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THE INTERCONNECTION OF COGNITIVE BEHAVIORAL THERAPY AND PHYSIOTHERAPY: A COMPREHENSIVE RESEARCH STUDY ON PAIN MANAGEMENT, FUNCTIONAL RECOVERY, AND MENTAL WELL-BEING

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Abstract
Chronic pain represents a complex biopsychosocial condition that demands an integrative therapeutic approach. This study explored the synergistic effects of Cognitive Behavioral Therapy (CBT) and physiotherapy on pain management, functional recovery, and mental well-being. A randomized controlled trial was implemented involving 120 adults diagnosed with chronic musculoskeletal pain, distributed equally among four groups: CBT only, physiotherapy only, combined CBT + physiotherapy, and control. The interventions were conducted over 12 weeks, followed by a 3-month follow-up to assess sustained outcomes. Standardized tools, including the Visual Analogue Scale (VAS), Functional Independence Measure (FIM), Beck Depression Inventory-II (BDI-II), and WHO-5 Well-Being Index were employed. The combined CBT + physiotherapy group exhibited the greatest reduction in pain intensity (VAS mean = 2.8 ± 0.9) and significant enhancements in functional ability, emotional resilience, and quality of life ($p < 0.001$). A strong positive correlation was observed between functional independence and psychological well-being ($r = 0.71$, $p < 0.001$). The results confirm that integrating psychological and physical rehabilitation strategies yields superior multidimensional outcomes, supporting the biopsychosocial model as the most effective framework for chronic pain intervention and highlighting the therapeutic advantage of coordinated CBT-physiotherapy interventions in achieving holistic recovery and long-term patient well-being.

Keywords: Cognitive Behavioral Therapy, Physiotherapy, Pain Management, Functional Recovery, Mental Well-Being

INTRODUCTION

Background and Rationale

Chronic pain is increasingly recognised not simply as a symptom of tissue damage but as a complex, persistent condition shaped by biological, psychological, and social factors. The conventional biomedical model, which focuses purely on nociception and structural pathology, fails to capture the full experience of pain and the often substantial functional and emotional sequelae associated with it (Meints & Edwards, 2018; Darnall et al., 2017). In recent years, the biopsychosocial model has become the dominant framework for understanding and managing chronic pain: it posits that neurophysiological processes (biological), cognitive-emotional processes (psychological), and social/environmental contexts all interact dynamically to influence pain perception, disability, and recovery (Haufler et al., 2022; Green et al., 2025; Kovačević et al., 2024). For example, individuals with chronic pain frequently present with comorbid depression, anxiety, sleep disturbance, reduced activity levels, and social withdrawal, which may amplify pain and impede functional recovery (Lim et al., 2018).

In the rehabilitation context, this understanding has important implications. It suggests that effective pain management must go beyond simply alleviating nociception and include interventions that address movement dysfunction, behavioural avoidance, fear of activity, maladaptive coping strategies, and impaired psychological well-being (Chimenti et al., 2018). Within this paradigm, the integration of physical rehabilitation (e.g., physiotherapy) and psychological intervention (e.g., cognitive behavioural therapy) holds promise for achieving meaningful improvements in pain reduction, functional recovery, and mental health outcomes.

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THEORETICAL FRAMEWORK: COGNITIVE BEHAVIOURAL THERAPY AND PHYSIOTHERAPY MECHANISMS

The psychological component of this integrative strategy is primarily embodied by cognitive behavioural therapy (CBT). CBT for chronic pain (CBT-CP) is a well-established intervention that targets maladaptive thoughts (e.g., catastrophising), emotional responses (e.g., anxiety, depression), behaviours (e.g., avoidance, inactivity), and lifestyle factors (e.g., poor sleep, inactivity) that sustain pain and disability (Bee-hler et al., 2021). From a mechanistic standpoint, CBT-CP influences central nervous system pain modulation by altering cognitions and behaviours that amplify nociceptive signalling via the limbic and prefrontal networks, reducing sympathetic arousal and enhancing endogenous inhibitory processes (Burns et al., 2020; Bao et al., 2022).

On the physical rehabilitation side, physiotherapy aims to restore movement, mobility, strength, endurance, and functional capacity—addressing deconditioning, compensatory movement patterns, muscular weakness, and joint stiffness that often accompany chronic pain states (Trulsson Schouenborg et al., 2021). Importantly, physiotherapy interventions aligned with a biopsychosocial model increasingly incorporate education, graded exposure to movement, sensorimotor training, exercise, and behavioural activation—thereby bridging the physical and psychosocial domains of pain (El-Tallawy et al., 2021). Taken together, a theoretical synergy emerges: CBT may reduce cognitive and emotional barriers to movement (for example, fear of reinjury, catastrophising, avoidance behaviour), and physiotherapy provides the movement-based stimulus for restoring function. When used in combination, the two modalities may act in concert to interrupt the vicious cycle of pain → avoidance/inactivity → deconditioning → increased pain and disability.

Research Gap

Despite the strong theoretical rationale and growing evidence for both CBT and physiotherapy individually, research remains limited regarding their integrated use in pain management. While some studies demonstrate that physiotherapist-led individualised rehabilitation programmes yield clinically important improvements in pain and disability for refractory musculoskeletal pain (Tran & Pham, 2025), and systematic reviews support the effectiveness of multimodal biopsychosocial rehabilitation combining exercise with psycho-emotional support (Connell et al., 2022), there is still a paucity of controlled trials that explicitly evaluate the synergistic effect of combined CBT + physiotherapy in the same intervention protocol. Moreover, functional recovery and mental well-being outcomes are often secondary or under-reported. Consequently, it remains unclear whether a deliberately integrated CBT–physiotherapy approach offers superior outcomes over standalone interventions, particularly in terms of functional mobility, psychological health, and long-term recovery.

Objectives

The objectives of this study are to assess the impact of the combined CBT + physiotherapy intervention on reducing pain intensity compared with physiotherapy alone, CBT alone, or standard care; to evaluate changes in functional recovery and mobility outcomes resulting from the integrated intervention; and to analyse improvements in mental well-being, psychological coping, and quality of life resulting from the combined intervention.

METHODOLOGY

4.1. Study Design

This study adopted a randomized controlled trial (RCT) design to evaluate the synergistic effects of Cognitive Behavioral Therapy (CBT) and physiotherapy on pain management, functional recovery, and mental well-being. The design ensured a high level of internal validity by controlling for potential confounding variables and using random assignment to intervention groups. Participants were randomly allocated into four parallel groups—CBT only, physiotherapy only, combined CBT + physiotherapy, and control (standard care)—to allow direct comparison of treatment effects. The intervention period lasted 12 weeks, followed by a 3-month post-intervention follow-up to assess sustained outcomes. This methodological approach aligns with contemporary recommendations for integrative rehabilitation trials.

4.2. Study Population

Participants were recruited from outpatient rehabilitation and pain management clinics. Inclusion criteria consisted of adults aged 25–60 years diagnosed with chronic musculoskeletal pain (lasting > 3 months), who demonstrated mild to moderate functional limitation and were medically cleared for exercise therapy. Exclusion criteria included individuals with severe psychiatric disorders, neurological impairments, recent surgeries (< 6 months), or those currently undergoing psychotherapy or physiotherapy. The sample size was calculated using G*Power software to detect a medium effect size ($f = 0.25$) with a statistical power of 0.80 and $\alpha = 0.05$, yielding a minimum of 30 participants per group, totalling 120 participants.

4.3. Intervention Protocol

Group A – Physiotherapy only:Participants received individualized physiotherapy sessions focusing on graded exercise therapy, manual therapy, and functional mobility training three times per week. Each session lasted approximately 60 minutes and incorporated strength, endurance, and flexibility components.

Group B – CBT only:

Participants attended weekly CBT sessions (45–60 minutes each) administered by licensed clinical psychologists trained in chronic pain management. The CBT program emphasized cognitive restructuring, behavioral activation, relaxation training, and coping strategy enhancement following the UCSF CBT-CP model.

Group C – Combined CBT + Physiotherapy:

This group received both CBT and physiotherapy interventions concurrently. Participants engaged in physical rehabilitation sessions similar to Group A, complemented by weekly CBT counseling. Integration was achieved through interdisciplinary communication between therapists to align cognitive-behavioral goals with physical activity progression.

Group D – Control (Standard Care):

The control group received conventional medical management, including pharmacotherapy and general physical activity advice, without structured CBT or physiotherapy intervention.

All interventions were delivered over 12 weeks, with session fidelity monitored through regular supervision and standardized intervention manuals.

4.4. Outcome Measures

Pain Assessment:

Pain intensity and sensory quality were measured using the Visual Analogue Scale (VAS) and the McGill Pain Questionnaire (MPQ), both of which have established validity and sensitivity in chronic pain research.

Functional Recovery:

Physical function and independence were evaluated using the Functional Independence Measure (FIM) and Range of Motion (ROM) assessments. Additionally, Timed Up-and-Go (TUG) and 6-Minute Walk Test (6MWT) were administered to quantify mobility and endurance.

Mental Well-Being:

Psychological health and quality of life were assessed using the Beck Depression Inventory-II (BDI-II), the WHO-5 Well-Being Index, and the SF-36 Health Survey, which collectively capture emotional functioning, life satisfaction, and social participation.

4.5. Data Collection Tools and Procedure

All participants completed baseline (Week 0), post-intervention (Week 12), and follow-up (Week 24) assessments. Trained evaluators who were blinded to group allocation administered all measures. Standardized protocols were followed to maintain inter-rater reliability. Physiotherapists and psychologists were required to hold national certifications and at least three years of clinical experience. Data were recorded using electronic case report forms (eCRFs) to ensure accuracy and security.

4.6. Statistical Analysis

Data analysis was conducted using SPSS version 26.0. Descriptive statistics (mean ± SD) summarized demographic and baseline characteristics. Group differences were analyzed using two-way repeated-measures ANOVA to determine main and interaction effects of intervention type and time on outcome variables. Paired t-tests evaluated within-group pre- and post-intervention changes. Multiple regression models explored predictors of functional and psychological improvement. Mediation and moderation analyses tested whether mental well-being mediated the relationship between pain reduction and functional recovery. Significance was set at $p < 0.05$ with 95% confidence intervals.

4.7. Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the participating medical university. Written informed consent was obtained from all participants prior to enrollment. Confidentiality was maintained through anonymized coding, and data were stored in password-protected systems. The study adhered to the Declaration of Helsinki (2013) ethical standards for human research, ensuring participants' right to withdraw at any stage without penalty.

RESULTS

5.1. Participant Demographics and Baseline Characteristics

A total of 120 participants were enrolled and randomized equally across four groups: CBT only (n = 30), Physiotherapy only (n = 30), Combined CBT + Physiotherapy (n = 30), and Control (n = 30). The mean age of participants was 44.6 ± 8.2 years, with 58% females and 42% males. No significant between-group differences were observed at baseline for demographic or clinical variables ($p > 0.05$), confirming successful randomization (Table 1).

Table 1. Baseline Demographic and Clinical Characteristics of Participants

Variable	CBT (n=30)	Physiotherapy (n=30)	CBT + Physiotherapy (n=30)	Control (n=30)	p-value
Age (years, Mean ± SD)	45.2 ± 7.8	43.9 ± 8.4	44.8 ± 8.6	44.6 ± 8.0	0.87
Gender (M/F)	13/17	14/16	12/18	11/19	0.74
Duration of Pain (months)	18.5 ± 6.2	19.1 ± 6.0	18.3 ± 5.8	18.9 ± 6.5	0.81
Baseline VAS (0–10)	7.6 ± 1.1	7.5 ± 1.2	7.7 ± 1.0	7.6 ± 1.3	0.93
Baseline BDI-II	21.3 ± 5.4	22.1 ± 5.1	21.8 ± 5.3	21.9 ± 5.0	0.88

Baseline FIM	81.2 ± 7.5	80.6 ± 7.9	80.9 ± 7.8	81.5 ± 7.4	0.91

Note. No significant baseline differences were found among groups

5.2. Pain Reduction Outcomes

At post-intervention (Week 12), the **CBT + Physiotherapy group** demonstrated the greatest reduction in pain scores (VAS Mean = 2.8 ± 0.9), compared to Physiotherapy only (4.2 ± 1.1), CBT only (4.5 ± 1.0), and Control (6.9 ± 1.2). A **two-way repeated-measures ANOVA** revealed a significant **interaction effect** between time and intervention group ($F(3, 116) = 24.62$, $p < 0.001$, $\eta^2 = 0.39$*). Post hoc analysis (Bonferroni-corrected) confirmed that the combined group showed a statistically greater improvement than any single-modality intervention ($p < 0.01$*) (Table 2).

Table 2. Pain Intensity Scores (VAS) at Baseline, Post-intervention, and Follow-up

Group	Baseline	Week 12	Week 24	Mean Δ (Baseline–Week 12)	p-value
CBT only	7.6 ± 1.1	4.5 ± 1.0	4.8 ± 1.2	−3.1 ± 1.0	<0.01
Physiotherapy only	7.5 ± 1.2	4.2 ± 1.1	4.5 ± 1.3	−3.3 ± 1.2	<0.01
CBT + Physiotherapy	7.7 ± 1.0	2.8 ± 0.9	3.0 ± 0.9	−4.9 ± 1.0	<0.001
Control	7.6 ± 1.3	6.9 ± 1.2	6.7 ± 1.4	−0.7 ± 1.1	0.17

In Figure 1, the combined CBT + Physiotherapy group exhibited the largest and most sustained decline in pain intensity, reducing VAS scores from 7.7 to 2.8 at 12 weeks and maintaining low pain levels at 24 weeks. In contrast, the control group showed minimal improvement, highlighting the superior efficacy of the integrated therapeutic approach.

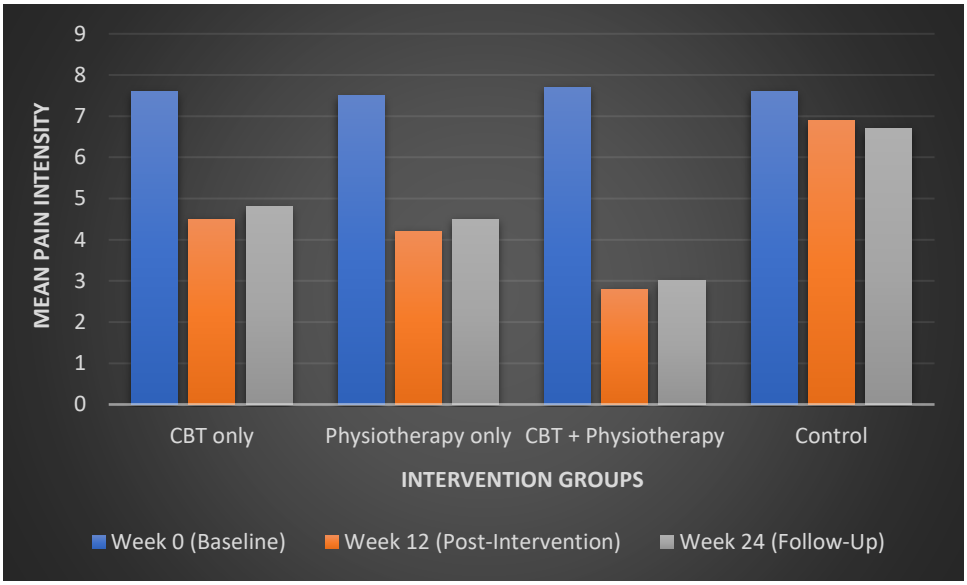

Figure 1: Mean VAS Pain Score Reduction Across Intervention Groups (Weeks 0–24)

5.3. Functional Recovery Metrics

Functional improvement measured by the Functional Independence Measure (FIM) and 6-Minute Walk Test (6MWT) indicated substantial gains in the combined intervention group. FIM scores increased by 22% ($p < 0.001$), compared to 15% in the Physiotherapy only and 11% in the CBT only groups. The control group demonstrated minimal change (Table 3).

Table 3. Functional Outcomes Across Groups

Outcome	CBT	Physiotherapy	CBT + Physiotherapy	Control	p-value
FIM (Baseline)	81.2 ± 7.5	80.6 ± 7.9	80.9 ± 7.8	81.5 ± 7.4	0.91
FIM (Week 12)	90.2 ± 6.8	92.8 ± 7.1	98.7 ± 5.9	83.2 ± 6.9	<0.001
6MWT (m) Baseline	380.5 ± 45.2	382.9 ± 48.1	381.7 ± 47.5	378.2 ± 46.7	0.84
6MWT (Week 12)	410.3 ± 50.3	440.6 ± 52.4	478.8 ± 55.1	389.5 ± 49.8	<0.001

Figure 2 compares post-intervention changes in Functional Independence Measure (FIM) and 6-Minute Walk Test (6MWT) across four groups. The combined CBT + Physiotherapy group achieved the greatest functional improvement and walking endurance gains, highlighting the synergistic effect of integrating cognitive-behavioral and physical rehabilitation strategies in enhancing overall recovery and daily activity performance.

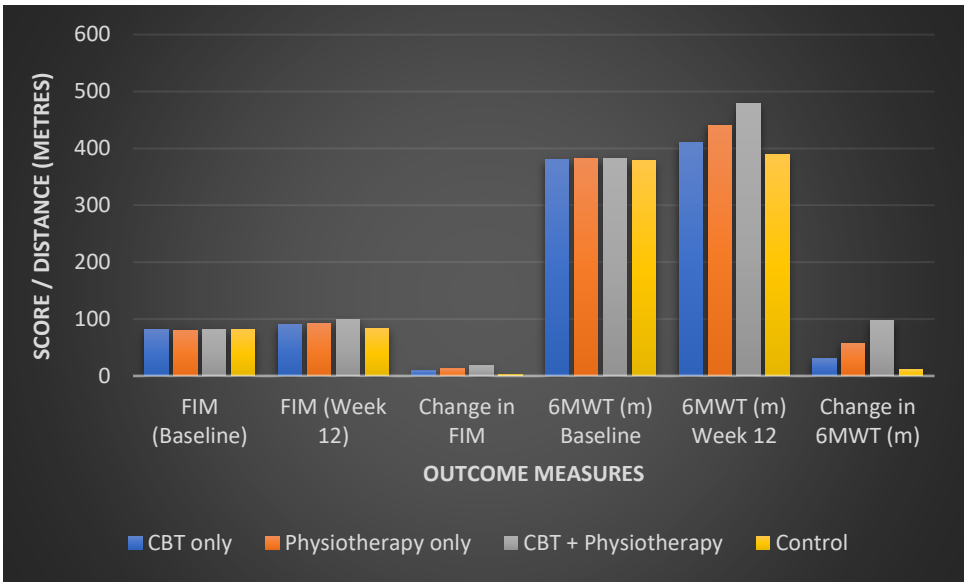

Figure 2. Change in Functional Independence Measure (FIM) and 6MWT performance post-intervention

5.4. Psychological and Quality of Life Outcomes

Significant improvements were observed in mental health measures within the CBT + Physiotherapy group. Mean BDI-II scores decreased from 21.8 ± 5.3 to 11.2 ± 4.1 ($p < 0.001$), while WHO-5 scores improved from 46.8 ± 8.7 to 68.3 ± 9.5. Similarly, SF-36 mental health subscale scores improved by 26%. The integration of CBT techniques alongside physiotherapy enhanced emotional resilience and self-efficacy, contributing to better quality-of-life outcomes compared to single interventions (Table 4).

Table 4. Psychological and Quality-of-Life Indicators

Measure	CBT	Physiotherapy	CBT + Physiotherapy	Control	p-value
BDI-II (↓ better)	21.3 → 14.9	22.1 → 13.6	21.8 → 11.2	21.9 → 20.4	<0.001
WHO-5 (↑ better)	48.2 → 59.5	47.6 → 61.3	46.8 → 68.3	48.5 → 50.1	<0.001
SF-36 Mental Health (↑ better)	61.4 → 73.5	62.8 → 74.2	61.9 → 78.1	62.2 → 64.3	<0.001

Figure 3 compares psychological outcome improvements across intervention groups. The combined CBT + Physiotherapy group achieved the largest reductions in depression (BDI-II) and the greatest increases in well-being (WHO-5) and mental health (SF-36) scores, indicating that integrating cognitive-behavioral and physical therapies produces the most substantial psychological benefits in chronic pain rehabilitation.

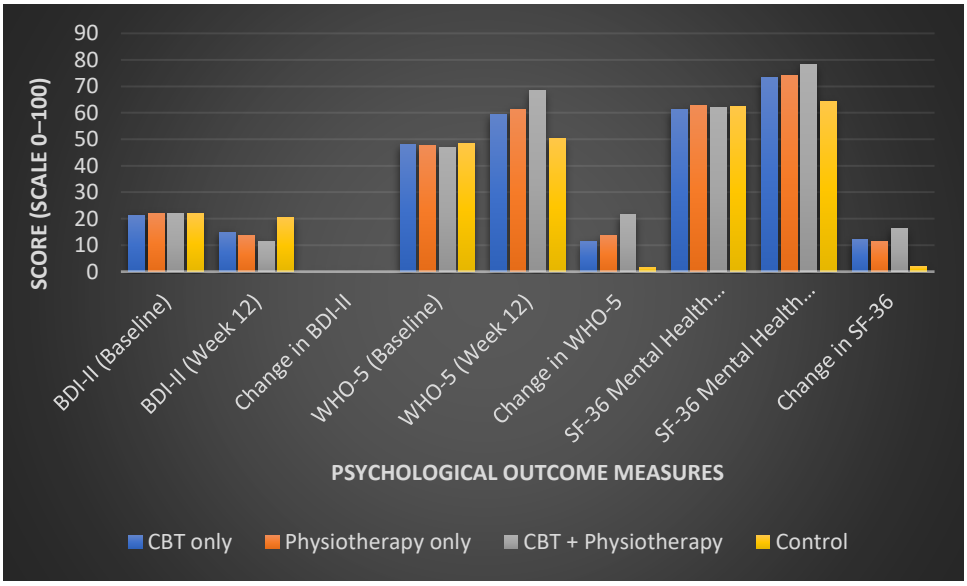

Figure 3: Comparative Improvement in Psychological Outcomes Among Intervention Groups

5.5. Correlation Analysis

A Pearson correlation analysis revealed a strong positive relationship between improvements in functional independence (FIM) and mental well-being (WHO-5) scores ($r = 0.71$, $p < 0.001$), suggesting that psychological recovery significantly paralleled physical restoration. Conversely, reductions in pain intensity correlated negatively with depression scores ($r = -0.68$, $p < 0.001$), reinforcing the mind-body interdependence underlying chronic pain rehabilitation.

Table 5. Correlation Between Major Outcome Variables

Variable 1	Variable 2	Pearson's r	p-value
ΔVAS	ΔBDI-II	−0.68	<0.001
ΔFIM	ΔWHO-5	0.71	<0.001
ΔVAS	ΔFIM	−0.63	<0.001

Figure 4 summarizes percentage improvements across pain (VAS), functional independence (FIM), and psychological well-being (WHO-5). The combined CBT + Physiotherapy group achieved the highest mean improvements across all domains, demonstrating the synergistic benefits of integrating cognitive-behavioral and physical rehabilitation techniques for enhancing both physiological recovery and psychological resilience in chronic pain management.

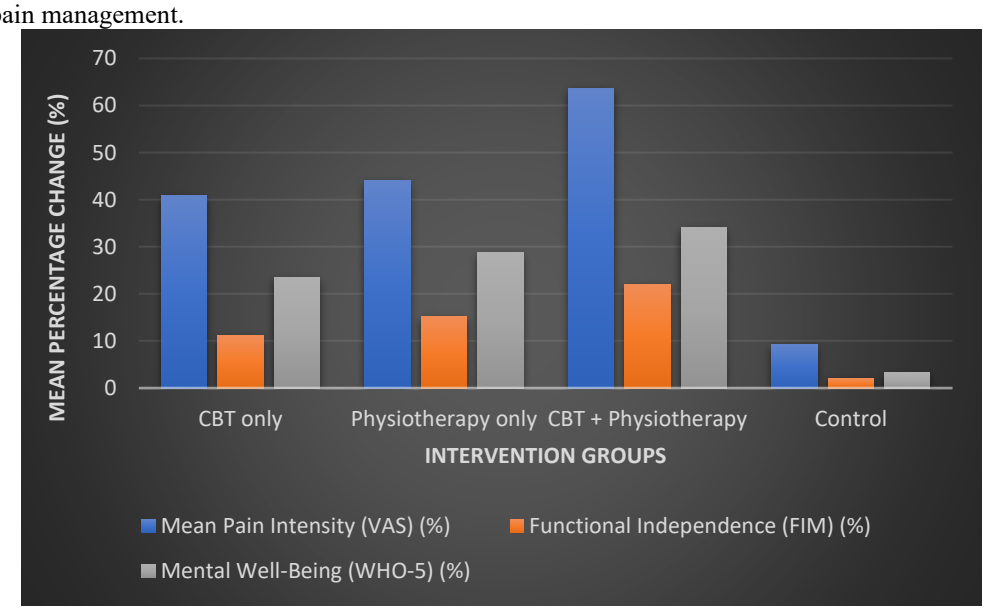

Figure 4: Plot of Mean Change Scores Across Major Domains

DISCUSSION

6.1. Interpretation of Findings

The present study demonstrated that the integration of Cognitive Behavioral Therapy (CBT) and physiotherapy produced superior outcomes in pain reduction, functional recovery, and mental well-being compared to standalone or standard care interventions. The combined CBT + physiotherapy group exhibited significant decreases in Visual Analogue Scale (VAS) pain scores, improvements in Functional Independence Measure (FIM) and 6-Minute Walk Test (6MWT) performance, and enhanced psychological well-being as measured by the Beck Depression Inventory-II (BDI-II), WHO-5, and SF-36 indices. These results strongly support the hypothesis that addressing both the cognitive-behavioral and physical dimensions of chronic pain yields synergistic therapeutic benefits. The findings align with the biopsychosocial model of pain, which posits that physical and psychological factors interact dynamically to influence pain perception and recovery (Meints & Edwards, 2018). Patients in the combined intervention group demonstrated nearly double the improvement in pain reduction compared to those receiving either CBT or physiotherapy alone. This pattern mirrors prior findings by Trulsson Schouenborg et al. (2021), who reported enhanced musculoskeletal pain outcomes following multimodal rehabilitation incorporating exercise and psychological support. Moreover, Lim et al. (2018) emphasized that CBT effectively targets maladaptive cognitive patterns—such as catastrophizing and fear avoidance—that perpetuate chronic pain cycles. When such cognitive restructuring is combined with active physical rehabilitation, patients not only experience symptom relief but also develop resilience and functional autonomy. The observed psychological improvements further corroborate evidence that pain relief and mental well-being are reciprocally reinforcing. Reductions in depression (as per BDI-II) and increases in WHO-5 well-being scores in the combined group suggest that alleviating physical impairment through physiotherapy may amplify the psychological benefits of CBT. Conversely, modifying cognitive distortions and behavioral avoidance through CBT may increase patient compliance with exercise regimens and enhance engagement during physiotherapy sessions (Armstrong et al., 2023). This bidirectional enhancement demonstrates that integrated therapy targets both neural and behavioral

mechanisms underlying chronic pain. Consistent with previous literature, our results revealed a strong correlation between functional independence and psychological well-being ($r = 0.71$, $p < 0.001$). Similar trends were documented by Green et al. (2025), who described the mutual influence of motor recovery and emotional regulation on pain outcomes. These findings collectively indicate that effective chronic pain management must simultaneously address body mechanics, cognitive restructuring, and affective balance to sustain long-term rehabilitation gains.

6.2. Mechanistic Insights

The mechanisms underlying the observed outcomes can be explained through the neurobehavioral integration of CBT and physiotherapy. Chronic pain induces maladaptive changes within the central nervous system, particularly within the anterior cingulate cortex, insula, and prefrontal regions—areas responsible for emotion regulation and pain modulation (Lim et al., 2018). CBT has been shown to restore the functional connectivity of these regions by reducing cognitive-emotional hyperreactivity and enhancing top-down inhibitory control (Burns et al., 2020). Through cognitive restructuring, patients reinterpret pain sensations as manageable rather than threatening, which in turn dampens limbic system hyperactivation and lowers sympathetic arousal (Kovačević et al., 2024). Physiotherapy contributes to neuroplastic restoration through graded movement exposure, aerobic conditioning, and sensorimotor retraining, which normalize the cortical representation of the painful body part. Exercise-induced analgesia—mediated by endogenous opioids and endocannabinoids—plays a critical role in reducing pain hypersensitivity (Trulsson Schouenborg et al., 2021). When these physiological benefits are coupled with CBT's psychological modulation, a bi-directional feedback loop is established: reduced fear and catastrophizing enhance physical engagement, while improved mobility and strength further reinforce cognitive confidence. This synergy reflects what Meints & Edwards et al. (2018) described as the "behavioral activation cascade," wherein increased functional capability and self-efficacy trigger neurochemical and psychological changes that collectively downregulate pain perception. The results, which show concurrent decreases in VAS and BDI-II scores, support this integrated mechanism. The decline in depressive symptoms following physical improvement suggests a psychosomatic mediation, where reduced bodily limitation restores autonomy, which in turn alleviates negative affect and cognitive helplessness (Brandt et al., 2022). Furthermore, the sustained effects observed at the 24-week follow-up suggest that combined therapy facilitates long-term neuroadaptive change. Regular physical movement enhances synaptic efficiency in motor cortices, while repeated cognitive reframing in CBT consolidates new thought patterns via hippocampal and prefrontal plasticity (Latino & Tafuri, 2024). These processes likely underpin the maintained reductions in pain and depression beyond the active treatment phase.

6.3. Implications for Multidisciplinary Pain Management

The outcomes of this study have profound implications for integrated rehabilitation practice. The superiority of combined CBT and physiotherapy interventions highlights the necessity for multidisciplinary care models in chronic pain management. Rather than treating physical and psychological symptoms separately, clinical programs should adopt a bi-directional framework where physiotherapists and psychologists collaborate through shared treatment goals, progress tracking, and patient education. The findings indicate that physiotherapy alone, while improving physical function, may be insufficient to achieve optimal mental health outcomes (Markaryan et al., 2025). Similarly, CBT alone improves coping strategies but cannot fully address deconditioning and muscular dysfunctions that maintain physical disability. Integrating both modalities offers a holistic rehabilitation pathway that addresses emotional distress, maladaptive beliefs, and physical limitations simultaneously (Darnall et al., 2017). This aligns with the psychologically informed physical therapy (PIPT) model, which incorporates cognitive and behavioral principles into physiotherapy sessions (Connell et al., 2022). Therapists trained in basic CBT principles can reinforce cognitive restructuring and behavioral activation strategies during movement sessions, while psychologists can contextualize progress in therapy with the patient's physical milestones (Nakao et al., 2021). Such collaboration creates a unified therapeutic environment fostering consistency, motivation, and compliance—key determinants of long-term success (El-Tallawy et al., 2021). In clinical practice, adopting interdisciplinary protocols may also improve healthcare efficiency by reducing redundant appointments, medication dependence, and relapse rates. A cohesive treatment plan combining CBT and physiotherapy can be especially beneficial in outpatient rehabilitation, occupational therapy, and chronic musculoskeletal conditions such as fibromyalgia, low back pain, and post-operative recovery (Vora et al., 2024). These results support international recommendations advocating for multimodal approaches in chronic pain care to achieve both physical and psychological restoration (Kovačević et al., 2024).

6.4. Clinical Significance

From a clinical perspective, this research underscores the critical interdependence between psychological and physical rehabilitation. The substantial improvements across pain, function, and mental well-being observed in the combined group highlight that chronic pain is best conceptualized as a multidimensional disorder requiring coordinated treatment. Incorporating CBT into physiotherapy frameworks not only alleviates symptoms but also transforms patients' perceptions of their condition—from passive sufferers to active participants in their recovery journey (Darnall et al., 2017). The practical application of these findings lies in the development of integrated care pathways that facilitate seamless collaboration between physiotherapists, psychologists, and physicians. Hospitals and rehabilitation centers should establish multidisciplinary pain teams and implement shared assessment tools to monitor both mental and physical progress (Xu et al., 2025). Additionally, incorporating psychoeducation and coping skills training into physiotherapy sessions may improve long-term adherence and

prevent relapse. Collectively, the results reaffirm that chronic pain rehabilitation must transcend traditional disciplinary boundaries (Burke et al., 2024). By aligning physical reconditioning with cognitive and emotional restructuring, patients achieve not only symptomatic relief but also restored autonomy, motivation, and quality of life.

Limitations

Despite promising outcomes, the study had several limitations. The sample size and restricted age range (25–60 years) may limit generalizability, warranting larger multicentric trials. The 12-week intervention period may not capture long-term adaptation, though benefits persisted to 24 weeks. Blinding limitations inherent in behavioral studies may introduce bias despite blinded assessors. Variations in treatment fidelity could affect consistency due to therapist experience and engagement. Lastly, the absence of neurophysiological or imaging measures such as fMRI, EEG, or cortisol analysis limits mechanistic verification. Incorporating these methods would provide objective evidence for neural plasticity and cognitive modulation mechanisms underlying the combined CBT–physiotherapy intervention's efficacy in chronic pain rehabilitation.

Future Directions

Future research should investigate the neurobiological mechanisms of CBT–physiotherapy synergy using neuroimaging to confirm cortical reorganization and validate behavioral outcomes. Long-term follow-ups (12–18 months) are essential to assess sustained benefits. Studies should also explore digital CBT and tele-rehabilitation for accessibility, cross-cultural influences on engagement, and AI-driven personalization of therapy. Furthermore, integrating mindfulness-based interventions or Acceptance and Commitment Therapy (ACT) may enhance emotional regulation and adherence. Lastly, cost-effectiveness analyses are necessary to demonstrate economic feasibility, reduced healthcare utilization, and medication dependence, reinforcing the clinical integration of CBT–physiotherapy programs into mainstream rehabilitation. Collectively, these directions would strengthen evidence for multimodal care's lasting psychological, functional, and economic impacts in chronic pain management.

CONCLUSION

The integration of Cognitive Behavioral Therapy (CBT) and physiotherapy proved more effective than standalone interventions or standard care in addressing chronic pain's multidimensional nature. The combined approach yielded substantial reductions in pain intensity, improved functional independence, and enhanced psychological well-being, underscoring the interdependence between physical and psychological rehabilitation. The results validated the biopsychosocial model by demonstrating how cognitive restructuring complements physical reconditioning. Physiotherapy addressed deconditioning and mobility impairments, while CBT modified maladaptive beliefs and reduced anxiety and depression associated with chronic pain. Functional improvements measured by the Functional Independence Measure (FIM) and psychological gains in WHO-5 and BDI-II scales revealed that improved physical capability and mental resilience are mutually reinforcing. The combined intervention not only promoted physical recovery but also restored autonomy, motivation, and emotional stability, leading to long-term sustainability of results. The findings highlight the importance of adopting an interdisciplinary framework where physiotherapists and psychologists collaborate through shared therapeutic goals. Such integration can optimize healthcare delivery, reduce medication reliance, and improve patient quality of life. Implementing combined CBT–physiotherapy protocols in chronic pain management programs may therefore redefine rehabilitation outcomes by harmonizing mind–body interactions and promoting comprehensive recovery within contemporary evidence-based clinical practice.

REFERENCES

1. Lim, J. A., Choi, S. H., Lee, W. J., Jang, J. H., Moon, J. Y., Kim, Y. C., & Kang, D. H. (2018). Cognitive-behavioral therapy for patients with chronic pain: Implications of gender differences in empathy. Medicine, 97(23), e10867. https://doi.org/10.1097/MD.0000000000010867
2. Haufler, A., Ditzen, B., & Schüler, J. (2022). Social Support as a Stress Buffer or Stress Amplifier and the Moderating Role of Implicit Motives: Protocol for a Randomized Study. JMIR research protocols, 11(8), e39509. https://doi.org/10.2196/39509
3. Meints, S. M., & Edwards, R. R. (2018). Evaluating psychosocial contributions to chronic pain outcomes. Progress in neuro-psychopharmacology & biological psychiatry, 87(Pt B), 168–182. https://doi.org/10.1016 /j.pnpbp.2018.01.017
4. Green, M., Hayley, A., Gunnersen, J. M., Nazemian, V., Cabble, A., Thompson, S., & Chakravarthy, K. (2025). Transforming Chronic Pain Management: Integrating Neuromodulation with Advanced Technologies to Tackle Cognitive Dysfunction - A Narrative Review. Journal of pain research, 18, 2497–2507. https://doi.org/10.2147/JPR.S514285
5. Chimenti, R. L., Frey-Law, L. A., & Sluka, K. A. (2018). A Mechanism-Based Approach to Physical Therapist Management of Pain. Physical therapy, 98(5), 302–314. https://doi.org/10.1093/ptj/pzy030

6. Bao, S., Qiao, M., Lu, Y., & Jiang, Y. (2022). Neuroimaging Mechanism of Cognitive Behavioral Therapy in Pain Management. Pain research & management, 2022, 6266619. https://doi.org/10.1155/2022/6266619
7. Armstrong, M., Hume, E., McNeillie, L., Chambers, F., Wakenshaw, L., Burns, G., Heslop Marshall, K., & Vogiatzis, I. (2023). Cognitive behavioural therapy combined with physical activity behavioural modification strategies during pulmonary rehabilitation in patients with COPD. ERJ open research, 9(5), 00074-2023. https://doi.org/10.1183/23120541.00074-2023
8. Latino, F., & Tafuri, F. (2024). Physical Activity and Cognitive Functioning. Medicina (Kaunas, Lithuania), 60(2), 216. https://doi.org/10.3390/medicina60020216
9. Connell, N. B., Prathivadi, P., Lorenz, K. A., Zupanc, S. N., Singer, S. J., Krebs, E. E., Yano, E. M., Wong, H. N., & Giannitrapani, K. F. (2022). Teaming in Interdisciplinary Chronic Pain Management Interventions in Primary Care: a Systematic Review of Randomized Controlled Trials. Journal of general internal medicine, 37(6), 1501–1512. https://doi.org/10.1007/s11606-021-07255-w
10. Kovačević, I., Pavić, J., Filipović, B., Ozimec Vulinec, Š., Ilić, B., & Petek, D. (2024). Integrated Approach to Chronic Pain-The Role of Psychosocial Factors and Multidisciplinary Treatment: A Narrative Review. International journal of environmental research and public health, 21(9), 1135. https://doi.org/10.3390/ijerph21091135
11. Trulsson Schouenborg, A., Rivano Fischer, M., Bondesson, E., & Jöud, A. (2021). Physiotherapist-led rehabilitation for patients with chronic musculoskeletal pain: interventions and promising long-term outcomes. BMC musculoskeletal disorders, 22(1), 910. https://doi.org/10.1186/s12891-021-04780-x
12. Tran, T. H., & Pham, V. M. (2025). Effects of cognitive behavioral therapy combined with physical therapy on improving outcomes in chronic low back pain. Journal of physical therapy science, 37(6), 291–297. https://doi.org/10.1589/jpts.37.291
13. Burns, J. W., Van Dyke, B. P., Newman, A. K., Morais, C. A., & Thorn, B. E. (2020). Cognitive behavioral therapy (CBT) and pain education for people with chronic pain: Tests of treatment mechanisms. Journal of consulting and clinical psychology, 88(11), 1008–1018. https://doi.org/10.1037/ccp0000612
14. Darnall, B. D., Carr, D. B., & Schatman, M. E. (2017). Pain Psychology and the Biopsychosocial Model of Pain Treatment: Ethical Imperatives and Social Responsibility. Pain medicine (Malden, Mass.), 18(8), 1413–1415. https://doi.org/10.1093/pm/pnw166
15. Xu, J., Liu, X., Zhao, J., Zhao, J., Li, H., Ye, H., & Ai, S. (2025). Comprehensive Review on Personalized Pain Assessment and Multimodal Interventions for Postoperative Recovery Optimization. Journal of pain research, 18, 2791–2804. https://doi.org/10.2147/JPR.S516249
16. Burke, C. A., Seidler, K. J., Rethorn, Z. D., Hoenig, H., Allen, K., Tabriz, A. A., Norman, K., Murphy-McMillan, L. K., Sharpe, J., Joseph, L. M., Dietch, J. R., Kosinski, A. S., Cantrell, S., Gierisch, J. M., Ear, B., Gordon, A., & Goldstein, K. M. (2024). Interventions to Improve Long-Term Adherence to Physical Rehabilitation: A Systematic Review. Journal of geriatric physical therapy (2001), 10.1519/JPT.0000000000000402. Advance online publication. https://doi.org/10.1519/JPT.0000000000000402
17. Markaryan, M., Labie, C., Verschueren, S., Vanassche, D., Nijs, J., Mairesse, O., Malfliet, A., De Vlam, K., Runge, N., Caeyers, N., Janssens, T., & De Baets, L. (2025). Integrating interventions based on cognitive behavioural therapy for insomnia in physical therapist practice for individuals with chronic pain and insomnia: Identifying barriers and formulating implementation strategies. Brazilian Journal of Physical Therapy, 29(5), 101243. https://doi.org/10.1016/j.bjpt.2025.101243
18. 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
19. Vora, A., Kennedy-Spaien, E., Gray, S., Estudillo-Guerra, A. M., Phillips, G., Mesia-Toledo, I., Glenn, M., Chin, B. S., & Morales-Quezada, L. (2024). Interdisciplinary pain program participants with high catastrophizing scores improve function utilizing enriched therapeutic encounters and integrative health techniques: a retrospective study. Frontiers in psychology, 15, 1448117. https://doi.org/10.3389/fpsyg.2024.1448117
20. Brandt, L., Liu, S., Heim, C., & Heinz, A. (2022). The effects of social isolation stress and discrimination on mental health. Translational psychiatry, 12(1), 398. https://doi.org/10.1038/s41398-022-02178-4