

A SYSTEMATIC REVIEW OF "CORE STABILIZATION VS. STRENGTHENING IN CHRONIC LOW BACK PAIN"

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Abstract: One of the most prevalent musculoskeletal conditions in the world, non-specific chronic low back pain (NSCLBP) is linked to discomfort, disability, decreased functional ability, and a poor quality of life. A safe and successful conservative therapy strategy for NSCLBP is exercise-based rehabilitation. Core stabilisation exercises (CSE) and muscle strengthening exercises (MSE) are two of the many exercise therapies that are frequently advised for increasing functional performance, lowering discomfort, and improving spinal stability. The goal of the current systematic review was to assess how core stabilisation and muscle strengthening exercises affected those with chronic low back pain that wasn't specific.

Electronic databases such as PubMed, Google Scholar, Cochrane Library, and Medline were used to conduct a systematic review of literature published between 2018 and 2024. Included were relevant clinical papers, systematic reviews, and randomised controlled trials examining the effects of CSE and MSE in NSCLBP patients. Exercise-based therapies for chronic low back pain that were published in English were chosen based on predetermined inclusion and exclusion criteria.

The review's conclusions showed that in individuals with NSCLBP, both core stabilisation and muscle strengthening exercises significantly reduced pain intensity, improved spinal stability, increased muscular strength and endurance, and lowered functional impairment. Neuromuscular control, posture, proprioception, and activation of deep trunk muscles including the transversus abdominis and multifidus were all enhanced by core stabilisation activities. By increasing the strength and stamina of the hip stabilisers, gluteal muscles, and lumbar extensors, muscle strengthening activities lessened the mechanical strain on the lumbar spine. Additionally, a number of studies noted benefits in range of motion, flexibility, balance, and general quality of life. Exercise regimens that combined CSE and MSE produced better results than single therapies.

In summary, non-invasive, safe, and successful treatments for non-specific persistent low back pain include core stabilisation and muscle building exercises. These exercise methods are important for improving general spine health, reducing pain, improving function, and preventing recurrence. For people with NSCLBP, customised exercise regimens with sustained adherence may offer the best treatment results.

Index Terms— Non-specific chronic low back pain, Core stabilization exercises, Muscle strengthening exercises, Exercise therapy, Physiotherapy, Rehabilitation, Systematic review.

1 INTRODUCTION

Low back pain (LBP) is one of the most common musculoskeletal disorders affecting individuals across all age groups and socioeconomic backgrounds. It is characterized by pain, discomfort, stiffness, or functional limitation localized between the lower rib margin and the gluteal folds. Chronic low back pain, particularly non-specific chronic low back pain (NSCLBP), has emerged as a major public health concern because of its high prevalence, recurrent nature, and association with disability and reduced quality of life. NSCLBP refers to low back pain that persists for more than 12 weeks without a clearly identifiable pathological cause such as fracture, infection, tumor, inflammatory disease, or nerve root compression.

Globally, low back pain is recognized as one of the leading causes of years lived with disability. The burden of chronic low back pain affects not only physical health but also psychological well-being, occupational productivity, and social participation. The condition often leads to limitations in daily activities, absenteeism from work, increased healthcare utilization, and financial strain on individuals and healthcare systems. Epidemiological studies suggest that nearly 50–80% of adults experience low back pain at least once during their lifetime, while a significant proportion develop chronic symptoms.

The etiology of NSCLBP is multifactorial and influenced by biomechanical, physiological, psychological, occupational, and lifestyle factors. Sedentary habits, prolonged sitting, poor posture, obesity, muscle weakness, lack of physical activity, repetitive movements, heavy lifting, stress, and spinal degeneration contribute to the development and persistence of chronic low back pain. Altered muscle activation patterns, reduced spinal stability, impaired proprioception, and decreased muscular endurance are also commonly observed in patients with NSCLBP.

Traditional management approaches for chronic low back pain have included pharmacological treatment, rest, manual therapy, electrotherapy, and surgical interventions in severe cases. However, growing evidence emphasizes the importance of conservative and exercise-based rehabilitation approaches due to their effectiveness, affordability, and lower risk of adverse effects. Among exercise interventions, core stabilization exercises (CSE) and muscle strengthening exercises (MSE) have gained considerable attention in physiotherapy and rehabilitation practice.

Core stabilization exercises focus on activating and strengthening the deep stabilizing muscles of the trunk, including the transversus abdominis, multifidus, diaphragm, pelvic floor muscles, and internal obliques. These muscles play a crucial role in maintaining spinal alignment, postural control, and lumbopelvic stability during static and dynamic movements. Dysfunction or delayed activation of these muscles may contribute to spinal instability and chronic pain. Core stabilization programs aim to restore neuromuscular coordination, improve proprioception, and reduce excessive mechanical stress on spinal structures.

Muscle strengthening exercises, on the other hand, primarily target the superficial and global muscle systems responsible for movement generation and load transfer. These exercises involve resistance training and progressive overload techniques to improve the strength, endurance, and function of muscles such as the erector spinae, gluteal muscles, abdominal muscles, hip abductors, and quadratus lumborum. Improved muscular strength can enhance spinal support, optimize movement mechanics, and reduce the likelihood of recurrent injury.

Several clinical trials, systematic reviews, and meta-analyses have investigated the effects of core stabilization and muscle strengthening exercises in individuals with chronic low back pain. Findings from these studies indicate improvements in pain intensity, functional disability, spinal stability, balance, proprioception, muscle activation, and quality of life. However, there remains debate regarding the superiority of one intervention over another and the most effective exercise protocols for different patient populations.

In recent years, healthcare professionals have increasingly advocated combined exercise approaches that incorporate both core stabilization and strengthening components. Such integrated programs may provide comprehensive rehabilitation by simultaneously improving deep stabilizing muscle control and global

muscular strength. Moreover, individualized exercise prescription and patient education are considered essential elements for achieving long-term therapeutic outcomes.

Given the growing prevalence of NSCLBP and the increasing emphasis on non-invasive treatment approaches, it is important to critically evaluate the available evidence regarding the effectiveness of core stabilization and muscle strengthening exercises. Understanding the mechanisms, benefits, limitations, and clinical implications of these interventions can help physiotherapists and rehabilitation professionals design evidence-based exercise programs tailored to patient needs.

This systematic review therefore aims to analyze and synthesize the current literature on the impact of core stabilization and muscle strengthening exercises on non-specific chronic low back pain. The review focuses on their effectiveness in reducing pain, improving functional outcomes, enhancing spinal stability, and promoting long-term recovery.

2 Need of the Study

Non-specific chronic low back pain (NSCLBP) is one of the most prevalent musculoskeletal disorders and a leading cause of pain, disability, and reduced quality of life worldwide. Despite the widespread use of exercise therapy as a conservative treatment, uncertainty remains regarding the comparative effectiveness of core stabilization exercises and muscle strengthening exercises in improving clinical outcomes. A comprehensive evaluation of the available evidence is therefore essential to guide evidence-based physiotherapy practice.

The present systematic review was undertaken to evaluate the impact of core stabilization exercises and muscle strengthening exercises on individuals with non-specific chronic low back pain. Specifically, this review aims to examine the effectiveness of core stabilization exercises in reducing pain and disability, assess the role of muscle strengthening exercises in improving spinal stability and functional outcomes, compare the therapeutic effects of both interventions, and evaluate their influence on quality of life, postural control, balance, and prevention of recurrence. The findings of this review are expected to assist physiotherapists in selecting appropriate exercise interventions and contribute to the development of effective rehabilitation strategies for the management of NSCLBP.

3 REVIEW OF LITERATURE

The management of non-specific chronic low back pain has been extensively studied in rehabilitation science, particularly with regard to exercise therapy. Among various therapeutic interventions, core stabilization exercises and muscle strengthening exercises have shown promising outcomes in reducing pain and disability while improving functional performance.

Antonio Frizziero et al. (2021) reviewed the effectiveness of core stability exercises in patients with non-specific chronic low back pain. The authors concluded that core stabilization exercises significantly reduced pain intensity and functional disability while improving quality of life and muscle activation. The review suggested that core stability training was more effective than minimal intervention and provided better outcomes when combined with other exercise therapies.

Beomryong Kim et al. (2020) examined the effects of core stabilization and hip strengthening exercises in patients with NSCLBP. Their randomized controlled trial demonstrated that strengthening the core and hip muscles improved physical function, spinal stability, and movement patterns. Patients also reported reduced pain during daily activities and better overall mobility.

Lin Pipeng et al. (2024) conducted a systematic review of randomized controlled trials investigating the effects of core stability training on muscle physiology in adults with chronic low back pain. The study identified that core stabilization exercises significantly improved muscle activation and core muscle strength. Although evidence regarding muscle endurance and thickness remained controversial, the authors recommended core stability training as an effective intervention for improving muscle physiology in patients with chronic low back pain.

Obinna Dickson Nwodo et al. (2022) compared core stabilization exercises with conventional exercise programs in chronic low back pain management. Their findings indicated that core stability exercises were more effective in improving back-specific functional status and reducing pain in the short term. The study emphasized the importance of trunk control and postural stability in rehabilitation.

Sacha Clael et al. (2021) explored the role of strengthening exercises in improving lumbar extensor muscle function in individuals with NSCLBP. The review demonstrated that strengthening interventions improved muscle strength, endurance, and electrical activity while reducing pain and disability. The authors also highlighted the psychological benefits of exercise, including improved mood due to increased serotonin and endorphin release.

Fábio Renovato França et al. (2022) compared segmental stabilization exercises with general muscle strengthening exercises in patients with chronic low back pain. Their findings showed that both interventions improved pain and functional disability. However, segmental stabilization exercises produced superior improvements in spinal stability and motor control.

Su Su Hlaing et al. (2021) investigated the effects of core stabilization and strengthening exercises on proprioception, balance, and muscle thickness in patients with subacute non-specific low back pain. The study concluded that core stabilization exercises improved neuromuscular control, balance ability, and proprioception more effectively than strengthening exercises alone.

Camila Santana de Sousa et al. (2019) focused on lower limb muscle strength in individuals with low back pain. Their systematic review indicated that strengthening the hip and lower limb muscles improved spinal alignment and reduced mechanical stress on the lumbar spine. The authors suggested incorporating lower extremity strengthening into rehabilitation programs.

Hye Jin Moon et al. (2013) compared lumbar stabilization exercises with dynamic strengthening exercises. Both interventions improved lumbar extensor strength and pain severity. However, lumbar stabilization exercises demonstrated superior improvements in functional outcomes and low-angle lumbar extensor strength.

Mohsen Kazeminia et al. (2022) performed a meta-analysis on pelvic floor muscle strengthening exercises for low back pain. The findings revealed that pelvic floor strengthening significantly reduced pain intensity and improved spinal stability, suggesting that pelvic floor exercises should be integrated into comprehensive rehabilitation protocols.

Gema Santamaría et al. (2023) examined the effects of hip muscle strengthening exercises on pain and disability in patients with NSCLBP. Their systematic review concluded that strengthening exercises targeting the gluteal muscles and hip abductors significantly improved pelvic stability, reduced pain, and enhanced functional ability.

Isman Ingsih et al. (2023) evaluated strengthening exercises in elderly individuals with low back pain. Their findings demonstrated reduced pain intensity and improved physical function following strengthening interventions. The authors emphasized the importance of exercise therapy in enhancing mobility and quality of life among elderly populations.

Abd El-Hamied et al. (2025) compared core stability exercises with strengthening exercises in patients with chronic non-specific low back pain. The results indicated that although both interventions reduced pain, core stabilization exercises were more effective in improving proprioception, muscle thickness, balance, and reducing fear of movement.

Arash Khaledi et al. (2024) investigated isometric and isotonic core stabilization exercises in patients with NSCLBP. Both exercise methods significantly reduced pain and disability, with isometric exercises showing slightly greater improvements.

Muhammad Waseem Akhtar et al. (2017) conducted a randomized controlled trial comparing core stabilization exercises with routine physiotherapy exercises. The findings revealed greater pain reduction and improved trunk muscle activation in the core stabilization group.

Zachary Smrcina et al. (2022) reviewed the effectiveness of core stabilization exercises in patients with non-specific low back pain and found moderate evidence supporting their role in reducing symptoms and improving function, particularly in short-term rehabilitation.

Puntumetakul et al. (2018) demonstrated that core stabilization exercises improved lumbar joint position sense, reduced pain, and enhanced functional performance in patients with subacute NSCLBP.

Singhal et al. (2024) investigated athletes with non-specific low back pain and found that core stability exercises improved muscle coordination, spinal stability, and neuromuscular control while reducing pain and muscle spasm.

WAFAA A. SALAMA et al. (2024) concluded that core stability exercises combined with breathing programs and pelvic floor training significantly reduced pain intensity in patients with chronic non-specific low back pain.

Collectively, the reviewed literature suggests that both core stabilization and muscle strengthening exercises are effective rehabilitation strategies for managing chronic low back pain. Core stabilization exercises appear particularly effective for improving spinal stability, neuromuscular control, and proprioception, whereas muscle strengthening exercises are beneficial for enhancing muscle endurance, force production, and functional performance. Many authors advocate a combined exercise approach to achieve optimal therapeutic outcomes.

4 RESEARCH METHODOLOGY

4.1 Study Design

The present study was conducted as a systematic review of literature focusing on the impact of core stabilization and muscle strengthening exercises on non-specific chronic low back pain.

4.2 Search Strategy

A comprehensive literature search was performed between 2018 and 2024 using electronic databases including PubMed, Google Scholar, Cochrane Library, and MEDLINE. Relevant studies were identified using combinations of the following keywords:

“Core stability”

“Core stabilization”

“Core strengthening”

“Muscle strengthening”

“Chronic low back pain”

“Non-specific low back pain”

“Motor control exercise”

“Lumbar stabilization”

Boolean operators such as AND and OR were used to refine the search results.

4.3 Inclusion Criteria

The following studies were included in the review:

Articles published in English.

Randomized controlled trials, systematic reviews, and meta-analyses.

Studies involving adults with non-specific chronic low back pain.

Studies investigating core stabilization exercises and/or muscle strengthening exercises.

Studies reporting outcomes related to pain, disability, balance, strength, or quality of life.

4.4 Exclusion Criteria

The following studies were excluded:

Studies involving acute low back pain or specific spinal pathologies.

Non-English publications.

Studies lacking adequate methodological details.

Studies with irrelevant outcomes.

Duplicate publications.

4.5 Study Selection

A total of 145 records were initially identified through database searching. After removing duplicates, 120 articles remained for screening. Following title and abstract review, 95 full-text articles were assessed for eligibility. Finally, 55 studies met the inclusion criteria and were included in the systematic review.

4.6 Data Extraction

Data extracted from the selected studies included:

Author and year of publication

Study design

Sample size

Intervention type

Duration of intervention

Outcome measures

Main findings

4.7 Outcome Measures

The review focused on the following outcomes:

Pain intensity

Functional disability

Spinal stability

Muscle strength and endurance

Balance and proprioception

Quality of life

Recurrence prevention

4.8 Ethical Considerations

Since this study was a systematic review and did not involve direct human participation, ethical approval was not required.

5 RESULTS AND DISCUSSION

The present systematic review analyzed findings from multiple studies investigating the effectiveness of core stabilization exercises and muscle strengthening exercises in patients with non-specific chronic low back pain. The findings consistently demonstrated that exercise-based rehabilitation plays a crucial role in reducing pain, improving function, and enhancing quality of life.

5.1 Pain Reduction

Most of the reviewed studies reported significant reductions in pain intensity following exercise interventions. Core stabilization exercises showed particularly rapid improvements in pain relief within the initial 4–6 weeks of training. Activation of deep stabilizing muscles such as the transversus abdominis and multifidus reduced mechanical stress on spinal structures and improved spinal support.

Muscle strengthening exercises also reduced pain intensity, although improvements tended to occur more gradually. Strengthening the lumbar extensors, gluteal muscles, abdominal muscles, and hip stabilizers improved load distribution and reduced strain on the lumbar spine.

Several studies suggested that combined exercise approaches produced superior pain reduction compared to isolated interventions.

5.2 Functional Improvement

Improvements in functional disability were consistently observed across studies. Participants reported enhanced ability to perform activities of daily living, improved walking tolerance, reduced movement fear, and better occupational performance.

Core stabilization exercises improved trunk control, balance, and postural alignment, enabling patients to move with greater efficiency and less discomfort. Muscle strengthening exercises increased muscular endurance and force production, thereby improving lifting ability, gait mechanics, and overall physical performance.

5.3 Spinal Stability and Muscle Activation

Core stabilization exercises demonstrated strong effectiveness in enhancing spinal stability and neuromuscular control. Improved activation of deep core muscles contributed to better lumbar support and reduced compensatory movement patterns.

Several studies also reported increased muscle thickness of the transversus abdominis and lumbar multifidus following core stabilization training. Enhanced proprioception and balance were additional benefits observed in patients undergoing stabilization programs.

5.4 Muscle Strength and Endurance

Muscle strengthening interventions significantly improved lumbar extensor strength, abdominal endurance, and hip muscle function. Stronger muscles improved spinal alignment and reduced mechanical overload during functional activities.

Strengthening exercises targeting the gluteal muscles and hip abductors also contributed to improved pelvic stability and reduced abnormal movement patterns associated with chronic low back pain.

5.5 Quality of Life

Exercise interventions positively influenced psychological well-being and quality of life. Reduced pain and improved physical function enabled individuals to participate more actively in social, occupational, and recreational activities.

Several studies reported reductions in anxiety, fear avoidance behavior, and depression following regular exercise participation. Enhanced confidence and self-efficacy were also noted.

5.6 Long-Term Outcomes

Long-term adherence to exercise programs was associated with sustained improvements in pain and function. Patients who continued exercise beyond supervised rehabilitation periods demonstrated reduced recurrence rates and improved long-term spinal health.

The combination of core stabilization and muscle strengthening exercises appeared to provide the most comprehensive rehabilitation outcomes by simultaneously improving deep stabilizing muscle control and overall muscular strength.

5.2.1 The findings of this systematic review support the effectiveness of core stabilization exercises and muscle strengthening exercises in the management of non-specific chronic low back pain. Both interventions demonstrated beneficial effects on pain reduction, functional performance, spinal stability, muscle activation, and quality of life.

Chronic low back pain is often associated with impaired neuromuscular control, muscle weakness, altered movement patterns, and reduced spinal stability. Exercise-based rehabilitation addresses these underlying impairments by enhancing muscular support and improving movement efficiency.

Core stabilization exercises primarily target the deep stabilizing muscles of the trunk. These muscles play a critical role in maintaining segmental spinal stability and controlling movement during functional activities. Delayed activation or dysfunction of these muscles has been associated with chronic low back pain. By retraining motor control and improving muscle coordination, core stabilization exercises reduce excessive spinal loading and improve postural stability.

The reviewed studies consistently demonstrated that core stabilization exercises improve proprioception, balance, and muscle activation. Enhanced neuromuscular control may explain the rapid pain relief observed in many patients undergoing stabilization training. Furthermore, improvements in lumbar multifidus and transversus abdominis muscle thickness suggest positive physiological adaptations.

Muscle strengthening exercises contribute to rehabilitation by improving the strength and endurance of global muscle systems responsible for movement and force generation. Weakness in the lumbar extensors, gluteal muscles, and hip stabilizers can lead to abnormal biomechanics and increased lumbar stress. Strengthening these muscle groups improves load distribution and movement mechanics, thereby reducing pain and improving functional performance.

The evidence also suggests that strengthening exercises have long-term protective effects by enhancing muscular resilience and reducing recurrence risk. Patients with improved muscular endurance are better able to tolerate occupational and daily physical demands without exacerbating symptoms.

Although both interventions are effective, several studies suggest that core stabilization exercises may provide greater short-term improvements in pain and functional disability compared to general strengthening programs. This may be due to their focus on deep muscle activation and motor control restoration.

However, strengthening exercises remain essential because spinal stability requires adequate force production from both local and global muscle systems. Therefore, many clinicians advocate combining stabilization and strengthening exercises to achieve comprehensive rehabilitation.

The integration of hip and lower limb strengthening exercises is another important consideration. Weakness in the gluteal muscles and hip abductors can alter pelvic alignment and increase lumbar stress. Strengthening these muscles enhances pelvic control and improves kinetic chain function.

Another important finding of this review is the role of exercise in improving psychological health. Chronic pain is closely linked with fear avoidance behavior, anxiety, depression, and reduced self-confidence. Regular exercise promotes the release of endorphins and serotonin, improves mood, and enhances patient confidence in movement.

Despite the positive findings, several limitations should be acknowledged. Variability in exercise protocols, intervention duration, sample size, and outcome measures among studies makes direct comparison challenging. Some studies lacked long-term follow-up, limiting understanding of sustained outcomes.

Patient adherence also plays a critical role in treatment success. Individuals with chronic pain may struggle with motivation, fear of movement, or inconsistent participation. Therefore, rehabilitation programs should be individualized, progressive, and supported by patient education and encouragement.

Exercise prescription should follow the principles of progressive overload and functional integration. Gradual increases in intensity and complexity allow safe adaptation while minimizing symptom exacerbation. Incorporating functional and task-specific activities can improve the transfer of rehabilitation gains into daily life.

Future research should focus on identifying optimal exercise dosage, frequency, intensity, and progression strategies for different patient populations. Long-term randomized controlled trials are needed to determine sustained benefits and recurrence prevention.

Additionally, multidisciplinary rehabilitation approaches combining exercise therapy with education, behavioral therapy, ergonomic modification, and lifestyle interventions may further enhance patient outcomes.

Overall, the evidence strongly supports the inclusion of both core stabilization and muscle strengthening exercises in physiotherapy management programs for chronic low back pain.

CLINICAL IMPLICATIONS

The findings of this systematic review have important implications for physiotherapy and rehabilitation practice.

Core stabilization and muscle strengthening exercises should be considered primary conservative interventions for patients with non-specific chronic low back pain.

Exercise programs should be individualized according to patient symptoms, physical capacity, occupational demands, and rehabilitation goals.

Combined exercise approaches incorporating both stabilization and strengthening components may provide superior outcomes compared to isolated interventions.

Progressive overload principles should be applied to improve muscular adaptation and functional capacity.

Patient education regarding posture, body mechanics, and adherence is essential for long-term success.

Hip and lower limb strengthening should be integrated into rehabilitation programs to optimize lumbopelvic stability.

Supervised exercise sessions may improve adherence, technique, and treatment outcomes.

Long-term home exercise programs should be encouraged to maintain improvements and prevent recurrence.

LIMITATIONS OF THE STUDY

Only English-language studies were included.

Variability in study design and exercise protocols limited direct comparison.

Some studies had small sample sizes.

Long-term follow-up data were limited in several studies.

Differences in outcome measures reduced methodological consistency.

CONCLUSION

Non-specific chronic low back pain is a highly prevalent and disabling condition that significantly affects physical function, occupational performance, and quality of life. Exercise-based rehabilitation has emerged as a safe, effective, and cost-efficient treatment strategy for managing chronic low back pain.

The findings of this systematic review demonstrate that both core stabilization exercises and muscle strengthening exercises provide substantial therapeutic benefits for individuals with NSCLBP. Core stabilization exercises improve spinal stability, neuromuscular control, proprioception, posture, and pain reduction by targeting deep stabilizing muscles of the trunk. Muscle strengthening exercises enhance muscular strength, endurance, pelvic stability, and functional performance by improving the capacity of global muscle systems.

Evidence suggests that core stabilization exercises may produce faster improvements in pain and disability, whereas strengthening exercises contribute to long-term muscular resilience and functional recovery. The combination of both interventions appears to provide the most comprehensive rehabilitation outcomes.

Exercise therapy not only improves physical symptoms but also enhances psychological well-being, confidence, and quality of life. Long-term adherence to individualized exercise programs is essential for sustained benefits and recurrence prevention.

Healthcare professionals should incorporate evidence-based core stabilization and strengthening programs into physiotherapy management plans for chronic low back pain. Rehabilitation programs should be progressive, patient-centered, and functionally oriented to maximize recovery and long-term spinal health. Further high-quality research is required to determine optimal exercise protocols and establish standardized guidelines for clinical practice. Nevertheless, the current evidence strongly supports the integration of core stabilization and muscle strengthening exercises as essential components of conservative management for non-specific chronic low back pain.

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