several studies have shown that CBT not only reduces pain perception but also improves functional outcomes, sleep quality, and emotional well-being (Erickson et al., 2024; He et al., 2023; McCrae et al., 2019). For instance, research among veterans and older adults with chronic pain and sleep problems has confirmed that CBT for insomnia (CBT-I) can significantly enhance sleep efficiency and reduce fatigue (Erickson et al., 2024; He et al., 2023). These findings support the use of CBT as a first-line, evidence-based, nonpharmacologic intervention for fibromyalgia-related sleep disturbances and pain.

From a mechanistic standpoint, CBT's therapeutic action is mediated by cognitive restructuring and behavioral activation, which interrupt maladaptive feedback loops between pain, mood, and sleep disturbance (Alaiti et al., 2022; Murphy et al., 2022). Cognitive reframing helps patients reinterpret their pain experiences in less threatening ways, thereby reducing hypervigilance and emotional distress associated with chronic pain (Murphy et al., 2022). Behavioral interventions, such as activity pacing and relaxation training, contribute to improved functional capacity and decreased symptom intensity. These outcomes align with the concept of "central pain modulation," wherein cognitive-emotional interventions regulate neural activity within pain-processing networks, including the prefrontal cortex, anterior cingulate cortex, and insula (Lumley et al., 2017).

While CBT's efficacy for fibromyalgia has been well-documented, recent developments emphasize the need to

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individualize therapy according to patient characteristics, psychosocial context, and comorbidities (Burns et al., 2025; Delasas et al., 2025). Tailored CBT programs combining psychoeducation, cognitive restructuring, and exercise therapy have demonstrated superior outcomes in high-risk fibromyalgia patients compared to standard interventions (Delasas et al., 2025; Koulil et al., 2010). Similarly, group-based CBT formats have proven effective for enhancing social connectedness, self-efficacy, and adherence to treatment protocols (Castel et al., 2008). The integration of mindfulness, acceptance-based strategies, and body-awareness exercises into CBT has further enhanced its capacity to reduce pain intensity and emotional reactivity (Cojocaru et al., 2024; Sanabria-Mazo et al., 2023).

Despite these advances, fibromyalgia management remains challenging, largely due to the persistence of symptoms and inter-individual variability in treatment response (Climent-Sanz et al., 2024). Qualitative evidence from patients highlights ongoing struggles with fatigue, cognitive dysfunction ("fibro fog"), and frustration over inadequate symptom relief, underscoring the necessity for patient-centered care models (Climent-Sanz et al., 2024; Fors et al., 2024). Contemporary trials are increasingly focusing on combining CBT with complementary approaches such as exercise training, sleep therapy, or hypnotherapy to optimize outcomes (Kolbadinejad et al., 2022; Ozgunay et al., 2024). Cognitive-behavioral hypnotherapy, for example, integrates hypnotic suggestion with traditional CBT techniques to target pain perception and stress-related symptoms, yielding promising results in fibromyalgia populations (Castel et al., 2008; Kolbadinejad et al., 2022).

In addition to psychological interventions, neurobiological insights have inspired the exploration of adjunct therapies targeting stress-related biomarkers and neuroplastic mechanisms (Küster et al., 2017; Ribatti et al., 2025). Exercise-based and mind-body interventions, when combined with CBT, have shown to enhance endogenous pain inhibition and reduce central sensitization, contributing to sustained symptom improvement (Alaiti et al., 2022). Similarly, improvements in sleep quality following CBT have been associated with normalization of circadian rhythms and reduced physiological hyperarousal (Erickson et al., 2024; Pathak et al., 2025). Given that sleep impairment exacerbates pain and emotional distress, the bidirectional relationship between sleep and fibromyalgia symptoms further supports CBT's dual focus on cognitive-emotional and behavioral regulation (Hudson et al., 2025; McCrae et al., 2019).

Moreover, epidemiological evidence suggests that comorbid psychiatric and stress-related disorders are highly prevalent among individuals with fibromyalgia, reinforcing the importance of psychological assessment and intervention (Murphy et al., 2022; Zinchuk et al., 2025). Recent systematic reviews emphasize that interventions integrating CBT principles can effectively reduce depressive and anxiety symptoms while improving physical functioning (Cojocaru et al., 2024; Sanabria-Mazo et al., 2023). CBT-based therapies also help patients regain a sense of control over their symptoms, reducing perceived helplessness and enhancing adaptive coping strategies (Nakao et al., 2021). Furthermore, advances in digital health technologies have enabled remote and blended CBT programs, increasing accessibility and adherence among patients with limited mobility or geographical constraints (Delasas et al., 2025; Kozel et al., 2024).

A growing body of literature also points to the importance of assessing long-term efficacy and sustainability of CBT outcomes. Follow-up data indicate that CBT's effects on pain reduction and sleep quality can persist for several months after treatment completion, reflecting durable cognitive and behavioral changes (Burns et al., 2025; He et al., 2023). However, variability in response underscores the necessity for future research to identify mediators and moderators of CBT efficacy, such as baseline psychological flexibility, sleep quality, and neurocognitive resilience (Hudson et al., 2025; Pathak et al., 2025). In this regard, combining CBT with Acceptance and Commitment Therapy (ACT) or Emotional Awareness and Expression Therapy (EAET) may yield synergistic benefits for chronic pain conditions (Burns et al., 2025; Sanabria-Mazo et al., 2023).

Given this background, the present study was designed to evaluate the effectiveness of Cognitive-Behavioral Therapy in reducing perceived pain and improving sleep quality among patients with fibromyalgia.

2. Methods and Materials

2.1. *Study design and Participant*

This research is applied in purpose and quasi-experimental in design, utilizing a pretest–posttest and three-month follow-up structure with a control group. For the experimental groups (Experimental Group 1 = Cognitive-Behavioral Therapy; Experimental Group 2 = Acceptance and Commitment Therapy), intervention sessions were

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implemented according to standardized therapeutic protocols. Participants in the control group did not receive any intervention and were placed on a waiting list for treatment. The statistical population included all patients with fibromyalgia who attended the Rehabilitation Clinic of Modarres Hospital in Tehran during 2023–2024 and who, based on a specialist's diagnosis, medical tests, and clinical examinations, were confirmed to have fibromyalgia.

To determine the sample size, and given that the study employed a quasi-experimental design, 15 participants per group were deemed sufficient. Accordingly, from among the patients with fibromyalgia who attended the Rehabilitation Clinic of Modarres Hospital in Tehran during 2023–2024—and accounting for potential attrition—60 individuals who met the inclusion criteria were selected through purposive sampling and randomly assigned (by dice roll) to three groups: the first experimental group (Cognitive-Behavioral Therapy, 20 participants), the second experimental group (Acceptance and Commitment Therapy, 20 participants), and the control group (20 participants). Due to participant dropout and withdrawal, each group ultimately continued with 15 participants, and the final analysis was conducted on a total of 45 participants.

The inclusion criteria comprised: (a) a confirmed medical diagnosis of fibromyalgia by a specialist, with at least six months having passed since diagnosis; (b) literacy in reading and writing; (c) fluency in the Persian language; (d) complete responses to self-report tools across all three stages of the study; (e) female participants aged 45–65 years; (f) absence of any other physical or psychological disorder that could influence outcomes (e.g., personality disorders, bipolar disorder, psychosis), based on medical records, clinical interviews, and self-reports; and (g) willingness and ability to attend all sessions according to the schedule.

The exclusion criteria included: (a) absence from more than two intervention sessions; (b) exacerbation of disease symptoms necessitating hospitalization; (c) development of any chronic physical or psychiatric condition (e.g., personality disorder, post-traumatic stress disorder, bipolar disorder), or commencement of medication under specialist supervision, or a history of specific surgery; (d) participation in another therapeutic program during the intervention period; and (e) lack of motivation or cooperation, as evidenced by failure to complete therapeutic assignments or disruption of session regularity.

After obtaining research approval and the necessary institutional permissions, the researcher visited the Rehabilitation Clinic of Modarres Hospital in Tehran. Following coordination with clinic management and staff, the sample was selected from the target population. Prior to administering the questionnaires, each participant was individually informed about the study's purpose, procedures, and confidentiality assurances. Written informed consent was obtained before data collection. Self-report questionnaires were then administered individually, and any ambiguities were clarified according to the standardized instructions.

After completion, questionnaires were collected and the data analyzed. The interventions for both experimental groups were administered by clinical psychologists trained in their respective therapeutic modalities and adhered strictly to the standard protocols. During the same period, participants in the control group did not receive any psychological intervention but continued their routine medical treatments as prescribed by their physicians. A follow-up assessment was conducted three months after the posttest. Upon study completion, participants in the control group were offered the opportunity to receive the intervention.

2.2. Measures

Pain Perception Questionnaire (McGill, 2009): This self-report instrument, developed by McGill (2009), measures individuals' perception of pain across several dimensions. It comprises 20 groups of statements and includes four components: sensory pain perception (items 1–10), affective pain perception (items 11–15), evaluative pain perception (item 16), and diverse/variable pain experiences (items 17–20). Responses are rated on a 10-point numerical scale ranging from 1 (no pain) to 10 (very severe pain). Participants report their average daily pain over the past week. The minimum total score is 20, and the maximum is 77, with higher scores indicating greater perceived pain intensity. In the study by Dworkin et al. (2009), content validity was confirmed, and reliability using Cronbach's alpha ranged from 0.83 to 0.87 across subscales. Jahan et al. (2024) validated the Arabic version among patients with musculoskeletal pain, reporting Cronbach's alpha of 0.74 and item correlations above 0.90. Iranian studies have reported reliability coefficients of 0.84 (Ebrahimi-Desgerdi et al., 2022). In the current study, Cronbach's alpha for the overall instrument was 0.74, with subscale values ranging from 0.69 to 0.76.

Sleep Quality Questionnaire (Buysse et al., 1989): Developed by Buysse et al. (1989), this self-report

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instrument consists of 19 items and 7 subscales assessing different dimensions of sleep during the past month: (a) subjective sleep quality (item 9), (b) sleep latency (items 2 and 5a), (c) sleep duration (item 4), (d) sleep efficiency—calculated by dividing total hours slept (item 4) by total time in bed (item 1), multiplying by 100, and scoring 0 for >85%, 1 for 75–84%, 2 for 65–74%, and 3 for <65%, (e) sleep disturbances (items 5b–5j), scored from 0 (none) to 3 (three or more times per week), (f) use of sleep medication (item 6), and (g) daytime dysfunction (items 7 and 8). Each subscale receives a score from 0 to 3, and the total score (0–21) is derived by summing the components; scores of 0–4 indicate good sleep quality, whereas scores ≥5 indicate poor sleep quality. The original developers (Buysse et al., 1989) reported an overall Cronbach's alpha of 0.89, subscale alphas between 0.72 and 0.83, and test–retest reliability above 0.85. Oreskov and Norup (2023) reported Cronbach's alpha of 0.72 and test–retest reliability of 0.68 among Danish high school students. Arumugam et al. (2024) reported Cronbach's alpha of 0.65 among Arabic-speaking patients, and Petropoulakos et al. (2024) reported Cronbach's alpha of 0.98, test–retest reliability of 0.90, and concurrent validity between 0.55 and 0.86 among Greek patients with chronic nonspecific low back pain. In Iran, Cronbach's alpha has been reported as 0.87 (Kalbadinejad et al., 2022) and 0.84 among cardiac patients (Mohammadi et al., 2022). In the present study, internal consistency (Cronbach's alpha) for the total scale was 0.72, with subscale values ranging from 0.66 to 0.83.

2.3. *Intervention*

The Cognitive-Behavioral Therapy (CBT) intervention was implemented according to Thorne's (2005) classical therapeutic protocol, designed to modify maladaptive cognitions, regulate emotional responses, and promote adaptive behavioral patterns among participants with fibromyalgia. The intervention consisted of 10 structured group sessions conducted weekly, each lasting 90 minutes. Session 1 focused on rapport building, motivation, and introducing the structure and objectives of therapy, including discussions on illness perception and emotional responses to chronic pain. Session 2 emphasized group cohesion, ethical norms (confidentiality and respect), and introduced the ABC model linking thoughts, emotions, and behaviors. In Session 3, participants identified activating events, underlying beliefs, and emotional consequences while learning positive self-talk as homework. Session 4 introduced cognitive restructuring through the addition of the "D" (Disputation) component to the ABC model to challenge irrational beliefs. Session 5 reinforced mastery of the ABCD model and introduced progressive muscle relaxation as a behavioral technique. Session 6 centered on teaching problem-solving strategies and their mental health benefits through practical exercises. Session 7 guided participants in logical and functional analysis of maladaptive behaviors, while Session 8 focused on enhancing social skills, assertiveness, interpersonal effectiveness, and self-control. In Session 9, discussions addressed attributional styles, development of alternative beliefs, and emotional regulation through incompatible emotional experiences. The final session (Session 10) introduced thought-stopping and biofeedback methods for managing intrusive thoughts and fostering positive emotional states, concluding with a comprehensive review and assignment of consolidation exercises to reinforce learned skills.

2.4. *Data Analysis*

Data analysis was performed using descriptive statistics (mean and standard deviation) and inferential statistical tests. Assumption testing included the Shapiro–Wilk test for normality, Levene's test for homogeneity of variances, Box's M test for equality of covariance matrices, and analysis of the pretest × group interaction to examine homogeneity of regression slopes. Inferential analyses were conducted using mixed analysis of variance (ANOVA) with repeated measures at the follow-up stage. All statistical analyses were performed using SPSS version 26.

3. Findings and Results

Table 1 presents the descriptive statistics (mean and standard deviation) for the total scores and subdimensions of each dependent variable across assessment phases (pretest, posttest, and follow-up) for the experimental (Cognitive-Behavioral Therapy) and control groups.

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Table 1

Means and Standard Deviations of Dependent Variables by Group and Assessment Phases

Dependent Variable	Group	N	Pretest (M ± SD)	Posttest (M ± SD)	Follow-up (M ± SD)
Sensory Pain Perception	Cognitive-Behavioral Therapy	15	17.60 ± 3.88	11.80 ± 1.14	11.40 ± 1.05
	Control	15	15.65 ± 3.15	16.33 ± 3.33	16.20 ± 3.27
Affective Pain Perception	Cognitive-Behavioral Therapy	15	14.00 ± 2.69	10.20 ± 1.37	9.75 ± 1.16
	Control	15	15.45 ± 1.66	15.80 ± 2.09	15.80 ± 2.09
Evaluative Pain Perception	Cognitive-Behavioral Therapy	15	5.86 ± 1.76	4.40 ± 0.73	4.06 ± 0.45
	Control	15	6.26 ± 1.75	6.73 ± 1.33	6.80 ± 1.32
Diverse Pain Experiences	Cognitive-Behavioral Therapy	15	16.26 ± 3.17	13.26 ± 1.90	12.06 ± 2.43
	Control	15	16.75 ± 3.59	17.40 ± 3.29	17.40 ± 3.29
Pain Perception – Total Score	Cognitive-Behavioral Therapy	15	53.72 ± 11.50	39.66 ± 5.14	37.27 ± 5.09
	Control	15	54.11 ± 10.15	56.26 ± 10.01	52.20 ± 9.97
Subjective Sleep Quality	Cognitive-Behavioral Therapy	15	1.60 ± 1.12	0.60 ± 0.63	0.53 ± 0.51
	Control	15	1.80 ± 1.01	1.93 ± 0.96	1.93 ± 0.96
Sleep Latency	Cognitive-Behavioral Therapy	15	2.93 ± 1.79	1.20 ± 0.94	0.73 ± 0.66
	Control	15	2.86 ± 1.92	3.06 ± 1.70	3.06 ± 1.70
Sleep Duration	Cognitive-Behavioral Therapy	15	1.73 ± 1.09	0.80 ± 0.86	0.60 ± 0.82
	Control	15	1.93 ± 1.16	2.13 ± 0.91	2.13 ± 0.91
Sleep Efficiency	Cognitive-Behavioral Therapy	15	3.86 ± 2.72	1.93 ± 1.57	1.80 ± 1.47
	Control	15	4.53 ± 2.50	4.66 ± 2.35	4.60 ± 2.35
Sleep Disturbances	Cognitive-Behavioral Therapy	15	7.93 ± 2.40	4.53 ± 2.13	4.46 ± 2.09
	Control	15	7.60 ± 2.92	7.86 ± 2.58	7.86 ± 2.58
Use of Sleep Medication	Cognitive-Behavioral Therapy	15	1.86 ± 1.06	0.66 ± 0.72	0.53 ± 0.63
	Control	15	1.86 ± 1.06	1.93 ± 1.03	2.00 ± 1.06
Daytime Dysfunction	Cognitive-Behavioral Therapy	15	3.06 ± 1.48	0.86 ± 0.35	0.73 ± 0.49
	Control	15	3.46 ± 1.30	3.60 ± 1.24	3.60 ± 1.24
Sleep Quality – Total Score	Cognitive-Behavioral Therapy	15	22.97 ± 11.66	10.58 ± 6.90	9.38 ± 6.67
	Control	15	23.74 ± 11.87	25.17 ± 10.77	25.18 ± 10.77

As shown in Table 2, the mean scores of perceived pain (including sensory, affective, evaluative, and diverse pain dimensions) and total pain perception decreased in the cognitive-behavioral therapy group from pretest to follow-up, while remaining relatively stable or slightly increasing in the control group. Similarly, mean scores across sleep quality subscales (subjective sleep quality, sleep latency, duration, efficiency, disturbances, use of sleep medication, and daytime dysfunction) showed marked improvement in the experimental group following the intervention and during the follow-up phase, in contrast to the control group, whose scores exhibited no significant changes across the three assessment phases.

Before conducting the mixed analysis of variance (ANOVA), the statistical assumptions necessary for its application were examined, including the normality of data distribution, homogeneity of error variances, equality of variance–covariance matrices, and sphericity. The results of the Shapiro–Wilk test indicated that all dependent variables met the normality assumption, as the obtained significance levels were greater than 0.05 for all cases—for example, sensory pain perception (pretest $W = 0.969$, $p = 0.256$; posttest $W = 0.988$, $p = 0.331$; follow-up $W = 0.971$, $p = 0.402$), affective pain perception (pretest $W = 0.971$, $p = 0.306$; posttest $W = 0.934$, $p = 0.319$; follow-up $W = 0.982$, $p = 0.808$), and total sleep quality (pretest $W = 0.961$, $p = 0.138$; posttest $W = 0.885$, $p = 0.154$; follow-up $W = 0.890$, $p = 0.310$). Therefore, the null hypothesis of normality could not be rejected, indicating that the data were normally distributed. The Levene's test for equality of variances also confirmed the assumption of homogeneity across groups, as all dependent variables yielded nonsignificant results ($p > 0.05$). For instance, for sensory pain perception, the F values were 1.706 ($p = 0.194$) in the pretest, 0.903 ($p = 0.103$) in the posttest, and 1.379 ($p = 0.444$) in the follow-up, while the total sleep quality scores showed F values of 0.276 ($p = 0.460$), 3.227 ($p = 0.053$), and 2.735 ($p = 0.076$) respectively, confirming homogeneity of error variances. The Box's M test results also supported the equality of variance–covariance matrices, as all significance levels exceeded 0.05, such as for sensory pain perception (Box's $M = 63.487$, $F = 4.737$, $p = 0.615$), affective pain perception (Box's $M = 37.518$, $F = 8.405$, $p = 0.221$), and total sleep quality (Box's $M = 47.465$, $F = 3.542$, $p = 0.545$). Consequently, the assumption of homogeneity of variance–covariance matrices was confirmed. Finally, Mauchly's test of sphericity yielded significant results for all dependent variables, with p-values less than 0.01—for example, sensory pain perception (W =

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0.136, χ^2 = 81.809, df = 2, p = 0.001) and total sleep quality (W = 0.251, χ^2 = 56.730, df = 2, p = 0.001)—indicating violation of the sphericity assumption. Therefore, to correct for this violation, Greenhouse–Geisser corrections were applied to all within-subject effects to ensure the robustness and validity of the ANOVA results.

Next, Table 2 presents the results of the mixed analysis of variance (ANOVA) with repeated measures, illustrating the effect of the independent variable (Cognitive-Behavioral Therapy) on the dependent variables, namely pain perception and sleep quality.

Table 2

Within- and Between-Subject Results of Mixed ANOVA for Dependent Variables

Dependent Variable	Source	F	Sig.	Effect Size (η²)	Power (1–β)
Sensory Pain Perception	Group	6.941	0.014	0.199	0.720
	Time	29.713	0.000	0.515	1.000
	Time × Group	44.118	0.000	0.612	1.000
Affective Pain Perception	Group	23.103	0.000	0.452	0.996
	Time	23.872	0.000	0.460	0.999
	Time × Group	33.139	0.000	0.542	1.000
Evaluative Pain Perception	Group	19.506	0.000	0.411	0.989
	Time	4.767	0.032	0.145	0.599
	Time × Group	16.645	0.000	0.373	0.986
Diverse Pain Experiences	Group	11.097	0.002	0.284	0.895
	Time	9.934	0.001	0.262	0.928
	Time × Group	19.781	0.000	0.414	0.998
Pain Perception – Total	Group	123.761	0.000	0.327	0.996
	Time	62.593	0.000	0.401	1.000
	Time × Group	107.539	0.000	0.349	1.000
Subjective Sleep Quality	Group	10.489	0.003	0.273	0.878
	Time	11.645	0.001	0.294	0.927
	Time × Group	19.536	0.000	0.411	0.993
Sleep Latency	Group	6.722	0.015	0.194	0.706
	Time	20.943	0.000	0.428	0.997
	Time × Group	30.976	0.000	0.525	1.000
Sleep Duration	Group	9.868	0.004	0.261	0.858
	Time	8.035	0.003	0.223	0.872
	Time × Group	17.204	0.000	0.381	0.996
Sleep Efficiency	Group	7.156	0.012	0.204	0.733
	Time	14.261	0.000	0.337	0.970
	Time × Group	17.291	0.000	0.382	0.988
Sleep Disturbances	Group	5.947	0.021	0.175	0.653
	Time	44.756	0.000	0.615	1.000
	Time × Group	61.096	0.000	0.586	1.000
Use of Sleep Medication	Group	8.287	0.008	0.228	0.794
	Time	15.460	0.000	0.356	0.993
	Time × Group	21.504	0.000	0.434	0.999
Daytime Dysfunction	Group	24.652	0.000	0.468	0.998
	Time	44.652	0.000	0.615	1.000
	Time × Group	56.478	0.000	0.669	1.000
Sleep Quality – Total	Group	41.373	0.000	0.491	1.000
	Time	134.510	0.000	0.628	1.000
	Time × Group	190.376	0.000	0.427	0.998

The results in Table 2 indicate that Cognitive-Behavioral Therapy produced statistically significant effects on all dependent variables. Specifically, CBT significantly reduced pain perception across all dimensions (sensory, affective, evaluative, and diverse), as well as total pain perception ($p < .001$). Furthermore, CBT significantly improved sleep quality and its subcomponents, including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, and daytime functioning ($p < .001$). These findings demonstrate that participation in Cognitive-Behavioral Therapy effectively reduced both pain perception and sleep-related difficulties among patients with fibromyalgia. Next, pairwise comparisons of the adjusted means across the three measurement phases (pretest,

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posttest, and follow-up) for the dependent variables are presented in Table 3.

Table 3

Bonferroni Post-Hoc Results for Dependent Variables to Examine Durability of Effects

Study Variable	Adjusted Mean	Comparisons	Mean Difference	Sig.
Sensory Pain Perception	Pretest = 16.633	Pretest – Posttest	*2.567*	0.000
	Posttest = 14.067	Pretest – Follow-up	*2.833*	0.000
	Follow-up = 13.800	Posttest – Follow-up	*0.267*	0.024
Affective Pain Perception	Pretest = 14.733	Pretest – Posttest	*1.733*	0.000
	Posttest = 13.000	Pretest – Follow-up	*1.967*	0.000
	Follow-up = 12.767	Posttest – Follow-up	0.233	0.236
Evaluative Pain Perception	Pretest = 6.067	Pretest – Posttest	0.500	0.146
	Posttest = 5.567	Pretest – Follow-up	0.633	0.082
	Follow-up = 5.433	Posttest – Follow-up	0.133	0.402
Diverse Pain Experiences	Pretest = 16.500	Pretest – Posttest	*1.167*	0.043
	Posttest = 15.333	Pretest – Follow-up	*1.767*	0.003
	Follow-up = 14.735	Posttest – Follow-up	*0.600*	0.043
Pain Perception – Total	Pretest = 53.900	Pretest – Posttest	*5.967*	0.000
	Posttest = 47.960	Pretest – Follow-up	*7.200*	0.000
	Follow-up = 46.730	Posttest – Follow-up	*1.233*	0.000
Subjective Sleep Quality	Pretest = 1.700	Pretest – Posttest	*0.433*	0.006
	Posttest = 1.267	Pretest – Follow-up	*0.467*	0.004
	Follow-up = 1.233	Posttest – Follow-up	0.034	0.178
Sleep Latency	Pretest = 2.900	Pretest – Posttest	*0.767*	0.000
	Posttest = 2.133	Pretest – Follow-up	*1.000*	0.000
	Follow-up = 1.900	Posttest – Follow-up	*0.233*	0.026
Sleep Duration	Pretest = 1.833	Pretest – Posttest	*0.467*	0.011
	Posttest = 1.367	Pretest – Follow-up	*0.367*	0.034
	Follow-up = 1.467	Posttest – Follow-up	−0.100	0.072
Sleep Efficiency	Pretest = 4.200	Pretest – Posttest	*0.900*	0.004
	Posttest = 3.300	Pretest – Follow-up	*1.070*	0.001
	Follow-up = 3.200	Posttest – Follow-up	0.100	0.571
Sleep Disturbances	Pretest = 7.767	Pretest – Posttest	*1.567*	0.000
	Posttest = 6.200	Pretest – Follow-up	*1.600*	0.000
	Follow-up = 6.167	Posttest – Follow-up	0.033	0.001
Use of Sleep Medication	Pretest = 1.867	Pretest – Posttest	*0.567*	0.001
	Posttest = 1.300	Pretest – Follow-up	*0.600*	0.001
	Follow-up = 1.267	Posttest – Follow-up	0.033	0.001
Daytime Dysfunction	Pretest = 3.267	Pretest – Posttest	*1.033*	0.000
	Posttest = 2.233	Pretest – Follow-up	*1.100*	0.000
	Follow-up = 2.167	Posttest – Follow-up	0.067	0.238
Sleep Quality – Total	Pretest = 23.533	Pretest – Posttest	*5.633*	0.000
	Posttest = 17.900	Pretest – Follow-up	*6.233*	0.000
	Follow-up = 17.300	Posttest – Follow-up	*0.600*	0.011

As shown in Table 3, the mean differences between pretest and posttest (reflecting the immediate intervention effect) and between pretest and follow-up (reflecting the persistence of the effect over time) were greater and statistically more significant than the mean differences between posttest and follow-up (indicating the stability of the intervention's impact). These findings suggest that Cognitive-Behavioral Therapy produced significant improvements in both sleep quality and pain perception at posttest, and these therapeutic benefits remained stable and durable during the follow-up period.

4. Discussion and Conclusion

The present study aimed to examine the effectiveness of Cognitive-Behavioral Therapy (CBT) on perceived pain and sleep quality in patients with fibromyalgia. The results indicated that CBT produced statistically significant improvements in both domains, demonstrating reduced sensory, affective, evaluative, and diverse pain perception scores and enhanced sleep quality across multiple dimensions, including subjective sleep quality, latency, duration, efficiency, and daytime functioning. These

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findings support the growing body of evidence highlighting CBT's central role in the nonpharmacological management of fibromyalgia and its comorbid psychological disturbances (Cojocaru et al., 2024; Delasas et al., 2025; Sanabria-Mazo et al., 2023). The results confirmed that cognitive restructuring, behavioral activation, and relaxation training—key mechanisms of CBT—effectively alter pain perception and promote adaptive coping in individuals suffering from chronic musculoskeletal pain syndromes (Alaiti et al., 2022; Murphy et al., 2022).

The significant decrease in perceived pain following CBT suggests that cognitive processes and maladaptive beliefs play a crucial role in the maintenance and amplification of chronic pain. This finding aligns with earlier research indicating that patients with fibromyalgia often exhibit distorted pain-related cognitions, including catastrophizing and attentional bias toward somatic sensations, which perpetuate symptom severity and emotional distress (Burns et al., 2025; Lumley et al., 2017). By restructuring these dysfunctional thought patterns and fostering cognitive flexibility, CBT reduces the emotional salience of pain, helping patients reinterpret it as a manageable rather than uncontrollable experience (Cojocaru et al., 2024; Nakao et al., 2021). Mechanistically, this cognitive reframing may dampen hyperactivity in pain-related neural circuits, particularly the anterior cingulate cortex and insula, regions implicated in emotional amplification of pain (Favretti et al., 2023; Ribatti et al., 2025). Moreover, the results corroborate previous findings showing that CBT modulates central sensitization through top-down cognitive control and attenuates the maladaptive neural plasticity often observed in chronic pain conditions (Koulil et al., 2010; Murphy et al., 2022).

The results regarding sleep improvement are consistent with prior studies demonstrating the efficacy of CBT in addressing sleep disturbance and insomnia symptoms commonly associated with fibromyalgia (Erickson et al., 2024; He et al., 2023; McCrae et al., 2019). Sleep dysfunction has been identified as one of the most debilitating features of fibromyalgia, exacerbating pain sensitivity, fatigue, and emotional dysregulation (Hudson et al., 2025; Pathak et al., 2025). In this study, participants exhibited significant reductions in sleep latency and improvements in sleep duration and efficiency after undergoing CBT, suggesting that therapeutic restructuring of dysfunctional sleep beliefs and behavioral modification (e.g., stimulus control, relaxation, and sleep hygiene) may restore circadian rhythm stability and reduce physiological hyperarousal. These outcomes mirror those observed in meta-analyses reporting that CBT for insomnia (CBT-I) enhances both subjective and objective sleep parameters in individuals with chronic pain and comorbid sleep disturbances (Erickson et al., 2024; He et al., 2023). Furthermore, the sustained improvement observed during the follow-up phase indicates that CBT not only yields immediate therapeutic benefits but also produces long-term behavioral and cognitive adaptations that maintain sleep quality over time (Kalbadi Nezhad et al., 2021).

The observed effects on pain and sleep may be explained through the biopsychosocial model of fibromyalgia, which posits a reciprocal relationship among cognitive, emotional, and physiological systems (Fors et al., 2024; Marshall et al., 2024). Chronic pain and poor sleep reinforce each other through shared neural and hormonal pathways, such as dysregulated hypothalamic-pituitary-adrenal (HPA) axis activity and alterations in serotonin and melatonin production (Favretti et al., 2023; Ribatti et al., 2025). CBT likely influences these interactions by reducing stress-induced sympathetic activation and improving emotional regulation. Evidence suggests that reductions in negative affect and arousal, achieved through cognitive reframing and relaxation techniques, help normalize stress biomarkers, thereby contributing to better sleep and pain control (Alaiti et al., 2022; Murphy et al., 2022). In this regard, the findings are in line with previous work showing that combined CBT and sleep interventions can significantly enhance pain coping and restore restorative sleep architecture in fibromyalgia patients (McCrae et al., 2019; Pathak et al., 2025).

Another key aspect of this study's findings relates to the durability of treatment effects observed at follow-up. The post-hoc Bonferroni comparisons revealed that the improvements achieved during the intervention phase remained stable three months after completion. This persistence underscores the long-term impact of cognitive and behavioral restructuring on pain perception and sleep regulation. Similar sustained benefits of CBT have been reported in other studies, where follow-up assessments indicated maintained improvements in mood, functional status, and sleep outcomes (Burns et al., 2025; Erickson et al., 2024; He et al., 2023). The durability of these effects may be attributed to the self-regulatory skills imparted through CBT—such as problem-solving, thought monitoring, and relaxation—which empower patients to maintain adaptive behaviors beyond the formal treatment setting (Cojocaru et al., 2024; Delasas et al., 2025).

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Additionally, the findings provide empirical support for integrating CBT as a core component of multidisciplinary treatment plans for fibromyalgia. Given the complex etiology of the disorder, interventions focusing solely on pharmacological management often fail to yield comprehensive or lasting symptom relief (Hudson et al., 2025; Pathak et al., 2025). The results here reinforce the value of combining psychological and behavioral approaches to address the cognitive and emotional aspects that exacerbate pain and disrupt sleep (Nakao et al., 2021; Sanabria-Mazo et al., 2023). The incorporation of CBT within rehabilitation programs aligns with current best-practice recommendations, emphasizing holistic care that targets both the mind and body to achieve sustainable improvement in quality of life (Climent-Sanz et al., 2024; Fors et al., 2024).

The findings also highlight the potential physiological underpinnings of CBT's effectiveness in fibromyalgia. Research suggests that CBT may influence neural plasticity and stress-related biomarkers, such as brain-derived neurotrophic factor (BDNF), irisin, and kynurenine pathway metabolites (Küster et al., 2017). These molecular mediators play vital roles in mood regulation, pain modulation, and cognitive performance. It is plausible that improvements in psychological resilience and sleep regulation observed in this study reflect broader neurobiological changes induced by cognitive and behavioral modification. Furthermore, reductions in pain-related catastrophizing and improved self-efficacy could modulate neuroinflammatory processes and reduce central sensitization, as documented in previous mechanistic studies (Favretti et al., 2023; Ribatti et al., 2025).

The consistency between this study's outcomes and those reported in the literature reinforces the robustness of CBT as an evidence-based intervention for fibromyalgia. For instance, comparative trials have shown CBT to be as effective as Acceptance and Commitment Therapy (ACT) or Emotional Awareness and Expression Therapy (EAET) in reducing pain interference and psychological distress, though CBT tends to produce stronger effects on behavioral activation and cognitive control (Burns et al., 2025; Sanabria-Mazo et al., 2023). In a systematic review, CBT and ACT were both found to significantly decrease anxiety and depression in fibromyalgia patients, but CBT exhibited greater improvements in sleep and daily functioning (Cojocaru et al., 2024). This aligns with the present study's findings, suggesting that targeting maladaptive cognitive schemas and promoting behavioral consistency are essential for reducing symptom burden in fibromyalgia.

The positive impact of CBT on sleep parameters in this study also corresponds with recent network meta-analyses that ranked CBT among the most effective nonpharmacological interventions for improving sleep quality in fibromyalgia patients (Hudson et al., 2025; Pathak et al., 2025). These improvements in sleep are not merely secondary benefits but may serve as mediators of pain reduction, as restorative sleep facilitates normalization of pain threshold and emotional regulation (Erickson et al., 2024; McCrae et al., 2019). Furthermore, group-based CBT interventions, as utilized in the current research, may yield additional psychosocial benefits such as social validation and reduced perceived isolation, which in turn contribute to emotional stabilization and adherence to therapeutic practices (Castel et al., 2008; Climent-Sanz et al., 2024).

It is noteworthy that these findings also support the role of behavioral adherence and patient engagement in mediating therapeutic outcomes. Studies indicate that consistent participation in CBT sessions and completion of cognitive and behavioral homework assignments are strongly associated with greater reductions in pain severity and psychological distress (Delasas et al., 2025; Murphy et al., 2022). The structured ten-session format used in this study may have facilitated both learning and internalization of CBT techniques, promoting sustainable behavioral change. Moreover, incorporating relaxation and cognitive restructuring within each session likely enhanced the synergistic effects of emotional regulation and physiological calmness, leading to the observed improvements in both pain and sleep.

From a clinical perspective, these results reaffirm the necessity of a biopsychological orientation to pain treatment, one that transcends traditional symptom management and emphasizes patient empowerment. Fibromyalgia is a chronic, multidimensional disorder requiring interventions that not only alleviate symptoms but also foster long-term resilience and psychological flexibility (Cojocaru et al., 2024; Sanabria-Mazo et al., 2023). The combination of psychoeducation, cognitive restructuring, and relaxation training—central elements of CBT—offers a comprehensive toolkit for patients to understand and manage their illness effectively. Integrating such interventions into standard care could improve treatment adherence, reduce healthcare costs, and enhance overall well-being among fibromyalgia populations (Delasas et al., 2025; Hudson et al., 2025).

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5. Limitations and Suggestions

Despite its strengths, this study had several limitations. First, the relatively small sample size limits the generalizability of the findings and may not adequately represent the broader fibromyalgia population. Second, the study included only female participants within a specific age range, which restricts the extrapolation of results to male patients or younger and older populations. Third, the reliance on self-report questionnaires for pain and sleep assessment introduces potential response bias, as subjective perceptions may not fully reflect physiological changes. Fourth, although the follow-up phase demonstrated stability of effects, the three-month duration may be insufficient to capture long-term maintenance or relapse of symptoms. Finally, the absence of physiological or neurobiological measures, such as polysomnography or stress biomarkers, limits the capacity to infer underlying mechanisms responsible for the observed improvements.

Future research should employ larger and more diverse samples to enhance external validity and examine potential gender or age-related differences in treatment response. Longitudinal studies with extended follow-up periods are needed to assess the sustainability of CBT's effects beyond several months. Incorporating objective physiological and neuroimaging measures could help elucidate the biological pathways through which CBT exerts its effects on pain and sleep. Moreover, comparative trials integrating CBT with other evidence-based interventions, such as mindfulness-based therapy, exercise programs, or pharmacologic treatments, could provide valuable insights into synergistic effects. Finally, the development of technology-assisted CBT platforms, including online or mobile applications, warrants investigation to improve accessibility for patients facing barriers to in-person therapy.

Practitioners should consider implementing CBT as a core component of multidisciplinary treatment plans for fibromyalgia, focusing on both pain reduction and sleep restoration. Structured CBT programs should include psychoeducation, cognitive restructuring, relaxation training, and behavioral activation tailored to each patient's functional needs. Group-based delivery formats can be particularly beneficial for fostering peer support and enhancing adherence. Clinicians are encouraged to integrate CBT alongside physical rehabilitation and pharmacotherapy to maximize holistic patient outcomes. Additionally, ongoing training for mental health professionals and physiotherapists in CBT-based pain management techniques can ensure the widespread and effective application of this evidence-based approach in clinical practice.

Authors' Contributions

Authors contributed equally to this article.

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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Ethical Considerations

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

References

Alaiti, R. K., Castro, J., Lee, H., Caneiro, J. P., Vlaeyen, J. W., Kamper, S. J., & Da Costa, M. F. (2022). What Are the Mechanisms of Action of Cognitive-Behavioral, Mind-Body, and Exercise-based Interventions for Pain and Disability in People With Chronic Primary Musculoskeletal Pain?: A Systematic Review of Mediation Studies From Randomized Controlled Trials. *The Clinical Journal of Pain*, *38*(7), 502-509. https://doi.org/10.1097/AJP.0000000000001047

Aslan Çİn, N. N., Açik, M., Tertemİz, O. F., Aktan, Ç., Akçali, D. T., Çakiroğlu, F. P., & Özçelİk, A. Ö. (2024). Effect of prebiotic and probiotic supplementation on reduced pain in patients with fibromyalgia syndrome: A double-blind, placebo-controlled randomized clinical trial. *Psychology, Health & Medicine*, *29*(3), 528-541. https://doi.org/10.1080/13548506.2023.2216464

Burns, J. W., Lumley, M. A., Vowles, K. E., Jensen, M. P., Day, M. A., Schubiner, H., Jaszczak, E., Abro, B., Addicks, S. H., Bordieri, M. J., Dow, M. M., Krohner, S., Mendoza, Z.,

PWJ
Psychology of Woman Journal
E-ISSN: 3041-8615

Meyer, E. C., Miro, D. Z., Tankha, H., Tubman, D. S., Yamin, J. B., & You, D. S. (2025). Comparative main effects, mediators, and moderators of cognitive behavioral therapy, acceptance and commitment therapy, and emotional awareness and expression therapy for chronic spinal pain: Randomized controlled trial rationale and protocol. *Contemporary Clinical Trials Communications*, 101428. https://doi.org/10.1016/j.conctc.2025.101428

Castel, A., Salvat, M., Sala, J. M., & Rull, M. (2008). Cognitive-behavioural Group Treatment With Hypnosis: A Randomized Pilot Trail in Fibromyalgia. *Contemporary Hypnosis*, *26*(1), 48-59. https://doi.org/10.1002/ch.372

Climent-Sanz, C., Hamilton, K. R., Martínez-Navarro, O., Briones-Vozmediano, E., Gracia-Lasheras, M., Fernández-Lago, H., Valenzuela-Pascual, F., & Finan, P. H. (2024). Fibromyalgia pain management effectiveness from the patient perspective: a qualitative evidence synthesis. *Disability and Rehabilitation*, *46*(20), 4595-4610. https://doi.org/10.1080/09638288.2023.2280057

Cojocaru, C. M., Popa, C. O., Schenk, A., Suciu, B. A., & Szasz, S. (2024). Cognitive-behavioral therapy and acceptance and commitment therapy for anxiety and depression in patients with fibromyalgia: a systematic review and meta-analysis. *Medicine and Pharmacy Reports*, *97*(1), 26. https://doi.org/10.15386/mpr-2661

Delasas, G. E., Delgado, N. M., Mojica, I. K., Ragasa, S., Manlapaz, D., & Dones Iii, V. (2025). Effectiveness of cognitive behavioral therapy versus conservative pain management on occupational performance in patients with low back pain: a systematic review protocol. *JBI Evidence Synthesis*. https://doi.org/10.11124/JBIES-23-00480

Erdrich, S., & Harnett, J. E. (2025). Fibromyalgia severity and symptoms are associated with the disorders of gut-brain interaction. *European Journal of Pain*, *29*(1), e4766. https://doi.org/10.1002/ejp.4766

Erickson, A. J., Rodriguez, J. C., Ravyts, S. G., Dzierzewski, J. M., Fung, C. H., Kelly, M. R., Ryden, A. M., Carlson, G. C., Josephson, K., Mitchell, M. N., Martin, J. L., & Alessi, C. A. (2024). The effectiveness of cognitive behavioral therapy for insomnia on sleep outcomes in the context of pain among older adult veterans. *Journal of the American Geriatrics Society*. https://doi.org/10.1111/jgs.18910

Favretti, M., Iannuccelli, C., & Di Franco, M. (2023). Pain Biomarkers in Fibromyalgia Syndrome: Current Understanding and Future Directions. *International Journal of Molecular Sciences*, *24*(13), 10443. https://doi.org/10.3390/ijms241310443

Fors, E. A., Wensaas, K. A., & Helvik, A. S. (2024). Prevalence and characteristics of fibromyalgia according to three fibromyalgia diagnostic criteria: A secondary analysis study. *Scandinavian journal of pain*, *24*(1), 20230143. https://doi.org/10.1515/sjpain-2023-0143

He, D., Guo, Z., McClure, M. A., Mu, Q., & Jiang, B. (2023). Cognitive-behavioral therapy for insomnia with objective short sleep duration phenotype: A systematic review with meta-analysis. *Sleep Medicine Reviews*, *67*, 101736. https://doi.org/10.1016/j.smrv.2022.101736

Hudson, J., Imamura, M., Robertson, C., Whibley, D., Aucott, L., Gillies, K., Manson, P., Dulake, D., Abhishek, A., Tang, N. K. Y., Macfarlane, G. J., & Brazzelli, M. (2025). Effects of Pharmacologic and Nonpharmacologic Interventions for the Management of Sleep Problems in People With Fibromyalgia: Systematic Review and Network Meta-Analysis of Randomized Controlled Trials. *Arthritis care & research*. https://doi.org/10.1002/acr.25505

Kalbadi Nezhad, M., Asadi, J., Pourasghar, M., & Aghaei, M. (2021). Comparing the Effectiveness of Cognitive-Behavioral Therapy and Cognitive-Behavioral Hypnotherapy on Resilience and Sleep Quality in Women with Fibromyalgia Syndrome. *Ravanshenasi Journal*, *10*(3). https://frooyesh.ir/article-1-2762-fa.html

Kolbadinejad, M., Asadi, J., Poorasghar Arabi, M., & Aghaei, M. (2022). Comparing the Effectiveness of Cognitive Behavioral Therapy and Cognitive Behavioral Hypnotherapy on Sexual Satisfaction in Women with Fibromyalgia Syndrome: A Clinical Trial. *Scientific Journal of Gorgan University of Medical Sciences*, *24*(1), 26-34. https://goums.ac.ir/journal/browse.php?a_id=3909&sid=1&slc_lang=en

Koulil, S. v., Lankveld, W. v., Kraaimaat, F. W., Helmond, T. v., Vedder, A., Hoorn, H. v., Donders, R., Jong, A. J. L. D., Haverman, J. F., Korff, K. J., Riel, P. L. C. M. v., Cats, H., & Evers, A. W. M. (2010). Tailored Cognitive–behavioral Therapy and Exercise Training for High-risk Patients With Fibromyalgia. *Arthritis care & research*. https://doi.org/10.1002/acr.20268

Kozel, G., Leary, O. P., Losee, Y., Ma, K. L., Carayannopoulos, A. G., Morris, J., & McLaughlin, E. (2024). Trends in engagement with cognitive-behavioral therapy for chronic pain conditions after referral. *Translational Behavioral Medicine*, *14*(3), 179-186. https://doi.org/10.1093/tbm/ibad079

Küster, O. C., Laptinskaya, D., Fissler, P., Schnack, C., Zügel, M., Nold, V., Thurm, F., Pleiner, S., Karabatsiakis, A., von Einem, B., Weydt, P., Liesener, A., Borta, A., Woll, A., Hengerer, B., Kolassa, I. T., & von Arnim, C. A. F. (2017). Novel Blood-Based Biomarkers of Cognition, Stress, and Physical or Cognitive Training in Older Adults at Risk of Dementia: Preliminary Evidence for a Role of BDNF, Irisin, and the Kynurenine Pathway. *J Alzheimers Dis*, *59*(3), 1097-1111. https://doi.org/10.3233/jad-170447

Lumley, M. A., Schubiner, H., Lockhart, N. A., Kidwell, K. M., Harte, S. E., Clauw, D. J., & Williams, D. A. (2017). Emotional awareness and expression therapy, cognitive behavioral therapy, and education for fibromyalgia: a cluster-randomized controlled trial. *Pain*, *158*(12). https://journals.lww.com/pain/fulltext/2017/12000/emotional_awareness_and_expression_therapy,.10.aspx

Marshall, A., Rapteas, L., Burgess, J., Riley, D., Anson, M., Matsumoto, K., Bennett, A., Kaye, S., Marshall, A., Dunham, J., Fallon, N., Zhao, S. S., Pritchard, A., Goodson, N., Malik, R. A., Goebel, A., Frank, B., & Alam, U. (2024). Small fibre pathology, small fibre symptoms and pain in fibromyalgia syndrome. *Scientific reports*, *14*(1), 3947. https://doi.org/10.1038/s41598-024-54365-6

McCrae, C. S., Williams, J., Roditi, D., Anderson, R., Mundt, J. M., Miller, M. B., & Robinson, M. E. (2019). Cognitive behavioral treatments for insomnia and pain in adults with comorbid chronic insomnia and fibromyalgia: clinical outcomes from the SPIN randomized controlled trial. *Sleep*, *42*(3), zsy234. https://doi.org/10.1093/sleep/zsy234

Murphy, J. L., Cordova, M. J., & Dedert, E. A. (2022). Cognitive behavioral therapy for chronic pain in veterans: Evidence for clinical effectiveness in a model program. *Psychological Services*, *19*(1), 95. https://doi.org/10.1037/ser0000506

Nakao, M., Shirotsuki, K., & Sugaya, N. (2021). Cognitive–behavioral therapy for management of mental health and stress-related disorders: Recent advances in techniques and technologies. *BioPsychoSocial Medicine*, *15*(1), 16. https://doi.org/10.1186/s13030-021-00219-w

Ozgunay, S. E., Kasapoglu Aksoy, M., Deniz, K. N., Onen, S., Onur, T., Kilicarslan, N., Eminoglu, S., & Karasu, D. (2024). Effect of hypnosis on pain, anxiety, and quality of life in female patients with fibromyalgia: Prospective, randomized, controlled study. *International Journal of Clinical and Experimental Hypnosis*, *72*(1), 51-63. https://doi.org/10.1080/00207144.2023.2277853

Pathak, A., Kelleher, E. M., Brennan, I., Amarnani, R., Wall, A., Murphy, R., Lee, H., Fordham, B., & Irani, A. (2025). Treatments for enhancing sleep quality in fibromyalgia: a systematic review and meta-analysis. *Rheumatology*, keaf147. https://doi.org/10.1093/rheumatology/keaf147

Ribatti, R. M., Merten, T., Lanciano, T., & Curci, A. (2025). Detecting simulated symptoms in chronic pain and fibromyalgia: A two-study evaluation of the Italian version of the Self-Report Symptom Inventory. *Applied Neuropsychology: Adult*, 1-9. https://doi.org/10.1080/23279095.2025.2475951

Sanabria-Mazo, J. P., Colomer-Carbonell, A., Fernández-Vázquez, Ó., Noboa-Rocamora, G., Cardona-Ros, G., McCracken, L. M., Montes-Pérez, A., Castaño-Asins, J. R., Edo, S., Borràs, X., Sanz, A., Feliu-Soler, A., & Luciano, J. V. (2023). A systematic review of cognitive behavioral therapy-based interventions for comorbid chronic pain and clinically relevant psychological distress. *Frontiers in psychology*, *14*, 1200685. https://doi.org/10.3389/fpsyg.2023.1200685

Zinchuk, M., Kustov, G., Tumurov, D., Zhuravlev, D., Bryzgalova, Y., Spryshkova, M., Yakovlev, A., & Guekht, A. (2025). Fibromyalgia in patients with non-psychotic mental disorders: Prevalence, associated factors and validation of a brief screening instrument. *European Journal of Pain*, *29*(2), e4730. https://doi.org/10.1002/ejp.4730

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