

## Exercise-based therapeutic interventions for lumbar disc herniation: A narrative review

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### Abstract

Lumbar disc herniation (LDH) poses a significant challenge to the quality of life for millions worldwide, often leading to debilitating pain and reduced functionality. This comprehensive narrative review critically assesses the effectiveness of various exercise-based therapeutic programs used in the treatment of LDH. Through a systematic search across multiple scientific databases, six pertinent studies were identified, each detailing specific exercise methodologies aimed at managing this condition. The therapeutic approaches analyzed include the McKenzie Method, core stabilization exercises, clinical Pilates, lumbar spine stabilization techniques, strength training targeted at lumbar stability, and yoga-based interventions. Each of these programs demonstrated significant reductions in pain intensity alongside marked improvements in functional outcomes, though notable variations were observed in both the duration and intensity of the interventions across studies. Comparative analysis reveals the heterogeneity of these therapeutic approaches, emphasizing the importance of individualized treatment plans that are tailored to the specific characteristics and needs of each patient. A consistent trend across studies highlighted the pivotal role of activating spinal stabilizer muscles, which appears to be crucial for effective rehabilitation in LDH cases. The integration of strength and flexibility exercises was repeatedly identified as a key factor in optimizing clinical outcomes. In conclusion, this review advocates for a multimodal therapeutic exercise strategy in managing LDH and underscores the necessity for further high-quality research to refine and standardize these protocols. Based on the findings of this narrative review, a series of recommended exercises are proposed for clinical application, underscoring their potential as effective, non-invasive interventions. Ultimately, this review consolidates current evidence on the most beneficial exercise protocols for LDH treatment, while stressing the importance of rigorous evaluation to maximize pain relief and functional recovery in affected patients.

**Key Words:** Lumbar Spine Rehabilitation, Therapeutic Exercise Protocols, Spinal Stabilization, Core Strengthening, Chronic Low Back Pain.

### Introduction

Lumbar disorders encompass a range of congenital, degenerative, traumatic, and inflammatory pathologies that can lead to various pain syndromes, such as radiculopathies, fractures, or slippages (spondylolysis or spondylolisthesis), as well as intervertebral disc degeneration, including protrusions and herniations (Alshami, 2015; Hoy et al., 2010). These conditions involve complex alterations in spinal biomechanics that not only compromise structural integrity but also contribute to significant functional impairments (Alshami, 2015; Hoy et al., 2010). In European countries, approximately 70% of people are affected by low back pain throughout their life span (Benzakour et al., 2019). In Spain, according to the 2020 Spanish Health Survey, 17.1% of women and 10.1% of men suffer from chronic lower back pain (INE, 2020). Globally, the World Health Organization (WHO) reported that in 2020, low back pain affected 619 million people worldwide (WHO, 2023). These epidemiological data underscore not only the widespread prevalence but also the substantial socioeconomic burden imposed by spinal disorders, thereby emphasizing the critical need for effective management and intervention strategies. These statistics reflect the growing number of people suffering from back pain, sciatica, and other spinal conditions that result in chronic issues, often hindering normal daily activities (Hurwitz et al., 2018).

Among lumbar pathologies, lumbar disc herniation (LDH) poses a significant challenge to the quality of life and well-being of millions of individuals worldwide (Hurwitz et al., 2018; Indrakanti et al., 2012). LDH is particularly debilitating as it not only disrupts spinal biomechanics but also contributes to chronic pain and reduced functional capacity (Hurwitz et al., 2018; Indrakanti et al., 2012). In response to this public health issue,

the use of physical exercise as a treatment, focusing on postural re-education and strengthening of the lumbopelvic and abdominal regions, has emerged as an effective therapeutic tool during rehabilitation programs (Aparecida Da Silva et al., 2024; Indrakanti et al., 2012). These interventions are designed to restore proper neuromuscular control and enhance the mechanical stability of the lumbar spine, thereby addressing both symptomatic relief and underlying dysfunctions. Not only does exercise help alleviate pain, but it also improves functionality in patients with LDH (Aparecida Da Silva et al., 2024; Indrakanti et al., 2012; Ju et al., 2012; Lomas-Vega et al., 2017). Such exercise regimens offer a promising, non-invasive alternative to surgical interventions, emphasizing long-term management through targeted strengthening and flexibility training.

To understand how LDH develops, it is important to recall that the intervertebral disc consists of a nucleus pulposus (NP) at its center and an annulus fibrosus (AF) surrounding it. The NP contains a high concentration of proteoglycans, which enable it to retain water and generate hydrostatic pressure, helping the spine resist axial compression (Amin et al., 2017). The AF, made primarily of type I collagen, serves as a robust containment structure that maintains the NP's position and integrity. In LDH, the disc can protrude, extrude, or completely lose continuity with the disc space, leading to sequestration of a free fragment (Amin et al., 2017). Such structural compromise results from degeneration or mechanical overload, which disrupts the normal biomechanical properties of the disc. When LDH occurs, it can result in motor and sensory deficits due to pressure on the nerve roots or central stenosis, causing pain and cramps in the lower limbs (Zhang et al., 2023). Changes in the biology of the intervertebral disc, such as decreased water retention and increased type I collagen in both the NP and AF, also contribute to LDH (Amin et al., 2017). These degenerative alterations not only diminish the disc's shock-absorbing capacity but also predispose adjacent spinal structures to abnormal mechanical stresses, thereby compounding the clinical severity of the condition (Zhang et al., 2023).

From a therapeutic perspective, the primary treatment for most patients is non-surgical. Gugliotta et al. (2016) found no evidence that surgery was more effective than conservative treatment in reducing the severity of sciatica symptoms or improving quality of life in LDH patients over the medium to long term. Although surgical interventions may provide more immediate pain relief, this advantage tends to diminish after three months, with long-term outcomes showing no significant differences between the two approaches (Gugliotta et al., 2016). As highlighted by Ju et al. (2012), even when surgical procedures are performed, it is crucial to follow up with a therapeutic exercise program to minimize pain from LDH and to re-engage lumbopelvic and abdominal strength after extended postoperative rest. Such rehabilitation protocols not only restore muscular function but also enhance spinal alignment and proprioceptive control, thereby promoting a more comprehensive recovery. This approach offers significant benefits, including improved joint capsule health, enhanced blood flow, and prevention of future injuries (Ju et al., 2012). Furthermore, these non-invasive interventions reduce healthcare costs and minimize the risks associated with surgical complications, making them a highly attractive option for long-term LDH management (Gugliotta et al., 2016).

In line with this, other studies have confirmed that physical exercise plays an active role in improving the recovery of patients with LDH. According to the study by Campos-Daziano (2020), over 30% of patients who included therapeutic exercises targeting the lumbar and abdominal regions showed significant recovery within two weeks, with the majority recovering by six weeks through conservative treatment, which included exercise therapy.

These findings underscore the rapid benefits of targeted exercise interventions in reducing pain and enhancing functional restoration (Campos-Daziano, 2020). Additionally, another study emphasized that although surgery may yield better short-term results compared to continuous conservative treatment, both approaches were found to be equally effective in long-term symptom improvement for LDH (Oosterhuis et al., 2014). This parity in long-term outcomes suggests that the incorporation of structured exercise programs can serve as a viable alternative to invasive surgical procedures (Oosterhuis et al., 2014). Therefore, physical exercise stands out as an essential therapeutic tool. As this study suggests, surgery alone may not be as effective in the long run and is often more complex, involving a distinct and sometimes more challenging postoperative recovery (Oosterhuis et al., 2014). Overall, the cumulative evidence supports the integration of exercise-based strategies as a cornerstone of LDH management, promoting sustainable pain relief and functional recovery (Oosterhuis et al., 2014).

However, while these studies have provided significant insights into therapeutic approaches and the role of exercise in the effective treatment of LDH, it remains unclear which methodology or multimodal approach is most effective for addressing the complexity of LDH treatment. Despite extensive research, variations in study design and outcome measures have hindered the establishment of a definitive, standardized protocol. Consequently, the aim of this narrative review is to evaluate and compare the most widely used therapeutic exercise programs for lumbar disc herniation, with the goal of identifying the most effective methodologies for reducing pain and improving patient functionality. The review seeks to propose an integrated therapeutic exercise approach that combines the strengths of various methodologies to enhance recovery outcomes for LDH patients. Ultimately, by synthesizing current evidence, this narrative review aims to provide a comprehensive framework that informs clinical practice and directs future research toward the optimization of exercise-based interventions for LDH.

**Material & methods**

This narrative review was elaborated following Bolderston’s guidelines on literature reviews (2008). To cover the literature available in both English and Spanish, the databases consulted included PubMed, Google Scholar, and Dialnet. The search strategy adopted combined the key terms and Boolean operators (AND/OR) listed in Table 1.

**Table 1**

Search equation used in the study (Search Strategy).

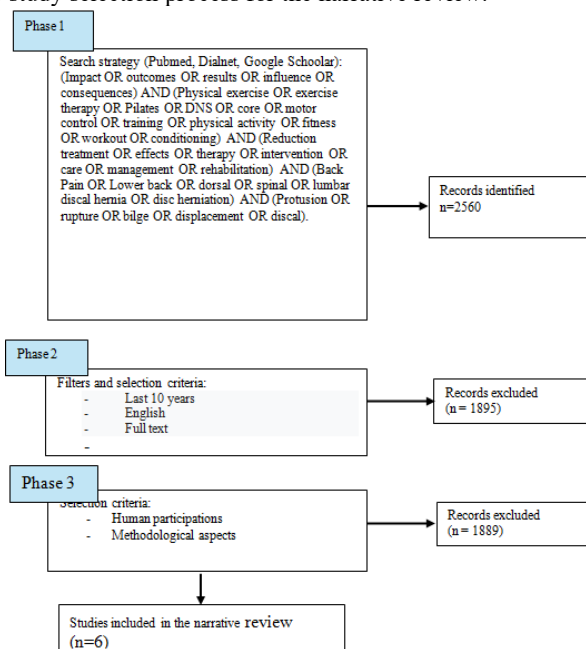
Area	Search Strategy
Effects	(Impact OR outcomes OR results OR influence OR consequences) AND
Exercise	(Physical exercise OR exercise therapy OR pilates OR DNS OR core OR motor control OR training OR physical activity OR fitness OR workout OR conditioning) AND
Treatment	(Reduction treatment OR effects OR therapy OR intervention OR care OR management OR rehabilitation) AND
Lumbar	(Back Pain OR Lower back OR dorsal OR spinal OR lumbar discal hernia OR disc herniation) AND
Hernia	(Protrusion OR rupture OR bilge OR displacement OR discal)

DNS: dynamic neuromuscular stretching

In this way, following an initial search and screening process, the studies selected for the narrative analysis of LDH therapeutic exercise methodologies were those published exclusively in English and Spanish. Furthermore, adhering to the Open Access Science principles as articulated in key frameworks such as the DORA (San Francisco Declaration on Research Assessment) and COARA (Coalition for Advancing Research Assessment) declarations (COARA, 2022; DORA, 2012) we included only the documents with full-text access included. These selected documents described specific therapeutic exercise treatments tailored to LDH and/or lumbar disc protrusion and involved an intervention group, allowing for a comparative analysis of intervention outcomes. Excluded were the documents that did not provide a detailed description of the therapeutic exercise methodology for LDH pain relief and functional improvement. Also excluded were the methodologies focused predominantly on physiotherapy, unless they served as complementary treatments to therapeutic exercise.

Studies published between 2014 and 2024 were selected to ensure the inclusion of the most recent and relevant scientific contributions in the fields of therapeutic exercise and rehabilitation. This timeframe was chosen to reflect the latest developments and evidence regarding LDH treatment. One exception, however, was the study by Ye et al. (2015), which was included owing to its valuable comparative analysis. All other selected documents had been published more recently, thus ensuring that the review incorporated up-to-date methodologies specifically focusing on therapeutic LDH exercises. The Figure 1 flowchart below summarizes the search and selection process.

**Figure 1.** Diagram of the study selection process for the narrative review.



**Results**

Following the final screening process, out of the initial 35 studies selected in Phase 3, six were identified and chosen for further analysis. They provided detailed descriptions of the various therapeutic exercise approaches that demonstrated significant LDH treatment improvements. The selected works were analyzed to determine the impact of each therapeutic method on patient outcomes, focusing on their effectiveness at reducing pain and improving functionality. Table 2 provides a comprehensive summary of each article, highlighting the most relevant findings to illustrate the effects of the different LDH therapeutic exercise treatments.

**Table 2**  
Studies on physical exercise for the treatment of lumbar disc herniation

AUTHOR/YEAR	SUBJECTS	EXERCISE PROGRAM	INSTRUMENTATION	RESULTS
Al-horani et al. (2020)	Male aged 46-60 years. 1 previous lumbar spine surgery. Recurrent disc hernias.	McKenzie Method - 2 months - 5 days/week EXERCISES: - Static floor postures - Prone flexions with overpressure - Planks	Straight leg raise (SLR). Visual Analog Scale Oswestry Disability Index (ODI) Modified Schober Test Maximal Repetition Strength Test and Multiple RM with cycling	Oswestry Disability Index reduced from 44% to 22%. Pain scale: from 4 to 8. ROM: improved 1.5 cm in foot flexion and 3 cm in extension. Unilateral leg extension and bilateral press increased by 16.5 kg and 70 kg, respectively.
Denny Pratama & Muhamad Elfitra Salam (2021)	Female aged 56 years. Lumbar disc herniation. Stiffness in both legs. Limitations in daily activities from 2019-2021.	Core stability exercise program - 4 weeks - 3 days/week - 3 sets-5 reps - 6-9 minutes per set - Hold time 5-10s EXERCISES: Pelvic tilt Bridge Four-point with arm raise Four-point with leg raise Cat-Cow	Modified Oswestry Low Back Pain Disability Questionnaire (MOLBPDQ) to measure functional capacity. Goniometer to measure ROM. Manual muscle strength tests to evaluate muscle strength. Visual Analog Scale (VAS) to measure pain intensity.	Significant improvement in functional capacity measured by MOLBPDQ. MOLBPDQ score decreased from 52% to 26% after 4 weeks of intervention. Pain intensity decreased from 4 to 2 on the VAS after intervention.
Taşpınar et al. (2023)	LDH patients, n = 54, aged 30-60 years. Diagnosis confirmed by MRI.	Clinical Pilates exercises (CPE) focusing on breath control, lumbar-pelvic region, chest, shoulder, head, and neck positions. 6-week training program, 3 times/week, 45-60 min	Visual Analog Scale (VAS) to evaluate pain intensity. Oswestry Disability Index for functional disability. Short Form-36 (SF-36) for health-related quality of life. Reach and finger-to-floor flexibility test. Side bridge and abdominal endurance tests for static and dynamic endurance.	Significant reduction in pain level and Oswestry Disability Index in the CPE group (p < 0.05). Significant increase in finger-to-floor reach, side bridge, and abdominal endurance tests in the CPE group (p < 0.05). Improvement in several SF-36 parameters in the CPE group (p < 0.05).
Ye et al. (2015)	63 men, aged 20-29 years, with LDH.	Lumbar Spine Stabilization Exercises (LSSE) - 12 weeks, 3 times/week, 45 minutes (10 min warm-up) EXERCISES: Progressive stretches of deep trunk and abdominal muscles with isometric contractions of the lumbar multifidus and TrA. Lumbar stability: curl-up, pelvic bridge, lateral bridge, and prone plank. General exercise group: limb and spine stretches. Strengthening abdominal flexors and lumbar extensors	Low-level laser therapy (LLLT) Pain intensity evaluation (Visual Analog Scale - VAS) Functional capacity (ODI)	LSSE showed greater reduction in VAS and ODI. LSSE improved dynamic stability and spinal functionality.

AUTHOR/YEAR	SUBJECTS	EXERCISE PROGRAM	INSTRUMENTATION	RESULTS
Gulsen & Sport (2019)	64 participants with lumbar protrusion and herniation, aged 15-69 years.	Lumbar stabilization strength training in supine, prone, and standing positions. Neuromuscular and proprioceptive training (PNF) in side-lying, crawling, sitting, or standing positions. Four distinct groups, 5 days/week for 4 weeks.	Visual Analog Scale (VAS) to evaluate pain intensity. ODI. Isokinetic dynamometer (Cybex 770 Norm) to measure trunk muscle strength. Abdominal muscle endurance test (curl-up test). Back extensor endurance test (dynamic back extension test). Physical therapy with heat pack, transcutaneous electrical nerve stimulation (TENS), and ultrasound therapy.	Pain reduction at rest and during activity. Improvement in functional capacity measured by ODI. Lumbar stabilization and PNF exercises increased abdominal and lumbar muscle strength and endurance. Improved left hip flexibility and trunk flexibility. Increased trunk muscle strength at various speeds. Positive effects in the physical therapy group, but less significant. Lumbar stabilization exercises showed significant improvements compared to other groups.
Yildirim & Gultekin (2022)	48 women with neuropathic LDH, aged 18-50 years, chronic pain for more than 2 months.	Yoga program - 12 weeks, 2 hours/week PROGRESSIVE EXERCISES: Increasing duration of more complex poses, range of motion, and rest intervals. Synchronized breathing with each posture.	Neuropathic pain questionnaire (DN4) Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) scale in McGill Pain Questionnaire (MPQ) Knee extension with modified Schober test Oswestry Disability Index (ODI)	Significant improvement in severe symptoms and functional status of neuropathic pain. Significant improvement in ODI. Increased spinal flexibility and hamstring muscle length. Faster recovery compared to conservative physical therapy groups.

LDH: lumbar disc herniation

### Dicussion

The results of this narrative review provide a comprehensive and up-to-date analysis of the various therapeutic exercise programs available to treat LDH and their effectiveness at improving patient outcomes. Although each reviewed study has its own unique methodological characteristics, several important points of cohesion were identified across the different programs.

Firstly, the diversity of the therapeutic exercise programs reflects the broad range of approaches currently employed to manage LDH. This variety suggests that an exercise program should be selected according to the patient's specific needs and recovery objectives. Factors such as LDH symptom severity, the patient's physical condition, and other individual characteristics influence the choice of treatment. Therefore, for LDH patients, a personalized approach is key to maximizing the benefits of therapeutic exercise.

Secondly, it is essential to thoroughly evaluate each program's specific characteristics and respective outcomes in order to assess the individual effectiveness of the interventions. In the reviewed studies, a variety of objective measurement tools were used to evaluate pain, function, and disability in LDH patients. Two studies notably employed widely recognized instruments such as the Visual Analog Scale (VAS) to quantify pain intensity, and the Oswestry Disability Index (ODI), a standard measure for assessing functional impairment due to lumbar pain (Lee et al., 2017; Shafshak & Elnemr, 2021; Yazici & Yerlikaya, 2022). These tools were complemented by additional functional tests aimed at evaluating the impact of therapeutic exercise on physical performance. Such tests are crucial in determining the efficacy of each program in alleviating pain, enhancing functional capacity, and reducing disability. The findings indicate that different exercise programs can yield significant benefits depending on the patient's individual needs and specific LDH characteristics. It is evident that objective measures, such as VAS and ODI, play a critical role in assessing the effectiveness of these interventions. Moving forward, it will be essential to further refine these methods to ensure that they are both adaptable to diverse patient populations and capable of addressing the range of LDH clinical presentations.

Regarding the use of the Visual Analog Scale (VAS) as a pain intensity measure, all therapeutic exercise programs reviewed were shown to reduce the pain levels of LDH patients. However, a significant variation was noted in the duration and intensity of these programs across the studies. For example, certain programs, such as the McKenzie Method and yoga (Al-horani et al., 2020; Yildirim & Gultekin, 2022), were implemented over a 12-week period, which represents a relatively long patient recovery timeframe. In contrast, other approaches, such as core stabilization exercises (Denny Pratama & Muhamad Elfitra, 2021), lasted only 4 weeks, thus reflecting a much shorter recovery time and suggesting that the method relieves pain faster.

A key finding from the latter approach is the significant reduction in pain intensity, as measured by the VAS, observed following the implementation of core stabilization exercises. Such an effect can be explained by the physiological response triggered by these exercises, as they stimulate the release of beta-endorphins—a type of peptide let out by the adrenocorticotrophic hormone (ACTH) in response to increased metabolic activity and body heat during exercise (Denny Pratama & Muhamad Elfitra, 2021). Beta-endorphins are known to interact with endogenous opioid receptors in the spinal cord, modulating the sensation of pain and contributing to the analgesic effects reported in the VAS results.

Moreover, the findings suggest that core stabilization exercises play a critical role in reducing pain perception because they affect circulating beta-endorphin levels in the bloodstream. This action mechanism highlights the potential of core stabilization exercises as an effective non-invasive therapeutic option, offering LDH patients both pain relief and functional improvement. Studies such as that by Thorén et al. (2011) further support the hypothesis according to which increased beta-endorphin levels correlate with improved pain management, reinforcing the argument that these exercises should be incorporated into clinical practice.

Nevertheless, the pain reduction was less pronounced than that reported by Gulsen & Sport (2019), where a significant relief in both resting and activity-related pain was observed following a four-week intervention involving core stabilization exercises and proprioceptive neuromuscular facilitation (PNF) training. The results of this study provide compelling evidence that both intervention strategies are effective at reducing pain in LDH patients. Upon closer analysis, however, significant differences appear between the two approaches.

In particular, the study highlighted notable distinctions between the lumbar stabilization group and the PNF group across several critical parameters. Specifically, the lumbar stabilization group demonstrated superior disability reduction outcomes, as measured by the Oswestry Disability Index (ODI), as well as improvements in left hip flexibility, overall flexibility as measured by the sit and reach test, and increased trunk muscle strength. These findings suggest that lumbar stabilization exercises may lead to more comprehensive functional and physical improvements than PNF training. The fact that lumbar stabilization exercises outperformed PNF training in these specific areas implies that the targeted strengthening of the lumbar musculature might be more effective at addressing the biomechanical and functional limitations associated with LDH. The observed trunk muscle strength and flexibility improvements further reinforce the hypothesis that stabilization exercises are crucial for enhancing spinal support and reducing strain on the intervertebral discs. Consequently, the evidence provided by Gulsen & Sport (2019) suggests that lumbar stabilization training may be more efficient at managing certain aspects of LDH rehabilitation than PNF training, particularly regarding core strength, flexibility, and functional capacity. On the other hand, the analysis conducted in this review revealed that each exercise program is based on distinct therapeutic approaches, grounded in different biomechanical and physiological principles. Yet certain common features can be identified across these methodologies.

The most prominent aspect in each study, due to its significance in the results, is the focus on improving muscle activation to stabilize the muscles surrounding the lumbar spine, as well as those in the anterior abdominal region. This aspect is evident in exercise programs based on Pilates, core stabilization training, proprioception, dynamic stabilization, and even in yoga-based programs (Denny Pratama & Muhamad Elfitra, 2021; Gulsen & Sport, 2019; Taşpınar et al., 2023; Ye et al., 2015; Yildirim & Gultekin, 2022). In this regard, it is worth noting the importance of activating essential muscles for lumbar stabilization, such as the multifidus, transverse abdominis, and spinal erectors (Sun et al., 2017; Zhao et al., 2000). As confirmed by Pratama and Salam (2021), when these muscle groups are coactivated correctly through central stabilization exercises, the load on the intervertebral discs is reduced, with the dual effect of improving trunk movement quality and reducing pain. The McKenzie-based approach (Al-horani et al., 2020), however, did not lead to clear lumbar strength improvement based on this method; instead, improvements were primarily seen in LDH patient Range of Motion (ROM) and in unilateral and bilateral force production.

Furthermore, the study by Ju et al. (2012) describes various analyses conducted to implement stabilization programs aimed at improving trunk muscles and ligaments, thereby preventing intervertebral disc micro-injuries. Notable in this regard are progressive resistance programs, which enhance isometric exercises, activating lumbar extensor muscles. Such an approach resulted in reduced pain and improved ROM in the assessed joints of HDL patients (Ju et al., 2012). Finally, an important finding is that lumbar pain is closely related to lumbar extension muscle strength. Consequently, many of the treatments evaluated focus on improving lumbar extension muscle activation (Steele et al., 2013, 2014).

Finally, the narrative analysis revealed a controversy regarding the optimal combination of therapeutic physical exercises based on those proposed in each program. The yoga program included stretching exercises










that contributed to improving patient flexibility (Yildirim & Gultekin, 2022). Stretching exercises were observed in this study to help reduce LDH patient disability and neuropathic pain (Yildirim & Gultekin, 2022). Similarly, the program presented in Verma et al. (2021) suggests that compared to intermittent lumbar traction stretching, performing piriformis muscle stretches combined with spinal extension exercises plays a crucial role in reducing LDH patient pain and disability. Furthermore, as highlighted in Yildirim & Gultekin (2022), the increase in flexibility may have contributed to functional improvement by allowing for smoother movements and reducing muscular stiffness associated with lumbar pain. The same study also emphasizes that while performing stretching exercises promotes neural mobilization, engaging solely in stabilization exercises only protects the lumbar spine rather than promoting stabilizer muscles activation. Consequently, this study combined both flexibility and strength exercises, which simultaneously enhanced mobility and increased the strength of the abdominal, lumbar, and hamstring muscles (Yildirim & Gultekin, 2022). Similarly, Avramova (2021) found that a specialized kinesiotherapy program combining hypopressive exercises and myofascial techniques significantly reduced pain levels and improved lumbar spine flexibility in women engaged in strength sports. The study demonstrated that strengthening deep abdominal muscles through hypopressive exercises contributed to better core stabilization, leading to improved functional outcomes and reduced risk of lumbar dysfunction.

Another notable finding is the fact that combining diaphragmatic breathing with the aforementioned exercises (such as core stabilization, Pilates, or yoga) enhances diaphragmatic neural drive, leading to muscle activation in the lumbar para-spinal region and contributes to functional improvement (Masroor et al., 2023). As a complementary aspect to this study, Additionally, incorporating mental imagery (MI) techniques during exercise, as demonstrated by (Daskalaki et al., 2024), further enhances functional outcomes in patients with chronic low back pain (CLBP). Their study found that combining self-myofascial release (SMR) with MI resulted in greater pain reduction, improved flexibility, and enhanced performance in functional tasks compared to exercise alone. This suggests that MI may contribute to neuromuscular control and proprioceptive awareness, synergizing with diaphragmatic breathing to foster better motor control and reduce unnecessary muscular tension in the lumbar region. It should be noted that passive therapeutic procedures do not seem to play a significant role in the recovery of the condition. However, there is evidence suggesting that controlled and progressive physical exercise, at moderate and vigorous intensities, improve the distribution of nutrients and hydration in the lumbar intervertebral discs and surrounding soft tissues (Bowden et al., 2018).

### Practical Application

A conclusion of this narrative literature review is that to properly manage LDH, a multifaceted approach must be adopted in which rehabilitation plays a crucial role through specific exercises. This proposed reconditioning program establishes a series of exercises based on the findings of this review. The exercises outlined below are focused on reducing pain, enhancing functionality, and strengthening the spinal stabilizer muscles. The program is divided into three progressive phases and combines stretching, strengthening, and stabilization exercises, along with periodic evaluations and personalized adjustments. It could potentially facilitate effective and sustained recovery, significantly improving the quality of life of patients with lumbar disc herniation.

**Table 3** Practical proposal. Training program

Phase 1: Pain reduction and basic mobility improvement		
Extension with diaphragmatic breathing	Baby rotation	Cat Cow
		
Phase 2: Strengthening and stabilization		
Quadruped without knee support	Arm-leg extension	Bird-Dog
		
Phase 3: Integration and functionality		
Hip Bridge	Side Plank with Rotation	Warrior
		



## Conclusion

In conclusion, the findings of this narrative literature review emphasize the importance of a tailored, multifaceted approach to LDH management, in which therapeutic exercise plays a pivotal role. The various exercise programs reviewed demonstrate the efficacy of specific therapeutic interventions in reducing pain, enhancing functionality, and improving the overall LDH patient's quality of life. While each program rests on distinct biomechanical and physiological principles, they share the common goal of stabilizing the lumbar spine through muscle activation, particularly targeting the deep stabilizer muscles such as the multifidus, transverse abdominis, and spinal erectors. Moreover, beyond its biomechanical benefits, therapeutic exercise appears to influence neurophysiological mechanisms that contribute to pain modulation and functional recovery. The studies analyzed further indicate that exercise programs based on Pilates, yoga, core stabilization, or proprioceptive training provide significant benefits in the treatment of LDH.

These findings reinforce the notion that a holistic and multimodal approach, integrating various exercise methodologies, may yield superior outcomes compared to isolated interventions. However, the lack of a universally accepted approach and the diversity of exercise methodologies highlight the need for further research to determine the optimal exercise prescription for patients with LDH. In summary, the present work provides a comprehensive overview of the therapeutic exercise interventions available. It also sets the stage for future studies that can refine and standardize rehabilitation protocols to ensure the most effective management of LDH. To finish, a promising avenue in the treatment of lumbar disc herniation is a well-structured exercise program that combines stretching, strengthening, and stabilization techniques, together with a progressive adjustment to each patient's individual needs.

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**Conflict of Interest** The authors declare that they have no conflicts of interest

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