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*Original Article*

# Determining the Effects of Multimodal Manual Therapy alone and MMT along with Cognitive Behavioral Therapy on Keele STarT Back Screening Tool in patients of Chronic Low Back Pain

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**Abstract**

**Background:** Low back pain (LBP) impacts 619 million individuals worldwide, leading to disability, decreased productivity, and significant economic costs. Addressing chronic low back pain (CLBP), which encompasses physical, psychological, and social dimensions, demands an integrated treatment strategy. Research indicates that combining Cognitive Behavioral Therapy (CBT) with Multimodal Manual Therapy (MMT) offers notable effectiveness. Randomized Controlled Trial (RCT). **Methods:** The study involved two groups: Group A, received MMT exclusively, and Group B, underwent a combination of CBT and MMT. Participants were closely matched by age and gender. Keele STarT Back Screening Tool (SBST) scores were recorded both before and after treatment to assess the risk of persistent disability, with statistical analyses performed to evaluate the effectiveness of the interventions within each group and between the groups. **Results:** The demographic analysis confirmed that both groups were well-matched, reducing the potential for bias in treatment outcomes. Pre-treatment SBST scores showed no significant difference between Group A and Group B. However, post-treatment, Group B exhibited significantly lower SBST scores than Group A, with a mean difference of 1.59. While both groups demonstrated significant improvements from pre- to post-treatment, the reduction was more pronounced in the CBT & MMT group. **Conclusion:** Combining CBT with MMT was more effective in lowering SBST scores, indicating a reduced risk of persistent disability compared to MMT alone. These findings emphasize the importance of integrating CBT with manual therapies for CLBP, reinforcing the value of a biopsychosocial approach that addresses both physical and psychological components in treatment planning.

***Keywords:*** *Chronic Low Back Pain; Cognitive Behavioral Therapy; Keele STarT Back Screening Tool; Multimodal Manual Therapy*

## Introduction

Low back pain (LBP) is one of the most widespread health issues worldwide, leading to significant disability, decreased work productivity, and considerable economic costs (Buchbinder *et al*., 2018). The World Health Organization (WHO) estimates that around 619 million people globally experience LBP,

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underscoring its importance as a major public health concern (Ferreira *et al.,* 2023). Chronic low back pain (CLBP), especially when persisting beyond 12 weeks, has a profound impact on quality of life, frequently leading to ongoing pain and disability. It is typically marked by dull or sharp pain in the lower back, sometimes extending to the legs, and is categorized as either specific or nonspecific depending on whether an identifiable pathology is present (Cho *et al*., 2012).

Congruently, numerous studies on individuals with CLBP have demonstrated a robust association between the presence of negative beliefs, such as catastrophizing thoughts or low expectations of recovery and heightened pain perception. These maladaptive cognitions not only amplify the subjective experience of pain but may also perpetuate disability and avoidance behaviors. Furthermore, CLBP has been linked to functional changes within the neural circuitry responsible for the cognitive and emotional regulation of pain. Such alterations in brain networks, particularly those involved in top-down modulation and cognitive control, can diminish an individual's ability to inhibit or reframe pain-related signals, thereby reinforcing the cycle of pain, distress, and impaired functioning (Chehadi *et al*., 2018).

**Literature Review**

Effective management of CLBP necessitates a holistic approach that accounts for the intricate interaction of physical, psychological, and social factors. This approach must address not only the physical symptoms but also the associated psychological distress and social impacts of the condition (Morley *et al*., 2013).

Pain neuroscience education (PNE) is an evidence-based educational strategy that moves patients away from a purely biomedical understanding of pain toward a more comprehensive, biopsychosocial perspective. It helps individuals learn that pain is not simply a direct reflection of tissue damage, but rather the result of complex processing within the nervous system that integrates sensory, cognitive, and emotional inputs. Through PNE, patients are taught about the mechanisms of peripheral and central sensitization, the role of the spinal cord and brain in modulating pain signals, and the influence of descending inhibitory and facilitatory pathways on their pain experience. At the same time, they are introduced to the powerful impact of psychological factors such as stress, fear of movement, catastrophizing, beliefs about pain, and past experiences, all of which can amplify or dampen the perception of pain. By gaining a clearer understanding of these physiological and psychological interactions, patients are often less fearful of movement, more motivated to participate actively in rehabilitation, and better able to employ self-management strategies. Ultimately, PNE empowers individuals to reconceptualize pain as a protective and modifiable process rather than an inevitable consequence of injury, which can improve adherence to treatment plans, reduce disability, and enhance functional outcomes (Tomás-Rodríguez *et al*., 2024).

Cognitive Behavioral Therapy (CBT) has shown promise as an intervention for managing CLBP, particularly when combined with other treatments such as Multimodal Manual Therapy (MMT). Beck (2020) has emphasized the potential advantages of integrated treatment strategies. Addressing this bidirectional relationship by deliberately fostering supportive social connections, whether through in-person interactions with family, peers, and community groups or through carefully moderated online platforms can have positive outcomes. These can, therefore, have a substantial impact on the health trajectory of these patients. Social engagement offers emotional support, reduces feelings of isolation, and provides opportunities for positive reinforcement of healthy behaviors, all of which can modulate stress responses and pain perception. At the same time, improved social networks often encourage greater adherence to therapeutic exercise and self-management programs, which in turn can enhance physical function and participation in daily activities. In this way, cultivating meaningful social relationships both offline and online does not merely address psychosocial aspects of illness but also promotes measurable gains in quality of life, functional independence, and long-term health outcomes (Bannon *et al*., 2021).

Homework assignments are a core component of many CBT protocols because they extend the therapeutic process beyond the confines of the consultation room. By engaging in structured exercises between sessions, patients are asked to apply concepts discussed with the therapist such as cognitive

restructuring, behavioral experiments, or exposure tasks to real-life situations. This practice not only reinforces the material learned in therapy but also encourages individuals to identify and monitor their own maladaptive thought patterns and behaviors as they occur in daily life. As patients repeatedly observe the links between their thoughts, emotions, and actions, they develop greater self-awareness and mastery over the strategies taught in CBT. Consistent completion of homework has been associated in the literature with stronger treatment adherence, faster symptom reduction, and improved long-term outcomes, underscoring its role as an active ingredient rather than a supplementary activity in evidence-based cognitive-behavioral interventions (Kazantzis & Miller, 2022).

Around 99% of LBP cases are classified as "nonspecific," meaning they lack identifiable objective findings. These cases are often linked to factors such as stress, limited physical activity, smoking, and obesity. In contrast, less than 15% of back pain episodes are attributed to nerve root or spinal pathology (Chou *et al*., 2009). However, no specific anatomical cause has been identified for the majority of these cases (Airaksinen *et al*., 2006).

A CBT intervention typically involves a structured programme of several sessions conducted by a trained and experienced therapist. The frequency and duration of these sessions can vary according to the patient's condition, goals, and response to treatment, but they are usually scheduled weekly or bi-weekly over a period of weeks or months to allow for progressive skill acquisition. Within each session, a range of evidence-based activities is implemented to address the multifaceted nature of pain and associated distress. These may include PNE to help patients understand how thoughts and emotions influence their perception of pain; relaxation training and breathing exercises to reduce physiological arousal; cognitive restructuring techniques to identify and manage automatic, maladaptive thoughts; stress management strategies; problem-solving skills to enhance coping with daily challenges; and sleep hygiene or education to improve restorative rest. By combining these elements in a systematic way, CBT aims to reduce symptom severity, improve functional outcomes, and enhance the patient's overall quality of life (Murphy *et al*., 2020).

Chronic pain, particularly chronic nonspecific LBP, appears to be far more destructive and disruptive to daily functioning than acute pain, which typically serves as an adaptive short-term warning signal alerting the individual to potential tissue damage. While acute pain can facilitate protective behaviors and healing, chronic pain often loses this protective purpose and becomes maladaptive. Over time, many patients with chronic nonspecific LBP begin to develop negative expectations about the nature and consequences of their pain. These beliefs frequently extend to their perceptions of personal capability and resilience, leading to diminished confidence in their ability to cope with pain or carry out normal activities. As a result, fear of re-injury or exacerbation of symptoms often drives avoidance behaviors, such as reluctance to return to work, exercise, or engage in everyday tasks. This cycle of fear-avoidance not only perpetuates disability and functional decline but also reinforces maladaptive pain-related cognitions, thereby contributing to a chronic pain state that is more complex and challenging to treat than acute pain (Reme *et al*., 2008).

The management of acute and sub-acute LBP involves various treatment protocols based on prognosis. Medical guidelines highlight the importance of offering updated advice to promote physical activity and discourage prolonged bed rest. However, there is still uncertainty surrounding effective strategies for preventing the progression to CLBP, despite the acknowledged importance of this issue (Campbell *et al*., 2013). LBP poses a major challenge in industrialized countries, with efforts aimed at preventing acute and sub-acute cases from becoming chronic. The prevalence of LBP among adults' ranges from 20% to 56%, yet only 6.4% of those affected in the UK seek treatment from healthcare professionals (Freburger *et al*., 2009).

Disabling LBP without identifiable serious pathology can be understood as a complex blend of neurobiological and behavioral reactions to an individual's real or perceived threats to their body, lifestyle, social roles, or overall physiological balance. This reaction is shaped by a cascade of alterations across the neuroendocrine, immune, and motor systems. These alterations are further modulated by a unique mix of genetic predispositions, structural or anatomical factors, physical status,

psychological state, social and lifestyle influences, and other health-related variables that cannot easily be separated from one another. The relative contribution of these factors also shifts across the lifespan. Together, these dynamic and interdependent elements influence inflammatory activity, pain perception, emotional distress, and subsequent behavioral responses (Hodges & Tucker, 2011).

However, other research indicates that 8% of individuals with LBP develop chronic pain, particularly among those whose symptoms persist for more than three months. This subgroup accounts for 75% of the total costs associated with LBP, along with poor rehabilitation outcomes (Chen *et al*., 2018). The management of CLBP includes rehabilitation through non-pharmacological therapies, such as education and encouragement, in addition to pharmacological treatments like analgesics. Ongoing reassessment is crucial, as many CLBP patients develop negative perceptions of their abilities, have difficulty coping with pain, and fear resuming normal activities due to the risk of further injury (Devasahayam *et al*., 2014). Therefore, CBT is an effective approach for addressing the psychosocial factors and maladaptive coping strategies that often arise during the extended recovery period in CLBP patients (Kamper *et al*., 2014).

Patients who exhibit an external health locus of control, that is, the belief that their symptoms and recovery are primarily determined by factors outside of their own influence often struggle to cope effectively with their condition. CBT interventions offer a valuable approach to modify these perceptions by fostering a more internalized sense of control over health outcomes. Through structured education, cognitive restructuring, and skills training, CBT can help individuals enhance their coping strategies, increase self-efficacy, and develop more adaptive beliefs about their ability to influence symptom management and recovery (Morley, 2011).

**Methodology**

A randomized controlled trial (RCT) was conducted at Akhtar Saeed Clinic of Physical Therapy in Lahore, Pakistan, with two intervention groups. Participants were randomly assigned to one of two groups: Group A, received MMT alone, and Group B, received both MMT and CBT. Both groups consisted of an equal number of participants. The study involved 108 individuals with CLBP who were at moderate risk of long-term disability. Participants were recruited through advertisements in local medical and allied health practices, inviting individuals experiencing LBP to take part.

Eligibility was determined by the treating practitioner, who used the SBST and a standardized assessment form during the initial consultation. This tool categorized participants as being at medium risk, indicating a moderate likelihood of developing CLBP. All eligible participants provided written informed consent after being fully informed about the study procedures. To qualify, individuals had to be over 18 years of age and had non-specific LBP lasting more than three months, as confirmed by the SBST. Those with severe spinal conditions (e.g., fractures, cancer, or infections), inflammatory diseases, canal stenosis, or cauda equina syndrome were excluded (Duncan *et al*., 2025).

**Ethical Consideration**

The research obtained ethical clearance from the Department of Physiotherapy and Rehabilitation Ethical Approval Committee of Akhtar Saeed College of Rehabilitation Sciences, Lahore, Pakistan with reference number: REC-18-2024 on 9th October 2024.

**Results**

***Table 1: Demographic Variables Across Two Groups***

| Variable | | Group A (MMT) | Group B (CBT & MMT) |
|---|---|---|---|
| **Age (Mean ± SD)** | | 47.01 ± 15.25 | 47.16± 15.03 |
| **Gender N (%)** | **Male** | 46.3 (25.0) | 51.9 (28.0) |
| | **Female** | 53.7 (29.0) | 48.1 (26.0) |

The mean age of participants in both groups was approximately 47 years, with Group A having a mean age of 47.01 years (SD = 15.25) and Group B a mean age of 47.16 years (*SD* = 15.03). The age distribution between the two groups was nearly identical, with a negligible difference in mean age,

suggesting that age was well-matched across the groups and minimizing the potential for age-related bias in the treatment outcomes. The gender distribution had a slight difference, with Group A having a higher proportion of females and Group B having more males. However, these differences are minimal, indicating that gender was relatively balanced between the two groups.

***Table 2: Between and within the Group Comparison for SBST***

| Variable | Group A (MMT) (Mean ± SD) | Group B (CBT & MMT) (Mean ± SD) | Mean Difference 95% CI | *p* value |
|---|---|---|---|---|
| **Pre-Treatment SBST** | 6.22 ± 1.44 | 6.57 ± 1.70 | 0.31 [0.28,0.91] | 0.303 |
| **Post-Treatment SBST** | 2.90 ± 0.99 | 1.31 ± 0.63 | 1.59 [1.27,1.91] | <0.001 |
| **Mean Diff** | 3.31 [2.83,3.79] | 5.22 [4.70,5.74] | | |
| ***P* value** | <0.001 | <0.001 | | |

The pre-treatment SBST scores were slightly higher in Group B (Mean ± SD = 6.57 ± 1.70) compared to Group A (Mean ± SD = 6.22 ± 1.44), though this difference was not statistically significant ($p = 0.303$). This suggests that both groups had similar baseline levels of disability risk, allowing for a fair comparison of post-treatment outcomes. After treatment, Group B showed a significantly lower mean SBST score (Mean ± SD = 1.31 ± 0.63) compared to Group A (Mean ± SD = 2.90 ± 0.99), with a mean difference of 1.59 ($p < 0.001$). This substantial reduction in Group B's SBST score indicates that the combination of CBT and MMT was more effective in reducing the SBST scores than MMT alone.

Both groups demonstrated significant improvements in their SBST scores from pre- to post-treatment. Group A showed a mean reduction of 3.31 (95% CI = 2.83, 3.79, $p < 0.001$), while Group B exhibited a larger mean reduction of 5.22 (95% CI = 4.70, 5.74, $p < 0.001$), both with $p$ values < 0.001. The greater reduction in Group B underscores the superior effectiveness of the combined treatment (CBT and MMT) in reducing the scores of SBST.

The demographic analysis confirmed that both groups were well-matched in terms of age and gender distribution, minimizing any demographic biases. With comparable pre-treatment SBST scores, the groups started with similar levels of disability risk. Post-treatment, the combined CBT and MMT approach demonstrated greater efficacy in reducing SBST scores compared to MMT alone. Both groups experienced significant improvements, but the larger magnitude of improvement in the combined treatment group highlights the potential benefits of integrating CBT with MMT for managing CLBP.

**Discussion**

The demographic analysis indicates that both groups were comparable in terms of age and gender distribution. The average age of participants in Group A (MMT) was 47.01 years, while Group B (CBT & MMT) had an average age of 47.16 years. This minor difference helps minimize age-related biases, ensuring a fair comparison of treatment outcomes. Additionally, the gender distribution was balanced in both groups, which is important as gender can impact pain perception and treatment response. This balance is crucial for minimizing gender-related confounding factors in the study.

The pre-treatment SBST scores were slightly higher in the CBT & MMT group compared to the MMT-only group (6.57 ± 1.70 vs. 6.22 ± 1.44), although this difference was not statistically significant ($p = 0.303$). This indicates that both groups had similar baseline levels of fear of movement and risk of continued disability, ensuring that any observed differences in post-treatment outcomes can be attributed to the interventions rather than pre-existing disparities. This comparability is essential for establishing a fair starting point for the interventions, leading to more reliable conclusions regarding the effectiveness of the treatments. Post-treatment SBST scores revealed a significant reduction in both groups, but the reduction was more substantial in the group receiving the combination of CBT and MMT. Group B's post-treatment SBST score was 1.31 ± 0.63, compared to 2.90 ± 0.99 in Group A, with a mean difference of 1.59 ($p < 0.001$). This notable reduction in SBST scores in the CBT & MMT group highlights the added benefit of integrating cognitive–behavioral strategies with manual therapy in managing CLBP. Research supports the efficacy of CBT in managing chronic pain by addressing psychological factors that contribute to pain perception and disability. Previous studies have reported

that CBT interventions effectively reduce kinesiophobia and improve physical functioning in chronic pain patients. The findings of the current study align with these previous studies, further emphasizing the role of CBT in enhancing the effectiveness of traditional manual therapies (Morley *et al*., 2013).

Studies have also supported that similar to nontargeted interventions, they neither target multiple aspects of an individual's pain experience nor individualize the targeting of such factors for each patient. Understanding these interacting processes such as CBT, demands a flexible multidimensional clinical reasoning framework, which allows the clinician to identify the various factors that can contribute to disabling LBP and act as targets for change in each individual (Falla *et al*., 2024).

Both groups experienced significant improvements in their SBST scores from pre- to post-treatment. Group A (MMT) exhibited a mean reduction of 3.31 ($p < .001$), while Group B (CBT & MMT) exhibited a larger mean reduction of 5.22 ($p < .001$). The greater reduction in the CBT & MMT group indicates that the multimodal approach was more effective in reducing fear of movement and risk of continued disability than MMT alone. The effectiveness of multimodal approaches in managing CLBP is well documented. For instance, it has been found that combining physical and psychological interventions is more effective than either approach alone in reducing pain and disability in CLBP patients. This study adds to this evidence by demonstrating that the combination of CBT and MMT is particularly effective in reducing kinesiophobia, a key predictor of long-term disability in CLBP patients (Kamper *et al*., 2014).

It is now widely acknowledged that the experience of pain is not simply an incoming message regarding tissue “damage” from the periphery. Instead, the pain experience reflects the person's assessment of how dangerous a particular input such as nociceptive input from an intervertebral disk, on the basis of not just the intensity of the input but also the person's prior experiences, beliefs, and contextual factors. Therefore, it is unsurprising that pain characteristics for individuals with disabling LBP are highly variable and fluctuate over time, reflecting the influence of different multidimensional influences on pain mechanisms (Rabey *et al*., 2015). One premise of CBT is that thoughts create a physiological response that usually includes adrenaline and cortisol. Thoughts may represent cognitive distortions that have little to do with reality. The result may be unpleasant in that it includes a physical sense of alertness and tension to enable a “fight or flight” response. CBT aims to create an awareness of these distortions and resultant maladaptive behaviors (i.e., to identify automatic negative thoughts). CBT has been reported to be effective in treating anxiety and depression as well as other mental health conditions. CBT is particularly relevant to the treatment of chronic pain, in that different stressors and states of mind have an adverse effect on the perception of pain and functional outcomes (Vallury *et al*., 2015).

The findings of this study have significant clinical implications. Firstly, they suggest that integrating CBT into manual therapy regimens can lead to better outcomes for patients with CLBP, particularly in reducing kinesiophobia and the associated risk of disability. This aligns with current clinical guidelines, which recommend a bio-psychosocial approach to managing chronic pain, incorporating both physical and psychological interventions. Secondly, the study underscores the need for individualized treatment plans that consider both the physical and psychological aspects of chronic pain. Given the significant improvements observed in the CBT & MMT group, clinicians should consider incorporating cognitive-behavioral strategies into their treatment protocols for CLBP patients, especially those with high levels of kinesiophobia or psychological distress. Finally, the study highlights the importance of early intervention. The greater improvements observed in the CBT & MMT group suggest that addressing psychological factors early in the treatment process can lead to better outcomes. This is particularly relevant in the context of CLBP, where fear of movement and avoidance behaviors can exacerbate pain and disability over time.

**Limitations**

While this study provides valuable insights into the benefits of combining CBT with MMT for CLBP, it also has some limitations. The study was conducted in a specific population, and the findings may not be generalizable to other populations or settings. Additionally, the study did not assess long-term outcomes, so it is unclear whether the benefits of the combined treatment persist over time. Future research should address these limitations by conducting larger, more diverse studies and by assessing

the long-term efficacy of combined CBT and MMT interventions. Moreover, future studies should explore the mechanisms underlying the observed benefits of CBT and MMT. Understanding how these interventions interact to reduce kinesiophobia and disability could help refine treatment protocols and further improve patient outcomes.

## Conclusion

In conclusion, the combination of CBT and MMT proves to be more effective than MMT alone in reducing the SBST scores and the associated risk of disability in patients with CLBP. These findings align with previous research that highlights the advantages of multimodal approaches in pain management and emphasize the importance of addressing both the physical and psychological aspects of chronic pain. Clinicians are encouraged to incorporate CBT into their treatment protocols for CLBP to improve patient outcomes and alleviate the burden of chronic pain.

## Conflict of Interest

The author(s) declare that there is no conflict of interest regarding the publication of this article.

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