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Impact of physical exercise on low back pain: a review

Izabella Sośniak [IS]

e-mail: iza.sosniak@gmail.com

ORCID: <https://orcid.org/0009-0000-9438-6175>

Brothers Hospitallers Hospital in Kraków, Trynitarska 11, 31-061 Kraków, Poland

Marta Miejska-Kamińska [MK]

e-mail: miejskamarta@gmail.com

ORCID: <https://orcid.org/0009-0008-5592-1778>

University of Rzeszów, aleja Tadeusza Rejtana 16C, 35-310 Rzeszów, Poland

Lidia Jurczenko [LJ]

e-mail: lidia.jurczenko@gmail.com

ORCID: <https://orcid.org/0009-0005-5075-629X>

4th Military Clinical Hospital, Wrocław, Lower Silesia, Poland, Weigla 5, 53-114
Wrocław

Abstract

Low back pain (LBP) is one of the most common musculoskeletal disorders, affecting up to 80% of the population at least once in their lifetime. As the leading cause of disability worldwide, LBP significantly impacts quality of life and functional ability. Due to the limited effectiveness of pharmacological treatments, there is growing interest in non-pharmacological therapies, particularly physical exercise.

The aim of this review was to analyze the effectiveness of various forms of physical activity in the treatment of chronic non-specific low back pain (CNSLBP). The review considered stabilization training, core exercises, yoga, Pilates, breathing exercises, aquatic therapy, isokinetic training, dynamic neuromuscular stabilization (DNS), pelvic floor muscle training, and combined interventions, such as manual therapy with sexual counseling or group-based online programs.

The results of the analyzed studies indicate that exercise—especially when individually tailored and comprehensive—is effective in reducing pain, improving function, and enhancing quality of life in patients with CNSLBP. Particularly beneficial outcomes were observed in programs that combined motor training with a psychosocial approach.

Keywords: low back pain, exercise, sport, physical activity, chronic pain

1. Introduction

Low back pain (LBP) is one of the most common and most quality-of-life-reducing conditions in today's population, affecting not only working individuals but also seniors and young adults. It is estimated that up to 80% of people experience at least one episode of low back pain during their lifetime, making it one of the leading causes of disability worldwide [1].

Despite its prevalence, the etiology of LBP often remains non-specific, and treatment—particularly pharmacological—yields limited and short-term results [2], [3].

With growing awareness of the importance of non-pharmacological approaches, there is increasing interest in the role of physical activity and therapeutic exercises in alleviating symptoms and preventing the recurrence of low back pain. Various forms of exercise, such as stabilization training, stretching, yoga, Pilates, or aerobic workouts, are used both in the prevention and treatment of chronic and acute LBP. However, their effectiveness can vary depending on the type of pain, its intensity, duration, and the individual characteristics of the patient.

The aim of this review is to analyze available scientific studies on the impact of exercise and broadly understood physical activity on symptoms of low back pain.

2. Methodology

The Pubmed search engine uses the search criteria MeSH Terms: *Low back pain* and *Exercise*. The study included studies from 2024 - 2025 and free access to the full text of the article. Using filters, papers of the "Clinical Trial" and "Randomized Controlled Trial" types were searched for. Then, after a meticulous review of the available literature, articles on the effects of exercise on low back pain were included in the study.

3. Discussion

3.1 Stabilization training, manual therapy, kinesiотaping

A randomized clinical trial evaluated the effects of a 12-week exercise program focused on trunk stabilization and motor control, supported by manual therapy (MT) or kinesiотaping (KT), in patients with chronic low back pain (CLBP) and mild disability. The results showed that interventions based on a multimodal approach—combining exercise with additional therapeutic techniques—significantly reduced perceived pain, as measured by the Visual Analogue Scale (VAS). Although no clear differences were found between stabilization exercises alone and motor control training combined with MT or KT, positive changes were observed in the electrical activity of the rectus abdominis muscle, measured using electromyography (EMG). The improvement in pain perception was not directly correlated with changes in muscle electrical activity, which may indicate the complex mechanisms responsible for pain reduction in CLBP and the need to consider biopsychosocial aspects of treatment. [4]

A separate trial investigated the impact of a short core stabilization session on the phenomenon of exercise-induced hypoalgesia (EIH) in patients with non-specific chronic low back pain (CLBP), and analyzed factors that might influence this effect. In this randomized

crossover study, 30 patients performed a 10-minute isometric exercise and a control session. A significant increase in pressure pain threshold in the lumbar region was observed after the stabilization exercise, without any systemic effect. A moderate, negative correlation was found between the intensity of catastrophizing and the magnitude of the analgesic response. These findings suggest that short, simple core stabilization exercises can effectively and immediately reduce local pain in individuals with CLBP. [5]

Research also explored the influence of the “abdominal drawing-in” maneuver (ADIM) on spinal extensor muscle activity during selected exercises in individuals with non-specific low back pain (NSLBP). Forty participants performed three exercises—prone trunk lift, superman, and superman on an unstable surface—with and without the use of ADIM. Electromyographic analysis revealed that ADIM significantly modified muscle activity: it reduced activation of the lumbar portion of the iliocostalis and increased activation of its thoracic portion as well as the longissimus thoracis. The most notable changes were observed during the “unstable superman” exercise. These results indicate that incorporating ADIM into exercise programs may positively influence spinal stabilization and be an effective component of NSLBP therapy. [6]

In addition, a randomized clinical trial assessed the effectiveness of deep trunk muscle stabilization exercises with or without dry cupping therapy in patients with sacroiliac joint dysfunction. Twenty-eight participants were divided into two groups: an intervention group (stabilization exercises + dry cupping) and a control group (stabilization exercises only). The interventions were conducted once a week for six weeks. Both groups showed significant improvements compared to baseline in terms of pain intensity (NPRS) and disability level (modified Oswestry Disability Index). However, the combined therapy group achieved significantly better post-treatment outcomes than the control group. These results suggest that integrating dry cupping with stabilization exercises may offer greater benefits in reducing pain and functional limitations in patients with sacroiliac joint dysfunction. [7]

3.2 Walking

In the randomized clinical WalkBack trial, the effectiveness and cost-efficiency of an individualized, progressive walking program combined with education were evaluated for the prevention of recurrences of non-specific low back pain. The study included adults who had recently recovered from a pain episode and had no clear underlying diagnosis. Participants were randomly assigned to an intervention group, which engaged in a six-month, personalized walking program supported by a physiotherapist, or to a control group that received no treatment.

The results showed that the intervention effectively delayed the onset of the next activity-limiting pain episode—the median time to recurrence was 208 days in the intervention group compared to 112 days in the control group. Economic analysis confirmed the program’s cost-effectiveness, with a cost per quality-adjusted life year (QALY) gained of 7,802 Australian dollars and a 94% probability of being cost-effective at the willingness-to-pay threshold of

28,000 AUD. Although the overall number of adverse events was similar in both groups, lower limb complaints were more frequently reported in the intervention group.

This study confirms that an individualized walking program combined with education is an effective, low-cost, and easily implementable strategy for preventing low back pain recurrences, which may influence future guidelines for its treatment and prevention. [8]

3.3 Pilates

A randomized clinical trial compared the effectiveness of a Pilates exercise program with home-based exercises in individuals with chronic non-specific low back pain. The study included 145 participants aged 18 to 50, who were randomly assigned to either the Pilates group or the home exercise group. Both interventions were performed twice a week for six weeks. The results showed that immediately after completing the program, participants in the Pilates group experienced significantly lower pain intensity, reduced disability, and better health-related quality of life compared to those in the home exercise group. At the six-month follow-up, the superiority of Pilates persisted only in terms of quality of life, while differences in pain and disability were no longer statistically significant. Overall analysis revealed significantly better outcomes for Pilates in terms of disability and quality of life, though not for pain intensity. While the differences in pain and disability were statistically significant, they did not reach the threshold for clinical relevance. In contrast, the improvement in quality of life following the Pilates program was both statistically and clinically significant, suggesting that this form of exercise may have meaningful value in the long-term functional improvement of patients with chronic low back pain. [9]

Another study evaluated the impact of high- and low-intensity Pilates exercises on pain, disability, patient-specific function, and hip isometric strength in individuals with chronic non-specific low back pain. In this randomized trial, 168 participants completed Pilates programs of varying intensity over a six-week period. The results showed that both training intensities had a similar effect on all assessed parameters. At both 6 and 12 months, there were minimal differences in pain intensity favoring low-intensity Pilates, although no significant differences were observed in disability levels. Fewer adverse events were reported in the low-intensity group. These findings suggest that low-intensity Pilates exercises are an effective and safer option for the treatment of chronic non-specific low back pain. [10]

3.4 Exercises to strengthen the posterior chain muscles

A randomized trial evaluated the effects of balance training and strengthening exercises for the hamstring muscles in individuals with nonspecific low back pain (NSLBP). Twenty-six participants were divided into an experimental group (EG) and a control group (CG). The experimental group engaged in 45-minute training sessions three times per week for six weeks, while the control group continued their daily activities without any additional interventions.

After six weeks, the experimental group showed a significant reduction in pain intensity on the Visual Analog Scale (VAS) compared to the control group. Additionally, significant improvements were observed in back muscle strength, abdominal and back muscle endurance, and hamstring strength. However, no significant differences were found between the groups in terms of balance ability, abdominal muscle strength, or hamstring flexibility.

The results suggest that a six-week program focused on balance and posterior chain strengthening effectively reduces pain and improves strength and endurance parameters in individuals with NSLBP. [11]

3.5 Isokinetic exercise therapy

A prospective comparative study evaluated the effects of isokinetic rehabilitation and conventional active physiotherapy on the strength of spinal extensors and flexors in patients with chronic low back pain. Fifty participants were randomly assigned to two groups: one group (G1) underwent an isokinetic rehabilitation program, while the other group (G2) received conventional active physiotherapy. Clinical assessments (Sorensen and Shirado tests) and isokinetic analysis of trunk muscle strength were conducted before and after rehabilitation.

The results showed an initial strength deficit in both spinal extensors and flexors, with a more pronounced deficit in the extensors. After the intervention, both groups demonstrated significant improvements in muscular endurance as measured by clinical tests. Isokinetic analysis revealed greater gains in strength and endurance in the isokinetic rehabilitation group, with more marked increases in peak torque, power, and total work compared to the conventional therapy group. A particularly large increase in extensor strength was observed at a velocity of 60°/s, and a significant rise in power at 90°/s.

The findings suggest that isokinetic rehabilitation is a more effective method for improving muscular strength and endurance in patients with chronic low back pain compared to traditional forms of physiotherapy. [12]

3.6 Dynamic neuromuscular stabilization training

The study evaluated the effectiveness of Dynamic Neuromuscular Stabilization (DNS) training compared to conventional core exercises in patients with chronic low back pain (CLBP).

Sixty patients were randomly assigned to a DNS group or a control group, and both exercise programs were conducted over four weeks (three 50-minute sessions per week). Pre- and post-intervention assessments included ultrasound analysis of deep trunk muscle contractility (transversus abdominis, lumbar multifidus, and diaphragm), postural control tests (center of pressure displacement – COP), and questionnaires assessing pain and disability (VAS, ODI, RDQ).

After completing the program, the DNS group showed significantly greater improvements in deep muscle contractility and better performance in balance tests, particularly under conditions with limited visual input. Although both groups experienced reductions in pain and disability, the differences between them in these parameters were not statistically significant.

The findings suggest that DNS training is more effective than conventional core exercises in enhancing the function of stabilizing muscles and postural control in patients with CLBP, likely by strengthening proprioceptive mechanisms. [13]

3.7 Aquatic therapeutic exercises

The study analyzed risk factors for treatment failure in managing chronic low back pain (cLBP) following physiotherapeutic intervention. A secondary analysis of a randomized clinical trial included 98 patients who completed a 12-month follow-up. Patients were randomly assigned to a three-month aquatic exercise program or conventional physiotherapy treatments. The primary endpoint was treatment failure, defined as a failure to achieve a pain reduction of at least 2 points on the numerical rating scale after 12 months.

The results showed that among patients in whom treatment failed, the initial improvement observed at 3 months was not sustained—pain scores worsened at both 6 and 12 months. Older age significantly increased the risk of treatment failure (adjusted OR 3.26), while aquatic therapeutic exercises significantly reduced this risk compared to traditional physiotherapy methods (adjusted OR 0.19). Patient age was found to be a modifying factor in this relationship. The findings suggest that aquatic therapeutic exercises are a more effective long-term method for alleviating pain in cLBP, particularly in older adults, and may be more effective in preventing treatment failure than traditional physiotherapy approaches. [14]

3.8 Online group exercises

A study was conducted to evaluate the effectiveness of a group-based resistance exercise intervention delivered in real time via videoconferencing on lower back pain among elderly care workers. The study included 130 participants who were randomly assigned to an experimental group (EG) or a control group (CG). Both groups participated in standard workplace prevention programs, while the EG additionally took part in a 12-week supervised online exercise program. The primary outcome measured was the average intensity of back pain

over the past 7 days, assessed using a 0–10 numerical rating scale. At the end of the intervention, an intention-to-treat analysis showed a significant reduction in back pain in the EG ($p = 0.034$), along with improvements in arm/wrist pain and upper limb muscle performance ($p < 0.05$). A per-protocol analysis revealed additional benefits related to depression, quality of life, medication use, and lower limb and trunk muscle strength. The findings suggest that online intervention is an effective method for reducing pain and improving muscle function in this occupational group. [15]

3.9 Group exercise program for the elderly

The aim of the study was to evaluate the effects of a group exercise program on pain, disability, subjective improvement, fall frequency, fear of falling, and physical activity levels in older adults with chronic non-specific low back pain (CNSLBP). A total of 120 participants aged ≥ 60 years were included in the study and randomly assigned to either an exercise group or a waitlist control group. The intervention group participated in one-hour exercise sessions three times a week for 8 weeks. Compared to the control group, group exercise significantly reduced pain intensity (MD -2.0) and disability levels (MD -3.4), and improved subjective health assessment, with effects maintained for up to 12 months. A short-term increase in physical activity levels was also observed, while the impact on fear of falling was minimal. The results confirm the effectiveness and safety of group exercise in the treatment of CNSLBP in older adults in primary care settings. [16]

3.10 Breathing exercises

The effectiveness of deep muscle training combined with breathing exercises in treating chronic non-specific low back pain (CNLBP) was evaluated in this investigation. Eighteen patients with CNLBP were randomly assigned to one of three groups: core training only, core training with breathing exercises, and a control group. The 12-week intervention program included assessments of pain intensity (VAS), disability level (ODI), and muscle strength. The results showed that the group combining core training with breathing exercises achieved significantly greater pain reduction, functional improvement, and increases in muscle strength compared to the other groups. The findings suggest that incorporating breathing exercises into core training provides additional benefits in the treatment of CNLBP. [17]

3.11 Pelvic floor muscles

A study was conducted to evaluate the effects of combined core and pelvic floor muscle (PFM) training on lumbar function in sedentary women with low back pain (LBP). Sixty

participants were randomly assigned to one of three groups: a control group, a core training group, and a group performing combined core and PFM training. The intervention lasted four weeks and included three sessions per week. Trunk muscle endurance, deep lumbar stabilizer activity, and pain intensity were assessed. The results showed that both core training and the combined core and PFM training significantly improved muscular endurance and reduced pain, with the greatest benefits observed in the group performing core training alone. [18]

3.12 Low- load training

This study aimed to compare the effectiveness of low-load blood flow restriction training (LL-BFRT) and traditional high-load resistance training (HL-RT) in male collegiate athletes with chronic non-specific low back pain (CNLBP). Twenty-six participants performed exercises four times a week for four weeks. The LL-BFRT group achieved significant pain reduction and functional improvement. Both groups showed significant gains in trunk muscle strength and endurance. The results suggest that LL-BFRT may be an effective alternative for individuals with physical limitations. [19]

3.13 Sexual counselling

In a randomized single-blind trial, the effectiveness of manual therapy combined with sexual counseling (MT+SA) was evaluated in comparison to manual therapy alone (MT) and exercise therapy (ET) in patients with chronic lumbar disc herniation with sciatica symptoms (DHR). The study included 54 participants who were evenly assigned to the three treatment groups. The intervention period lasted 12 weeks, followed by a 40-week follow-up phase.

The MT+SA group achieved significantly better outcomes at all assessed time points (weeks 6, 12, 26, and 52), as well as in most parameters: reduction of back and lower limb pain, decreased medication use, improved mobility, reduced fear of movement (kinesiophobia), fewer activity limitations, and reduced sexual disability. These effects were also clinically significant. The study also identified the most commonly preferred sexual positions among patients with DHR. Among women, the most frequently chosen position was side-lying, while the least preferred was standing. Among men, the most common position was lying on the back, and the least preferred was sitting on a chair.

Conclusions: The combination of manual therapy and sexual counseling proved to be more effective than manual therapy alone or exercise therapy in patients with DHR. These findings highlight the importance of addressing the sexual dimension within the biopsychosocial approach to low back pain treatment, particularly in the context of improving patients' quality of life. [20]

3.14 Yoga

A non-randomized controlled study was conducted to evaluate the effectiveness of a professionally designed exercise program based on hatha yoga in improving trunk muscle endurance in healthy adults. Participants included individuals without spinal pain or prior experience with trunk endurance training. They were divided into two groups: the experimental group (EG) attended one-hour hatha yoga sessions twice a week for three months. These sessions included segmental stabilization exercises for the spine and pelvis. The control group (CG) made no changes to their usual physical activity. Trunk muscle endurance was measured before and after the intervention. The results showed that participants in the exercise group achieved a significant improvement in three out of four assessed muscle groups ($p < 0.05$) compared to the control group. However, no significant changes were observed in the endurance balance between individual muscle groups.

The findings suggest that regular hatha yoga practice enriched with segmental stabilization elements can effectively increase trunk muscle endurance in healthy individuals. Given the preventive potential of such training, the authors recommend further research in populations with low back pain to assess the long-term effectiveness of the program. [21]

4 Summary

This paper analyzes the available scientific evidence on the effectiveness of various forms of physical activity in the treatment of chronic non-specific low back pain (CNSLBP). Group exercise programs conducted in primary care settings demonstrate long-term effectiveness in reducing pain and disability. Incorporating breathing exercises into deep core muscle training provides additional functional benefits, while activation of the pelvic floor muscles may support lumbar spine stabilization, particularly in sedentary women. Low-load blood flow restriction training (LL-BFRT) appears to be an effective alternative to traditional resistance training for individuals with physical limitations. Therapeutic benefits have also been demonstrated for interventions that integrate psychosocial aspects, such as manual therapy combined with sexual counseling, as well as psychophysical exercises like hatha yoga.

The results highlight the importance of tailoring therapy to the individual needs of the patient and taking into account not only physical factors, but also psychological and social aspects in the treatment of chronic low back pain. Movement in its various forms proves to be a key element of an effective therapeutic approach in managing this condition.

Disclosure

Authors do not report any disclosures.

Author's contributions

Conceptualization: IS, MK, LJ

Methodology: IS, MK, LJ

Software: n/a; check: IS, MK, LJ

Formal analysis: IS, MK, LJ

Investigation: IS, MK, LJ

Resources: IS, MK, LJ

Data curation: IS, MK, LJ

Writing - rough preparation: IS, MK, LJ

Writing - review and editing: IS, MK, LJ

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