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Effectiveness of Physiotherapy in Improving Muscle Strength, Spinal Mobility and Pain Reduction in Patients with Low Back Pain: A Pilot Clinical Study

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SUMMARY/ABSTRACT

Introduction: Low back pain (LBP) is one of the most common musculoskeletal disorders in the modern population, representing a significant health, social, and economic issue. Physiotherapy is a fundamental component of conservative treatment for this condition.

Objective: The aim of this study was to evaluate the effect of physiotherapeutic intervention on improving trunk muscle strength, lumbar spine mobility, and pain intensity in patients with nonspecific LBP.

Methods: Fifty patients with non-specific low back pain were enrolled in the study. Each patient completed an individualized physiotherapy program composed of selected kinesiotherapy methods (spiral stabilization, spinal exercises, Pilates, stretching, and soft tissue techniques). Therapy was conducted three times per week, in 60-minute sessions, for a total of 10 sessions. Muscle strength was assessed using Janda's test; spinal mobility was evaluated through Schober's and Stibor's tests and lateral flexion measurements. Subjective pain and disability were assessed using the Oswestry Disability Index (ODI).

Results: Following physiotherapy intervention, statistically significant improvements were observed in all monitored parameters. Trunk muscle strength improved by an average of 0.61–0.95 points ($p < 0.001$), spinal mobility increased by 1.66–4.72 cm ($p < 0.001$). The ODI score decreased from a mean of 2.98 to 1.57 points ($p < 0.001$), indicating a significant reduction in perceived pain and functional limitation.

Conclusion: The results confirm that a targeted physiotherapy program leads to improved muscle function, increased spinal mobility, and reduced pain in patients with nonspecific low back pain. Physiotherapy remains an essential element in the management of this condition.

KEYWORDS

Low back pain, physiotherapy, mobility.

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1 INTRODUCTION

Low back pain (LBP) represents one of the most common reasons for seeking medical care. In economically developed countries, its prevalence among individuals aged 35 to 55 is reported to reach up to 70%. It constitutes a significant global health issue, affecting not only individual well-being but also exerting considerable socioeconomic impact. LBP negatively influences work capacity, increases the incidence of disability and sick leave, leads to long-term impairment, raises healthcare costs, and reduces the overall quality of life. Risk factors include increasing age, female sex, lower educational attainment, unfavorable socioeconomic status, physical inactivity, and certain occupational demands. In most cases, this condition can be effectively managed through conservative therapeutic approaches, with physiotherapy playing a key role. However, in a subset of patients with chronic or severe symptoms, surgical intervention may be indicated, particularly when there is substantial impairment of functional ability and quality of life.[1,2,3,4, 9, 10, 11, 12, 13]

2 OBJECTIVE

The objective of this pilot clinical study was to evaluate the effect of physiotherapeutic intervention on selected physiotherapeutic parameters in patients suffering from low back pain.

3 GROUP AND METHODS

A total of 50 patients were consecutively recruited for the study, with chronic non-specific low back pain as the primary inclusion criterion**.** Among the participants, 27 were men (54 %) and 23 were women (46 %), with a mean age of 47.8 ± 12.6 years. All patients reported chronic pain persisting for more than three months**.** All participants underwent baseline physiotherapeutic assessments focused on evaluating pain intensity, spinal range of motion, and trunk muscle strength. Data were collected using interviews, measurements, clinical observations, comparative methods, and the standardized Oswestry Disability Index questionnaire. The same assessments were repeated following the completion of the physiotherapeutic intervention. To evaluate spinal dynamics, the Schober test, the Stibor test, and lateral flexion measurements were employed. Spinal mobility was assessed using a tailor's measuring tape in accordance with established methodologies. Muscle strength of the trunk flexors, extensors, and pelvic elevators was evaluated using muscle testing based on Janda's method. Pain levels and functional limitations in daily activities were assessed via the Oswestry Disability Index Questionnaire.

Based on the initial assessment results, an individualized physiotherapy program was developed for each patient, followed by the initiation of therapy. The program incorporated various kinesitherapy methods, including spiral stabilization, the Kaltenborn method, spinal exercises, Pilates, stretching, and soft tissue techniques. Exercise sessions involved the use of equipment such as exercise balls, BOSU trainers, and resistance bands. Physiotherapy sessions were conducted individually with a physiotherapist three times per week, each lasting 60 minutes, for a total of 10 sessions. Physical therapy modalities were also applied as adjunct treatment for pain relief. Upon completion of the physiotherapy program, follow-up assessments using the same methods as the initial evaluation were performed to determine treatment effectiveness.

All patients provided informed consent for the anonymous processing and use of their data for research purposes. Data were statistically analyzed using paired t-tests or Wilcoxon signed-rank tests depending on data distribution, with a significance level set at $p < 0.05$.

4 RESULTS

4.1 Oswestry Disability Index

To evaluate pain and limitations in daily activities among patients with low back pain, the Oswestry Disability Index (ODI) was used. This widely recognized questionnaire assesses functional disability due to lower back pain. It includes questions related to pain intensity, sleep, sitting, standing, walking, and lifting, as well as social aspects such as self-care, sexual activity, traveling, and social life.

The questionnaire consists of 10 items each offering six response options. Responses are scored on a scale from 0 to 5, where 5 represents the highest level of disability for a given item. The total score is calculated by summing all item scores and expressed as a percentage from 0% to 100%.

Table 1 - Overview and statistical analysis of baseline and post-treatment ODI scores – perceived pain in daily life

Perceived Pain Level (ODI)	Mean ($\bar{x}$)	Median	SD	Minimum (pts)	Maximum (pts)	Z	p - value
Before physiotherapy	2,98	3,00	0,481	2,20	4,30	- 6.158	0.001
After physiotherapy	1,57	1,42	0,507	1,00	3,20		

$\bar{x}$ – arithmetic mean, *SD* – standard deviation *Z* – test statistic value *p* – statistical significance

The average score on the ODI before the start of physiotherapy was 2.98 points, with a minimum of 2.20 and a maximum of 4.30 points. After completing the therapy, the average score decreased to 1.57 points, with a minimum of 1.00 and a maximum of 3.20 points. At the beginning of physiotherapy, the mean ODI score was 2.98 points, which decreased to 1.57 points after the therapy. This represents a reduction in perceived pain of 1.41 points. The median score before therapy was 3.00 points, compared to 1.42 points after therapy. Statistical analysis confirmed a significant reduction in low back pain following the physiotherapeutic intervention ($p < 0.001$).

4.2 Spinal Mobility Assessment

To evaluate spinal mobility, we used three standardized tests: the Schober test, the Stibor test, and lateral flexion measurements on both sides. Spinal range of motion was assessed using a tailor's measuring tape according to established procedures.

Schober test - this test evaluates the mobility of the lumbar spine. A baseline point is marked at the level of the posterior superior iliac spines, and 10 cm above it. During forward flexion, the distance should normally increase by 4–6 cm.

Stibor test - this test assesses the mobility of both the thoracic and lumbar spine. The measurement is taken from the posterior superior iliac spines up to the C7 vertebra before and after forward bending. A normal increase is 7–10 cm.

Lateral flexion (right and left) - the test is performed in a standing position with arms relaxed along the body. The subject performs a lateral bend while the fingertips slide along a tailor's measuring tape. Normal lateral flexion values range between 20–25 cm.[5]

Table 2 - Overview of Spinal Mobility Test Results

Test	Pre-Treatment ($\bar{x}$ ± SD)	Post-Treatment ($\bar{x}$ ± SD)	Change	Median Pre	Median Post	Z	p-value
Schober Test	2.83 ± 0.85 cm	4.49 ± 0.95 cm	+1.66 cm	3.00 cm	4.50 cm	-5.948	0.001
Stibor Test	4.48 ± 1.05 cm	7.53 ± 1.55 cm	+3.05 cm	4.25 cm	7.75 cm	-5.981	0.001
Lateral Flexion (Right)	15.40 ± 4.18 cm	20.12 ± 3.52 cm	+4.72 cm	14.00 cm	21.00 cm	-5.313	0.001
Lateral Flexion (Left)	17.76 ± 4.38 cm	19.72 ± 3.52 cm	+1.96 cm	15.00 cm	20.00 cm	-5.282	0.001

$\bar{x}$ – arithmetic mean, *SD* – standard deviation *Z* – test statistic value *p* – statistical significance

After completing the physiotherapeutic program, a statistically significant improvement in spinal mobility was observed across all tests ($p < 0.001$). Both lumbar and thoracic spinal flexion, as well as lateral flexion, increased measurably, confirming the effectiveness of the applied physiotherapy intervention.

4.3 Muscle strength test

Assessing muscle strength is a key component of a comprehensive musculoskeletal evaluation. To evaluate the strength of trunk flexors, extensors, oblique abdominal muscles, and muscles responsible for pelvic elevation, we used the muscle test according to Janda. The testing was performed using a 0 to 5 grading scale, where 0 indicates no contraction and 5 represents full muscle strength against resistance. All assessments were conducted under standardized conditions and evaluated by the same physiotherapist to ensure the reliability of the results. We used the following muscle strength assessments: trunk flexion (assesses the strength of the rectus abdominis muscle), trunk flexion with rotation (evaluates the oblique abdominal

muscles), trunk extension (assesses the strength of the back extensors), pelvic elevation (tests the strength of pelvic stabilizers – mainly quadratus lumborum muscle).[6]

Table 3 - Overview of muscle strength test results

Muscle Strength Test	Before Therapy ($\bar{x} \pm SD$)	After Therapy ($\bar{x} \pm SD$)	Change	Median Before	Median After	Z	p-value
Trunk flexion	3.58 ± 0.84	4.19 ± 0.59	+0.61	3.50	4.00	-5.283	0.001
Trunk flexion with rotation	3.56 ± 0.55	4.22 ± 0.54	+0.66	3.50	4.25	-5.887	0.001
Trunk extension	3.57 ± 0.45	4.17 ± 0.58	+0.60	3.50	4.00	-5.842	0.001
Pelvic elevation	3.67 ± 0.59	4.45 ± 0.53	+0.78	3.50	4.50	-5.513	0.001

$\bar{x}$ – arithmetic mean, *SD* – standard deviation *Z* – test statistic value *p* – statistical significance

The data show a statistically significant improvement in muscle strength across all tested areas following the physiotherapy intervention ($p < 0.001$). Mean values increased in every test, indicating progress toward higher muscle function according to the Janda scale. The most notable improvement was observed in the pelvic elevation test, where muscle strength increased by an average of 0.78 points. Significant gains were also recorded in the trunk flexion and trunk flexion with rotation tests, demonstrating improved engagement of the abdominal muscle groups during therapy. These findings confirm that the physiotherapeutic intervention had a positive impact on trunk muscle function, particularly by strengthening muscle groups essential for spinal and pelvic stability and movement. Improved muscle strength in these areas is critical for posture control, movement coordination, and the prevention of recurrent back pain.

5 DISCUSSION

Vertebrogenic disorders are currently considered lifestyle diseases that affect people across all age groups. The highest prevalence is recorded among individuals aged 45 to 74 years. Lower back pain ranks among the most common chronic pain conditions and represents a major health, social, and economic burden worldwide. Low back pain is classified based on its duration, cause, and the presence of radicular symptoms. Acute pain is defined as pain lasting less than four weeks, subacute pain lasts from four to twelve weeks, and chronic pain persists for more than twelve weeks.

Treatment of back pain focuses primarily on symptom relief. In addition to pharmacological and invasive interventions, non-pharmacological approaches and lifestyle changes are increasingly being used, with physiotherapy playing a particularly important role. Physiotherapeutic interventions and targeted exercise programs are commonly applied in patients with nonspecific lumbar spine pain. In recent years, Pilates and yoga have become two of the most widely used methods in physiotherapy practice. Both approaches help improve strength, flexibility, fitness, balance, and reduce muscular imbalances. [4, 7, 8]

Based on the initial assessments, each patient received an individualized physiotherapy program. The intervention included elements of various kinesiotherapy techniques, such as spiral stabilization, the Kaltenborn method, spinal exercises, Pilates, stretching, and soft tissue treatment. The therapy was conducted three times per week in 60-minute sessions, for a total of ten sessions. Patient education about the "back school" and its application in daily activities formed an essential part of the treatment. Additionally, physical therapy modalities were employed to help relieve pain.

Following the physiotherapy intervention, significant improvements were observed across all measured parameters. The strength of the rectus abdominis muscle during trunk flexion increased by an average of 0.61 points ($p < 0.001$), the erector spinae muscle during extension improved by 0.60 points ($p < 0.001$), the obliquus internus and externus abdominis during rotational trunk flexion improved by 0.66 points ($p < 0.001$), and the quadratus lumborum muscle during pelvic elevation improved by 0.95 points ($p < 0.001$). Improvements in spinal mobility were also recorded: the average Schober's test result improved by 1.66 cm, the Stibor's test by 3.05 cm, right lateral flexion by 4.72 cm, and left lateral flexion by 1.96 cm (all $p < 0.001$).

A significant reduction in perceived pain was also recorded, assessed via the Oswestry Disability Index. Before the start of physiotherapy, the average ODI score was 2.98 points, which decreased to 1.57 points after completing the intervention. This represents an average reduction of 1.41 points, which was statistically significant ($p < 0.001$), confirming the effectiveness of the physiotherapy approach.
However, many patients encounter the principles of the back school only after symptoms have fully developed - either in an acute or chronic form[4]. Therefore, education and early prevention are crucial components of effective therapy. Vavro (2022) emphasizes the importance of patient motivation for exercise. Maintaining long-term motivation is a lifelong challenge for many people. A lack of willpower often leads to resignation, failure, and a search for alternative ways to eliminate pain. The easiest and most immediate option is the use of analgesics, which may offer temporary relief but do not address the underlying cause. As a result, patients may return to outpatient therapy repeatedly throughout the year without long -term benefits. To avoid such an undesirable scenario, we placed a strong emphasis on promoting internal motivation as a core component of our therapeutic strategy. Both patients approached their treatment with responsibility and genuine interest, confirming that the success of physiotherapy is largely dependent on the patient's active participation and cooperation.

The study is limited by a small sample size and the absence of a control group, which restricts the generalizability of the findings. Future studies with larger samples and control groups are needed to confirm the effectiveness of the treatment.

6 CONCLUSIONS

The findings of this pilot clinical study clearly demonstrate that a structured and targeted physiotherapeutic intervention yields substantial benefits for patients with non-specific lower back pain. Following the completion of an individualized rehabilitation program, participants experienced statistically significant improvements across multiple domains: enhanced trunk muscle strength, increased spinal mobility and functional dynamics, and a noteworthy reduction in self-reported pain levels, as evidenced by the Oswestry Disability Index.

These outcomes underscore the efficacy of comprehensive physiotherapy as a vital non-pharmacological strategy within a holistic, multidisciplinary care framework. Moreover, the active engagement and intrinsic motivation of patients emerged as key determinants in achieving sustained therapeutic success - factors all too often overlooked in conventional care models. Given these results, it is recommended that physiotherapy be systematically integrated into treatment protocols for chronic and subacute lower back pain.

REFERENCES

1. Chiarotto A, Koes BW. Nonspecific low back pain. *N Engl J Med* **386**, 1732–1740 (2022).
2. Nieminen LK, Pyysalo LM, Kankaanpää MJ. Prognostic factors for pain chronicity in low back pain: a systematic review. *Pain Rep* **6**, e919 (2021).
3. Nicol V, et al. Chronic low back pain: a narrative review of recent international guidelines for diagnosis and conservative treatment. *J Clin Med* **12**, 1685 (2023).
4. Vavro M. *Physiotherapy and its application in performance taekwondo athletes with lower back pain*. Specialization thesis, University of Ss. Cyril and Methodius, Trnava (2022).
5. Kolář P, et al. *Fundamentals of Clinical Rehabilitation*. Galén, Prague (2021).
6. Janda V, et al. *Muscle functional tests*, 1st ed. Grada Publishing, Bratislava (2024).
7. Migliorini F, et al. Impact of education in patients undergoing physiotherapy for lower back pain: a level I systematic review and meta-analysis. *Eur J Trauma Emerg Surg* **51**, 113 (2025).
8. Magalhães MO, et al. Effectiveness of graded activity versus physiotherapy in patients with chronic nonspecific low back pain: midterm follow up results of a randomized controlled trial. *Brazil J Phys Ther* **22**, 82–91 (2018).

9. García-Moreno JM, et al. Effectiveness of physiotherapy interventions for back care and the prevention of non-specific low back pain in children and adolescents: a systematic review and meta-analysis. *BMC Musculoskelet Disord* **23**, 314 (2022).
10. Christe G, et al. Physiotherapists' attitudes and beliefs about low back pain influence their clinical decisions and advice. *Musculoskelet Sci Pract* **53**, 102382 (2021).
11. Mescouto K, et al. Physiotherapists both reproduce and resist biomedical dominance when working with people with low back pain: a qualitative study towards new praxis. *Qual Health Res* **32**, 902–915 (2022).
12. Debnarova J, Libova L, Bachrata Z, et al. The impact of tele-education on the mobilization of mothers post Cesarean section. *Clin Soc Work* **39** (2019).
13. Nagyova I, Libova L, Otrubova J, et al. Implementing nursing standards in care maps for breast cancer patients. *Clin Soc Work Health Interv* **13**, 73–80 (2022).