Original Article

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Physiotherapy Section

Effects of a Cognitive-behavioural Chronic Pain Management Program on Depression, Pain Physiology Knowledge and Quality of Life in Chronic Musculoskeletal Pain Patients: A Prospective Interventional Study

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ABSTRACT

Introduction: Chronic Musculoskeletal Pain (CMP) is a widespread condition that demands focused attention from physiotherapy professionals due to its substantial impact on physical functioning, mental health, and overall Quality of Life (QoL).

Aim: The present study primarily aimed to evaluate the intra-intervention effects of a cognitive-behavioural chronic pain management program on depression, pain physiology knowledge, and QoL in individuals with CMP.

Materials and Methods: The present prospective, interventional study at Spinex (Physiotherapy Primary Care Facility), Surat, Gujarat, India between July 2023 and July 2024 was employed with 38 participants completing the Cognitive-Behavioural chronic pain management intervention for eight weeks. Depression levels were measured using the Patient Health Questionnaire (PHQ-9), pain physiology knowledge using the Neurophysiological Pain Questionnaire (NPQ), and QoL using the World Health Organisation QoL (WHO-QoL) scale. Psychological distress was evaluated using the Subjective Units of Distress Scale (SUDS). Data were analysed for intra-intervention differences using paired t-tests and effect sizes with IBM Statistical Package for Social Sciences (SPSS) Statistics Version 25, with statistical significance set at $p<0.05$.

Results: Significant improvements were observed in all evaluated domains. Depression scores decreased markedly with a mean difference of 4.55 (CI: 3.08-6.02, $p<0.001$) and a large effect size (Cohen's d=1.02). Pain physiology knowledge improved significantly by 1.42 points (CI: 0.80–2.04, $p<0.001$) with a moderate effect size (Cohen's d=0.75). QoL improved across all domains, with the physical domain showing the highest effect size (Cohen's d=1.03, $p<0.001$). SUDS scores reduced consistently from baseline to the fourth follow-up (Mean difference=3.13, $p<0.001$).

Conclusion: The cognitive-behavioural chronic pain management program demonstrated significant positive effects on depression, pain physiology knowledge, QoL, and psychological distress. These findings highlight the efficacy of structured cognitive-behavioural interventions in managing chronic pain and its psychological impact.

Keywords: Chronic pain, Depression, Mental health, Physiotherapy, Patient education, Quality of life

INTRODUCTION

The CMP is a common condition that is often treated by physiotherapy healthcare professionals. It is a widespread issue that profoundly impacts physical functioning, mental health, and overall QoL [1]. People experiencing chronic pain frequently suffer from higher levels of depression, psychological distress, and a limited understanding of pain mechanisms, which can worsen their condition [2,3]. Despite the availability of various treatment options, many patients do not achieve sufficient pain relief [4]. Cognitive and behavioural-based interventions have shown promise in addressing both the physical and psychological dimensions of chronic pain [5]. These interventions aim to modify maladaptive thought patterns, enhance coping strategies, and improve patients' understanding of pain physiology [6]. In the present study, a cognitive-behavioural chronic pain management program has been developed to target these multifaceted aspects of chronic pain [7]. Therefore, the present study intended to evaluate the implementation outcomes of a biopsychosocial model-based Pain Management program in managing CMP. The program integrates education on pain physiology, psychological distress management, and quality-of-life enhancement strategies in its sessions. So, this study aimed to provide empirical evidence for the efficacy of the program in improving the physical and psychological outcomes of individuals with chronic pain, thereby addressing a critical gap in pain management strategies.

The objectives of the present study were to assess the intervention improvements in depression, pain physiology knowledge, QoL, and psychological distress during the implementation of the program.

Null Hypothesis (H_0): The biopsychosocial model-based pain management program will have no significant effect on depression levels, pain physiology knowledge, QoL, or psychological distress in individuals with CMP.

Alternate Hypothesis (H_1): The biopsychosocial model-based pain management program will significantly reduce depression and psychological distress, while improving pain physiology knowledge and QoL in individuals with CMP.

MATERIALS AND METHODS

The present prospective, interventional study was conducted over an 8-week period at Spinex (Physiotherapy Primary Care Facility), Surat, Gujarat, India between July 2023 and July 2024 to evaluate the efficacy and implementation outcomes of the cognitive-behavioural chronic pain management program in individuals with CMP. Ethical approval was obtained from the PP Savani University Ethical Review Committee on 11/05/2023. The study was prospectively registered

with the Clinical Trials Registry - India (CTRI) under the registration number CTRI/2023/05/053340, registered on 31/05/2023.

Sample size calculation: A simple prospective random sampling method was used to select participants for the study. The sample size was calculated based on an assumed medium to large effect size, with a power of 0.9 and a Type I error rate (α) of 0.05. Including an estimated 15% dropout rate, the total sample size was determined to be 40 participants for the single intervention group. The calculation was performed using G*Power software version 3.1.9.2 (Germany) [8,9].

Inclusion and Exclusion criteria: The study included 40 patients diagnosed with CMP attending a Physiotherapy Outpatient Clinic. Participants were screened based on inclusion criteria, which required persistent musculoskeletal pain for more than three months and no prior engagement in biopsychosocial interventions. Exclusion criteria included cognitive impairments, concurrent severe psychiatric conditions, or inability to attend follow-up sessions.

Study Procedure

The cognitive-behavioural chronic pain management program consisted of 16 structured sessions (each 1 hour) delivered over eight weeks.

Key components included:

Pain physiology education: Sessions focused on enhancing patients' understanding of pain mechanisms;

Psychological distress management: Techniques such as cognitive restructuring, relaxation exercises, and distress tolerance strategies were employed;

Quality-of-Life (QoL) enhancement self-management strategies: Addressed physical, and psychological, social, and environmental domains [10].

The cognitive-behavioural chronic pain management program was structured into several sessions aimed at equipping participants with effective pain management strategies. The initial four sessions concentrate on the underlying mechanisms of pain, neurophysiological education, and the biopsychosocial model, highlighting the roles of neuroplasticity and sensitisation. The fifth session introduces the concept of SMART goal setting (Specific, Measurable, Achievable, Relevant, and Time-bound) to facilitate the establishment of clear objectives. Subsequently, sessions six and seven cover essential pacing principles, along with relaxation techniques and breathing exercises aimed at pain management in daily life. The program continues with session eight to ten, which foster engagement in enjoyable activities and the application of cognitive-behavioural modifications to address unhelpful thought patterns. Session eleven focuses on strategies for managing distress and enhancing coping skills, followed by session twelve, which emphasises the importance of sleep hygiene. Sessions thirteen and fourteen provide insights into lifestyle and self-management tactics for sustained well-being. The program culminates in sessions fifteen and sixteen, which serve as interactive reviews that reinforce previously covered material. The implementation of the intervention adheres to the Template for Intervention Description and Replication (TIDieR) Checklist to ensure clarity and rigour [11].

Patient Health Questionnaire (PHQ-9): The PHQ-9 is a widely used self-report tool to assess depression severity. It consists of nine items, each scored on a 4-point scale from 0 to 3, where 0="not at all," 1="several days," 2="more than half the days," and 3="nearly every day." The total score ranges from 0 to 27, with higher scores indicating greater depression severity. Scores can be categorised as minimal (0-4), mild (5-9), moderate (10-14), moderately severe (15-19), and severe depression (20-27) [12].

WHOQOL-BREF: This questionnaire includes 26 items assessing QoL across four domains: physical health, psychological health, social relationships, and environmental health. Each item is rated on a 5-point Likert scale, with scores transformed into domain-specific scaled scores ranging from 0 to 100. Higher scores indicate better perceived QoL within each domain [13].

Subjective Units of Distress Scale (SUDS): The SUDS is a self-assessment tool used to measure current psychological distress or anxiety levels. It uses a simple numeric rating scale from 0 to 10, where 0 indicates "no distress" and 10 represents "the highest level of distress imaginable." It provides a quick and subjective measure of distress intensity at a given moment [14].

Neurophysiological Pain Questionnaire (NPQ): The NPQ evaluates an individual's knowledge and understanding of the neurophysiological mechanisms underlying pain. It typically consists of 12 true/false or multiple-choice items covering concepts such as pain processing, central sensitisation, and the role of the nervous system. Each correct answer scores 1 point, with total scores ranging from 0 to 12. Higher scores indicate greater understanding of pain physiology, which is important for cognitive-behavioural pain management approaches [15].

The intervention was delivered to participants by trained Physiotherapists. Eight therapists, who underwent three full days of training, were involved in administering the treatment intervention. Outcome measures were repeated at scheduled intervals throughout the program, and participants received feedback on their scores. The study adhered to the principles of the Declaration of Helsinki, and ethical approval and consent were obtained from all participants [16].

STATISTICAL ANALYSIS

Descriptive and inferential statistical analyses were conducted using SPSS v25. Continuous variables were expressed as mean (SD) and categorical variables as frequencies and percentages. Paired t-tests or one-way ANOVA assessed intra-intervention changes and Cohen's d measured effect sizes (Effect size highlights the magnitude of a result, offering insights into its real-world significance beyond mere statistical significance. Cohen's d with 0.2 considered small, 0.5 medium, and 0.8 large in practical impact). The p-values<0.05 were considered statistically significant. The final analysis was done for 38 subjects out of 40 as there were two dropouts. (Discontinued intervention (n=2) Job related -1; other illness-1)

RESULTS

The study consisted of 40 participants with a mean age of 49.1 ±12.3 years, of whom 67.5% were female and 32.5% male. The mean duration of symptoms was 38.9±50.02 months. The other characteristics in [Table/Fig-1] reflect a heterogeneous cohort experiencing significant physical, psychological, and social challenges associated with chronic pain.

Participant characteristics	n (%)
Age (Mean/SD) years	49.1/12.3
Gender n (%)	
Male	13 (32.5)
Female	27 (67.5)
Duration of symptoms (Months)	38.93±50.02
Occupation n (%)	
Housewife	21 (52.5)
Retired	3 (7.5)
Employed	16 (40)
Education n (%)	
Primary	7 (17.5)
Secondary	6 (15)
Higher secondary and above	27 (67.5)

Marital status n (%)	
Married	36 (90)
Single	4 (10)
Living status n (%)	
Joint family	25 (62.5)
Nuclear family	12 (30)
Alone	3 (7.5)
Comorbidities n (%)	
Yes	12 (30)
No	28 (70)
Previous surgeries n (%)	
Yes	35 (87.5)
No	5 (12.5)
Pain locations n (%)	
<3	25 (62.5)
>3	15 (37.5)

[Table/Fig-1]: Demographic characteristics of participants (n=40).
Demographic characteristics are given for all 40 participants and were recorded before exclusion of two participants for mentioned reasons

Depression, pain physiology knowledge, and Quality of Life (QoL): The intra-intervention outcomes demonstrated significant improvements in all evaluated domains. Depression levels (PHQ-9) decreased markedly with a mean difference of 4.55 (CI: 3.08–6.02, p<0.001), yielding a large effect size (Cohen's d=1.02). Pain physiology knowledge (NPQ) improved significantly by 1.42 points (CI: 0.80–2.04, p<0.001) with a moderate effect size (Cohen's d=0.75). QoL across physical, psychological, social, and environmental domains showed notable enhancements, with the physical domain exhibiting the largest effect size (Cohen's d=1.03, p<0.001) [Table/Fig-2].

Psychological distress: The SUDS scores showed a consistent reduction across follow-ups, decreasing from a baseline mean of 5.89 (SD=1.74) to 2.76 (SD=1.22) by the fourth follow-up (p<0.001) [Table/Fig-3].

DISCUSSION

The present study evaluated the effectiveness of a multidimensional intervention in addressing the multifaceted challenges faced by individuals with chronic pain, focusing on depression, pain physiology knowledge, QoL, and psychological distress. The findings revealed significant improvements across all measured outcomes, demonstrating the potential of comprehensive interventions for this population, hence supporting the null hypothesis.

The reduction in depression scores, as measured by the PHQ-9, was both statistically and clinically significant, with a large effect size (Cohen's d=1.02). This highlights the effectiveness of the intervention in addressing the psychological burden associated with chronic pain. Depression is commonly linked to increased pain perception and reduced coping mechanisms; therefore, its alleviation is crucial for improving overall well-being. The observed improvements in psychological well-being, coupled with enhanced knowledge of pain physiology, underscore the importance of psychoeducation and cognitive restructuring as key components of the intervention. Similarly, studies from the literature have demonstrated the effectiveness of cognitive-behavioural interventions in managing chronic pain and associated psychological outcomes. Vranceanu A-M et al., (2017) highlighted the role of CBT in addressing both pain perception and emotional distress, while Herning MM et al., (2005) emphasised its utility in promoting health-enhancing behaviours such as physical activity. Bernard P et al., (2018) further supported these findings through a meta-analysis, showing that combining CBT with exercise leads to significant improvements in depression, pain management, and QoL among individuals with chronic conditions [17-19].

Participants demonstrated a significant improvement in their understanding of pain physiology, as reflected by increased NPQ scores. This aligns with previous findings that pain neuroscience education can positively influence patients' beliefs, reduce fear-avoidance behaviours, and improve engagement with treatment strategies. The moderate effect size (Cohen's d=0.75) indicates a meaningful impact of the educational component on participants' cognitive appraisal of pain. Similarly, Van Oosterwijck J et al., (2013) and Malfliet A et al., (2018) reported that pain physiology education enhances health status and pain modulation, even among individuals with central sensitisation and chronic spinal pain, respectively [20,21].

QoL significantly improved across all domains (physical, psychological, social, and environmental), with the physical domain showing the largest effect size (Cohen's d=1.03). These results highlight the intervention's effectiveness in addressing both the functional and psychosocial aspects of chronic pain. Improvements in the physical domain likely stem from increased engagement in manageable activities facilitated by pacing strategies, while psychological and social enhancements reflect better emotional regulation and interpersonal interactions. Similarly, the improvement observed in QoL among participants supports the broader understanding that QoL is influenced by an interplay of biopsychosocial factors. Kim H et al., (2024) emphasised the

Outcome measure	CCPM group (n=38) Mean (SD)		Mean difference (CI Lower-upper)	Effect size Cohen's d	t value	p-value significance
	First measurement (1 week)	Follow-up (8 week)				
PHQ (0-27)	9.16 (4.48)	4.61(2.85)	4.55(3.08-6.02)	1.02	6.29	<0.001
NPQ (0-13)	4.47(1.89)	5.89(1.90)	1.42(0.80- 2.04)	0.75	4.62	<0.001
WHO- QoL (0-100)						
Physical	52.6(12.5)	64.5(10.1)	11.87(8.11-15.6)	1.03	6.40	<0.001
Psychological	50.7(12.4)	61.3(12.0)	10.61(6.68-14.5)	0.89	5.47	<0.001
Social	67.4(18.6)	77.5(14.2)	10.16(4.03-16.3)	0.55	3.36	<0.001
Environmental	61.2(12.6)	68.9(12.4)	7.71(3.72- 11.7)	0.64	3.92	<0.001

[Table/Fig-2]: Participants intervention results of outcome measures for depression, pain physiology knowledge & Quality of Life (QoL) of CCPM group.
Paired t-test with significance at p-value <0.05; PHQ: Patient Health Questionnaire; NPQ: Neurophysiological Pain Questionnaire; WHO QoL: World Health Organisation -Quality of Life

Outcome Measure	CCPM group (n=38) Mean (SD)					Chi-square value	p-value significance
	First measurement (week 1)	Follow-up 1 (week 2)	Follow-up 2 (week 3)	Follow-up 3 (week 5)	Follow-up 4 (week 7)		
SUDS (0-10)	5.89(1.74)	4.26(1.54)	3.82(1.18)	2.95(1.51)	2.76(1.22)	93.4	<0.001

[Table/Fig-3]: Participants intervention results of outcome measures for psychological distress of CCPM group.
Repeated measure Friedman Anova test with significance at p-value <0.05; SUDS: Subjective Units of Distress Scale

role of physical, psychological, and social determinants in shaping QoL among adults, highlighting the relevance of comprehensive interventions. Hutting N et al., (2019) further advocated for the role of physical therapists in promoting self-management strategies to address persistent musculoskeletal disorders. This aligns with the shift toward a more holistic health perspective, as proposed by Huber M et al., (2011), which views health as the ability to adapt and self-manage in the face of physical, emotional, and social challenges [22-24]. A steady and significant reduction in SUDS scores across follow-ups indicates a marked decrease in psychological distress over time. This finding emphasises the sustained impact of the intervention, likely driven by its focus on self-regulation techniques, activity pacing, and support mechanisms. Lower distress levels contribute to improved coping abilities and overall QoL, reinforcing the multidimensional nature of chronic pain management. Similarly, psychological distress among individuals with CMP can be effectively addressed through structured group-based interventions. In line with the present study's findings of reduced distress levels across multiple follow-ups, Haugli L et al., (2003) demonstrated that a group learning programme significantly alleviated psychological distress and improved functional outcomes, including employment status. This supports the role of psychoeducational and cognitive-behavioural strategies in enhancing emotional resilience and coping in individuals living with chronic pain [25].

The study's findings underscore the importance of integrating psychoeducation, activity pacing, and individualised therapeutic approaches in chronic pain management programs. The comprehensive nature of the intervention effectively addressed the interplay between physical and psychological symptoms, emphasising the need for Physiotherapists and healthcare providers to adopt holistic strategies [26].

Limitation(s)

While the results are promising, several limitations should be acknowledged. The small sample size and the relatively short duration of follow-up may limit the generalisability of findings. Additionally, the heterogeneous nature of the cohort, while reflective of real-world clinical populations, introduces variability that may influence outcomes. Future research should focus on larger, more diverse cohorts and explore the long-term sustainability of intervention benefits. Randomised controlled trials comparing this approach to other interventions are necessary to establish its efficacy conclusively.

CONCLUSION(S)

The study concludes that a biopsychosocial model-based cognitive-behavioural chronic pain management program is effective in reducing depression and psychological distress, improving pain physiology knowledge, and enhancing QoL in individuals with CMP. These findings contribute to the growing evidence base supporting the integration of biopsychosocial approaches in chronic pain management and highlight the need for further research to refine and optimise such interventions. This study highlighted the potential of a biopsychosocial model-based pain management program in enhancing outcomes for patients with CMP in physiotherapy practice.

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