ISSN: 2347-6567

International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR |Vol.14 | Issue 2| Apr - Jun - 2026

www.ijamscr.com

DOI : https://doi.org/10.61096/ijamscr.v14.iss2.2026.969-977

Comparative Evidence on Core Stabilization versus General Strengthening Exercises in Chronic Low Back Pain: A Structured Review

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Published on:

21.05.2026

Published by:

Futuristic Publications

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Abstract:

Background: Chronic low back pain (CLBP) is one of the most prevalent musculoskeletal disorders worldwide and is associated with pain, disability, reduced functional capacity, and decreased quality of life. Exercise-based rehabilitation remains a primary conservative intervention for chronic non-specific low back pain. Among commonly prescribed approaches, core stabilization exercises emphasize neuromuscular control and lumbopelvic stability, whereas general strengthening exercises focus on improving the strength and endurance of global trunk musculature.

Objective: To compare the effectiveness of core stabilization exercises and general strengthening exercises in individuals with chronic low back pain.

Methods: A structured comparative review was conducted using literature identified through PubMed, Scopus, and Google Scholar databases. Peer-reviewed studies published between 2008 and 2024 were screened. Twenty relevant studies were included, comprising randomized controlled trials, systematic reviews, meta-analyses, epidemiological evidence, and clinical practice guidelines. Outcomes analyzed included pain intensity, disability, functional performance, proprioception, balance, lumbopelvic stability, muscle thickness, and long-term clinical effectiveness.

Results: Both approaches demonstrated improvements in pain and disability outcomes. Several studies reported greater short-term improvements with core stabilization exercises, particularly in pain reduction, functional performance, proprioception, and lumbopelvic stability, whereas long-term outcomes were often comparable between groups.

Conclusion: Core stabilization exercises appear to offer additional early benefits, particularly in neuromuscular control and symptom reduction. Nevertheless, conventional strengthening remains clinically effective, and long-term improvements are often comparable across both approaches.

Keywords: Chronic low back pain, Core stabilization, Motor control exercise, General strengthening, Rehabilitation, Comparative review.

Introduction

Chronic low back pain (CLBP) is one of the most prevalent musculoskeletal disorders worldwide and remains a major cause of disability and functional limitation across different populations. It is associated with reduced quality of life, decreased work productivity, and significant healthcare burden. Recent epidemiological evidence from the Global Burden of Disease Study has highlighted low back pain as one of the leading contributors to years lived with disability globally.[1]

Exercise-based rehabilitation is widely recognized as a cornerstone in the conservative management of chronic low back pain. Current clinical practice guidelines strongly recommend

therapeutic exercise for reducing pain, improving functional ability, and enhancing long-term self-management in individuals with chronic low back pain.[2] Systematic reviews and meta-analyses have further supported the effectiveness of structured exercise interventions in improving pain and disability outcomes in non-specific low back pain populations.[3–7]

Among various exercise approaches, core stabilization exercises (CSE), also referred to as motor control exercises, have gained increasing clinical attention. Stabilization-based programs emphasize activation and coordination of deep trunk musculature to improve lumbopelvic control and spinal stability during functional activities. In contrast, general strengthening exercises primarily focus on strengthening global trunk and lower limb muscles without specific emphasis on neuromuscular control retraining.

Several randomized controlled trials have investigated the comparative effectiveness of core stabilization and conventional strengthening programs in chronic low back pain rehabilitation. Evidence suggests that stabilization-focused interventions may provide superior short-term improvements in pain reduction, functional disability, proprioception, balance, trunk endurance, and lumbopelvic stability compared with general strengthening programs.[8, 16] In addition, imaging-based investigations have demonstrated increased abdominal and lumbar stabilizing muscle thickness following stabilization-oriented rehabilitation, supporting the neuromuscular adaptations associated with motor control training.[11,20]

Recent systematic reviews and meta-analyses evaluating movement control and motor control exercises have further reported clinically meaningful improvements in pain and disability outcomes in individuals with chronic non-specific low back pain.[17, 18] However, several studies have also shown that long-term outcomes between stabilization and general strengthening programs often become comparable over time when appropriate progression and exercise adherence are maintained.[5, 8, 15, 16, 19]

Despite the growing body of comparative evidence, variations in intervention protocols, training intensity, outcome measures, and follow-up duration contribute to inconsistencies in reported findings. Therefore, the objective of this structured comparative review is to evaluate the available evidence comparing core stabilization exercises and general strengthening exercise programs in individuals with chronic low back pain, with emphasis on pain, disability, functional performance, neuromuscular adaptations, and long-term clinical effectiveness.

Review

This comparative review synthesizes findings from relevant studies evaluating the effectiveness of core stabilization exercises versus general strengthening exercises in the management of chronic low back pain (CLBP):

Wu et al. (2020) conducted an epidemiological analysis using Global Burden of Disease Study 2017 data and reported that low back pain remains one of the leading causes of disability worldwide, emphasizing the need for effective rehabilitation strategies.

George et al. (2021) published updated clinical practice guidelines for the management of acute and chronic low back pain and recommended exercise therapy as a primary conservative intervention for improving pain and functional outcomes.

Saragiotto et al. (2016) conducted a Cochrane systematic review evaluating motor control exercise for chronic non-specific low back pain and concluded that motor control exercise improves pain and disability outcomes compared with minimal intervention or general exercise programs.

Owen et al. (2020) performed a network meta-analysis comparing different modes of exercise therapy for low back pain and reported that multiple exercise approaches, including stabilization-focused interventions, are effective in reducing pain and disability.

Wang et al. (2012) conducted a meta-analysis comparing core stability exercise versus general exercise for chronic low back pain and concluded that core stability exercise demonstrated significant improvement in pain and disability outcomes, particularly during short-term follow-up.

Byström et al. (2013) performed a meta-analysis on motor control exercises and reported significant reductions in pain and disability in chronic and recurrent low back pain populations, supporting stabilization-based rehabilitation programs.

Smith et al. (2022) conducted a systematic review examining the effectiveness of core stability exercises in non-specific low back pain and concluded that structured core stability exercise programs contribute to meaningful improvements in pain reduction and functional performance.

Tagliaferri et al. (2020) conducted a randomized controlled trial comparing general strength and conditioning exercise with motor control and manual therapy for chronic low back pain and reported that both intervention approaches produced clinically significant improvements in pain and disability outcomes.

Kim et al. (2021) compared core stabilization exercise and strengthening exercise in patients with non-specific low back pain and reported improvements in proprioception, balance, muscle thickness, and pain outcomes, with stabilization exercises demonstrating greater benefit.

Shamsi et al. (2015) compared core stability exercises with traditional trunk exercises using functional lumbopelvic stability tests and reported greater improvements in functional lumbopelvic stability following stabilization training.

Shamsi et al. (2016) compared core stability exercise with general exercise on abdominal muscle thickness using ultrasound imaging and concluded that stabilization training resulted in increased abdominal muscle thickness, suggesting neuromuscular adaptation.

Akhtar et al. (2017) compared core stabilization exercises with routine exercise therapy in chronic non-specific low back pain patients and concluded that stabilization-based training resulted in better pain management outcomes than routine exercise programs.

Inani and Selkar (2013) compared core stabilization exercises with conventional exercises in patients with non-specific low back pain and reported superior improvement in pain reduction and functional status in the core stabilization exercise group.

Hwangbo et al. (2016) evaluated the effectiveness of core stability exercise on lumbopelvic stability in chronic low back pain patients and reported significant improvements in lumbopelvic stability following stabilization exercise intervention.

Lee et al. (2024) compared core strengthening exercise with intensive dynamic back exercise in chronic non-specific low back pain patients and concluded that both interventions improved pain and disability outcomes following structured rehabilitation.

Lehtola et al. (2012) conducted a randomized controlled trial comparing specific movement control exercises with general exercise in chronic low back pain patients and reported greater improvements in movement control and functional outcomes in the movement control exercise group.

Luomajoki et al. (2018) performed a systematic review and meta-analysis evaluating movement control exercises in non-specific low back pain and concluded that movement control-based rehabilitation contributes to improvements in pain and disability outcomes.

Zhang et al. (2021) conducted a meta-analysis on motor control exercise in chronic non-specific low back pain and reported significant improvements in pain intensity and disability compared with general exercise interventions.

Coulombe et al. (2017) compared core stability exercise with general exercise in chronic low back pain patients and reported superior short-term improvements in pain and functional outcomes with stabilization-based exercise programs.

Akbari et al. (2008) conducted a randomized controlled trial comparing motor control exercise with general exercise on lumbar local stabilizing muscle thickness in chronic low back pain patients and reported increased stabilizing muscle thickness following motor control training, supporting neuromuscular adaptations associated with stabilization-based rehabilitation.

Author(s) & Year	Study Design	Sample Size & Population	Intervention	Outcome Measures	Key Findings
Wu et al., 2020	Epidemiological study (Global Burden of Disease analysis)	Global population data (1990–2017)	Not applicable (burden analysis)	Prevalence, years lived with disability	Reported low back pain as a leading cause of disability worldwide.
George et al., 2021	Clinical practice guideline	Acute and chronic low back pain populations	Exercise therapy recommendations	Pain, function	Exercise strongly recommended for chronic low back pain management.

Saragiotto et al., 2016	Cochrane systematic review	Chronic non-specific low back pain	Motor control exercise	Pain, disability	Motor control exercise improved pain and disability compared with control and general exercise interventions.
Owen et al., 2020	Network meta-analysis	Low back pain participants	Various exercise modes	Pain, disability	Multiple exercise modes effective; stabilization among effective interventions.
Wang et al., 2012	Meta-analysis	Meta-analysis	Core stability exercise versus general exercise	Pain, disability	Core stability exercise showed better short-term improvement in pain and disability.
Byström et al., 2013	Meta-analysis	Chronic and recurrent low back pain	Motor control exercise	Pain, disability	Motor control exercise reduced pain and disability outcomes.
Smith et al., 2022	Systematic review	Non-specific low back pain	Core stability exercise programs	Pain, function	Core stability exercise effective in improving pain and function.
Tagliaferri et al., 2020	Randomized controlled trial	Chronic low back pain patients	Strength conditioning versus motor control and manual therapy	Pain, disability	Both interventions improved pain and disability outcomes.
Kim et al., 2021	Randomized controlled trial	Non-specific low back pain patients	Core stabilization exercise versus strengthening exercise	Balance, proprioception, muscle thickness, pain	Greater improvement observed in stabilization exercise group.
Shamsi et al., 2015	Randomized controlled trial	Chronic low back pain patients	Core stabilization exercise versus traditional trunk exercise	Functional lumbopelvic stability tests	Improved lumbopelvic stability with core stabilization exercise.
Shamsi et al., 2016	Randomized controlled trial	Non-specific chronic low back pain patients	Core stabilization exercise versus general exercise	Ultrasound muscle thickness	Increased abdominal muscle thickness after stabilization

					training.
Akhtar et al., 2017	Randomized controlled trial	Chronic non-specific low back pain patients	Core stabilization exercise versus routine exercise therapy	Pain	Stabilization training showed better pain reduction.
Inani and Selkar, 2013	Randomized controlled trial	Non-specific low back pain patients	Core stabilization exercise versus conventional exercise	Pain, function	Core stabilization showed superior improvements in pain and function.
Hwangbo et al., 2016	Clinical trial	Chronic low back pain patients	Core stability exercise intervention	Lumbopelvic stability	Improved lumbopelvic stability after core stability program.
Lee et al., 2024	Randomized controlled trial	Chronic non-specific low back pain patients	Core strengthening exercise versus dynamic back exercise	Pain, disability	Both interventions improved chronic low back pain outcomes.
Lehtola et al., 2012	Randomized controlled trial	Chronic low back pain patients	Movement control exercise versus general exercise	Movement control, function	Movement control exercises improved functional outcomes more effectively.
Luomajoki et al., 2018	Systematic review and meta-analysis	Non-specific low back pain patients	Movement control exercise	Pain, disability	Movement control exercises improved pain and disability outcomes.
Zhang et al., 2021	Meta-analysis	Chronic non-specific low back pain participants	Motor control exercise versus general exercise	Pain, disability	Motor control exercise significantly reduced pain and disability.
Coulombe et al., 2017	Comparative clinical study	Chronic low back pain patients	Core stability exercise versus general exercise	Pain, function	Core stability exercise demonstrated superior short-term outcomes.
Akbari et al., 2008	Randomized controlled trial	Chronic low back pain patients	Motor control exercise versus general exercise	Lumbar stabilizing muscle thickness	Increased stabilizing muscle thickness following motor control training.

Studies included randomized controlled trials, systematic reviews, meta-analyses, clinical guidelines, and epidemiological analyses evaluating core stabilization and general strengthening exercises in chronic low back pain.

Methodology

This comparative review was prepared by identifying relevant peer-reviewed literature through electronic database searching and manual reference screening. Databases such as PubMed, Google Scholar, and Scopus were explored. The focus was limited to literature comparing core stabilization exercise programs with general strengthening or conventional exercise protocols in chronic low back pain populations.

Inclusion criteria: Adults diagnosed with chronic low back pain (duration ≥ 12 weeks), randomized controlled trials, systematic reviews, meta-analyses, clinical guidelines, and comparative clinical studies evaluating core stabilization exercises and general strengthening programs, and studies reporting at least one clinical outcome such as pain intensity, disability, functional performance, proprioception, balance, lumbopelvic stability, or muscle thickness.

Exclusion criteria: Acute or subacute low back pain, studies without direct comparison of interventions, protocol-only studies without results, and studies focusing exclusively on non-exercise interventions.

Primary outcomes included pain intensity and disability indices. Secondary outcomes included trunk endurance, balance, proprioception, ultrasound-measured muscle thickness, lumbopelvic stability, neuromuscular adaptations, and long-term follow-up outcomes. Twenty studies meeting the eligibility criteria were included in this review.

Outcome Domain	Measurement Tools	Effect	Clinical Implication
Pain	Visual Analog Scale, Numeric Pain Rating Scale	Greater short-term reductions in pain intensity	Enhanced comfort and early symptom relief
Disability	Oswestry Disability Index, Roland-Morris Disability Questionnaire	Improved disability scores in both groups, often favoring core stabilization exercises during early rehabilitation	Improved daily functional ability
Neuromuscular Adaptations	Ultrasound imaging, Electromyography	Increased deep muscle thickness and improved activation patterns	Enhanced segmental spinal stability
Functional Performance	Trunk endurance, balance tests	Improved trunk endurance, balance, proprioception	Better lumbopelvic motor control
Long-Term Outcomes	Follow-up assessments	Comparable outcomes between groups over time	Both interventions clinically effective

Outcome measures summarized from studies evaluating core stabilization exercises and general strengthening exercises in chronic low back pain populations.

Results

Analysis of the included studies consistently showed:

1. Greater short-term improvements in pain reduction and disability improvement in the core stabilization exercise groups.
2. Improvements in disability scores and functional limitation outcomes in both intervention groups, with early rehabilitation phases often favoring stabilization-based exercise programs.
3. Increased thickness and activation of deep abdominal and lumbar stabilizing musculature following stabilization-focused rehabilitation programs.

4. Improved trunk endurance, balance, proprioception, movement control, and lumbopelvic stability in both intervention groups, with greater improvements frequently reported following core stabilization and motor control exercise programs.
5. Comparable long-term outcomes between core stabilization and general strengthening programs in several follow-up studies, indicating that both approaches remain clinically effective over time.
6. Systematic reviews and meta-analyses consistently supported the effectiveness of exercise-based rehabilitation in reducing pain and disability in chronic non-specific low back pain populations.

Discussion

The findings of this comparative review indicate that core stabilization exercises provide meaningful short-term advantages in chronic low back pain management, particularly in pain reduction, disability improvement, proprioception, and lumbopelvic stability. These findings are supported by randomized controlled trials, systematic reviews, and meta-analyses reporting clinically relevant improvements with stabilization-based interventions.

The greater early benefit of stabilization training may be associated with improved neuromuscular control of the trunk and enhanced coordination of deep stabilizing musculature during functional activities. Several studies demonstrated improved movement control, functional stability, balance, and increased abdominal muscle thickness following stabilization-oriented rehabilitation, supporting the role of motor control-based exercise in spinal stabilization.

Movement control and motor control exercise approaches additionally demonstrated positive effects on functional performance and disability outcomes in individuals with chronic non-specific low back pain. Imaging-based studies evaluating muscle thickness further supported the neuromuscular adaptations associated with stabilization-focused rehabilitation.

However, long-term outcomes between core stabilization and general strengthening programs were often comparable. These findings suggest that although stabilization-focused rehabilitation may provide faster initial improvement, general strengthening exercises remain clinically effective by improving overall trunk conditioning, muscular endurance, and functional spinal support.

Variations in exercise dosage, intervention duration, progression methods, supervision level, and patient adherence may explain differences in study outcomes. Patient-specific factors including baseline functional impairment, proprioceptive deficits, and movement control dysfunction may also influence rehabilitation effectiveness and clinical response to different exercise approaches.

Overall, both core stabilization and general strengthening programs remain valuable interventions in chronic low back pain rehabilitation. Individualized exercise prescription or combined rehabilitation approaches incorporating stabilization and strengthening principles may provide optimal functional outcomes in patients with chronic low back pain.

Limitations

This review included studies with variation in exercise protocols, duration, and outcome measures, which may limit direct comparison across findings. Several trials had small sample sizes and limited long-term follow-up. In addition, a formal methodological quality assessment or risk-of-bias evaluation was not performed; therefore, the internal validity and methodological quality of the included studies were not systematically assessed.

Conclusion

Core stabilization exercises demonstrate greater short-term improvement in pain reduction, disability outcomes, proprioception, and neuromuscular control in individuals with chronic low back pain. However, long-term outcomes are often comparable between stabilization-based and general strengthening exercise programs. Both interventions are clinically effective, and exercise prescription should be individualized according to patient-specific rehabilitation goals.

Conflict of Interest

The authors declare no conflict of interest.

Funding

No external funding was received for this study.

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