



# Rehabilitation Impact on Functional Disability with Mechanical Back Pain and the Evaluation of their Effectiveness

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## Abstract

**Background:** Mechanical back pain is a common condition that severely affects daily functioning and the quality of life. It often manifests as pain, stiffness, and limited movement, resulting in a functional handicap for affected individuals.

**Objectives:** Comparing the results of active rehabilitation with functional disability and with follow-up patients who had mechanical low back pain.

**Patients and Methods:** an experimental study in which 159 participants with mechanical back pain were selected from physiotherapy clinics to participate in this exploratory investigation. Group 1 received physiotherapy exercises, Group 2 received physiotherapy modalities, such as Transcutaneous Electrical Nerve Stimulation, ultrasound, infrared radiation, and short-wave diathermy, and Group 3 received a mix of exercises and modalities. Participants were randomly divided into three groups. Ten sessions of treatment were given to everyone. The Oswestry Impairment Index (ODI) was used to measure functional impairment and pain levels both before and after treatment.

**Results:** The analysis revealed statistically significant differences among the three therapeutic intervention groups in pain intensity and functional disability before and after treatment ( $p < 0.001$ ). At baseline, participants in the Physical Therapy Modalities group presented with the highest levels of pain and disability. Following five treatment sessions, the Therapeutic Exercise and Physiotherapy Modalities Combined group showed the greatest reduction in pain intensity, with a post-intervention mean rank of 66.25, indicating significant clinical improvement. In contrast, the Therapeutic Exercise group achieved the most notable reduction in overall pain score, with a mean rank of 58.85, reflecting its specific effectiveness in pain perception. Regarding functional disability, the combined group again demonstrated the greatest improvement, suggesting that integrating exercise with physical modalities offers broader therapeutic benefits. These findings underscore the varying impact of each intervention, with the combined approach showing the most consistent improvement across both pain and functional outcomes.

**Conclusion:** This study has determined the effectiveness of physical therapy in reducing functional impairment in patients with mechanical back pain. The results indicated that the greatest improvement in pain reduction and functional mobility was achieved when physiotherapy exercises were combined with modalities such as Transcutaneous Electrical Nerve Stimulation, ultrasound, and infrared radiation.

**Keywords:** Back pain, Rehabilitation, Functional disability.

## Introduction

The most common musculoskeletal disorder of the general population, low back pain (1), has an estimated 568 million cases in the world. Pain within the region between the buttock creases and the lower rib borders is termed this and can sometimes be associated with radiculopathy. In the studies done recently, it was estimated that more years are spent disabled with low back discomfort than from any other disease (2). Among these, physical and rehabilitation medicine interventions include exercise therapy, back schools, Transcutaneous Electrical Nerve Stimulation, superficial heat or cold, Low Level Laser Therapy, individual patient education, massage, behavioral treatment, lumbar supports, traction, and multidisciplinary rehabilitation (3). Low back pain is a medical disorder that, for descriptive purposes, is defined as impairments in body structures and functions (biological component) that are often associated with limitations on participation or activities (functional component). Personal and environmental factors interact with the resultant LBP-related impairment, which includes pain and activity limitations/participant limits (4). With clinical and biomechanical evaluations, clinicians can establish a specific, organized rehabilitation program that targets mobility and strength deficiencies (5). On the other hand, whereas acute low back pain is mostly temporary and often has a clear underlying cause, the etiology of Chronic Low Back Pain is sometimes complex, implicating structural, biomechanical, neurological, psychological, and social factors. In contrast to its overall favorable prognosis, the high prevalence rate makes Chronic Low Back Pain a serious public health concern. This is particularly true considering that the prevalence of Chronic Low Back Pain increases linearly with age, and the population of the world is getting older (6). The main first-line medical treatments are usually acetaminophen, muscle relaxants, and

nonsteroidal anti-inflammatory medicines or Non-Steroidal Anti-Inflammatory Drugs. Physical therapy and other rehabilitation techniques come next (7). Pain can be prolonged or exacerbated by psychological factors such as fear, apprehension, mood swings, and a tendency to catastrophize. Similarly, long-term disability is influenced by social and environmental factors such as expectations regarding return to work, work social support, and physical demands of the job (8). According to the WHO, rehabilitation encompasses comprehensive interventions designed to improve function, lessen the consequences of certain illnesses or disabilities, or even increase people's participation in daily activities and in living. (9). Pain control, restore function, ensure that no future functional deficits develop, maintain employment and production, and prevent chronic back pain in cases of acute Low Back Pain are the key objectives of rehabilitation against the person with LBP (10). The aims of this study are to assess pain reduction and Measure Functional Improvement, Evaluate Quality of Life, Analyze Treatment Modalities (Transcutaneous Electrical Nerve Stimulation, Ultrasound, Shortwave Diathermy, and Infrared Radiation), and Explore Psychosocial Influences and Examine Long-term Effects.

## Patients and Methods

**Study design:** Experimental, Comparative Randomized Controlled Trial Study, divided into 3 groups, each containing 53 participants. Find people with back pain who were referred and diagnosed by orthopedic and rheumatology specialists and visited between October 2024 and May 2025. Inclusion criteria required participants to be between 18 and 70 years of age and to have intact cognitive and mental functioning, ensuring their ability to fully engage in the intervention and evaluation processes. Exclusion criteria included individuals with chronic medical conditions such as hypertension, diabetes, or cardiovascular disease, as well as those with a history of trauma,

spinal surgery, or fixation, or inflammatory back pain. These criteria were established to maintain sample uniformity and ensure the safety and validity of the intervention outcomes.

**Sampling method:** 159 patients with mechanical back pain were enrolled in the study, and each participant received 10 sessions of recommended intensive physiotherapy, lasting 40–60 minutes depending on personal tolerance, chosen through random sampling from a rehabilitation center or clinic.

**Group assignment:** Intervention Group: Participants who will undergo a structured rehabilitation program, a combination of Physiotherapy modalities and Therapeutic Exercise, with another group who receive only therapeutic exercise as a Rehabilitation program during selected sessions. The other group of Participants who will receive appropriate Physical modalities as a standard treatment that's used at our centers and hospitals without any additional rehabilitation program.

**Pre-assessment:** Before the rehabilitation program, determine baseline functional disability levels by administering the Oswestry Disability Index as the primary outcome and measuring pain intensity, morning stiffness, and duration as a secondary outcome using the Numerical Rating Scale (Pain Score), in which participants rate their level of pain on a scale from 0 to 10.

**Intervention:** Participants were randomly assigned to one of three intervention groups, each receiving a distinct physiotherapeutic approach over a total of 10 sessions.

The first group received a structured program of therapeutic exercises, administered under the direct supervision of a physiotherapist. The exercise protocol included Single Knee-to-Chest, Cat and Camel Stretching, Bridge Exercise, Cobra Pose, and Superman Hold. Each exercise was performed in 2 sets of 15 repetitions, twice daily, throughout the intervention period. These exercises were selected to improve spinal

mobility, core stability, and muscular endurance relevant to the management of mechanical low back pain. The second group received physical therapy modalities alone, delivered according to standardized clinical parameters. This included:

- Transcutaneous Electrical Nerve Stimulation (TENS): applied for 20 minutes at a frequency of 150 Hz and a pulse width of 50  $\mu$ m.
- Therapeutic Ultrasound: administered in continuous mode, with a frequency of 1 MHz for a duration of 5 minutes.
- Infrared Radiation (IRR): applied at 90 cm from the patient for 15 minutes.
- Short Wave Diathermy (SWD): delivered in continuous mode for 10 minutes.

These modalities were intended to provide analgesic effects, enhance circulation, and reduce muscular tension.

The third group received a combined intervention that incorporated both the therapeutic exercise regimen and the physical modalities described above. This integrated approach was designed to optimize clinical outcomes by addressing pain relief through modalities and improving function and strength through active rehabilitation. All groups completed 10 treatment sessions during the intervention period, with adherence monitored by the supervising physiotherapists.

**Post-assessment:** To assess changes in functional impairment, give each group a second administration of the Oswestry Disability Index and Pain Score with stiffness and duration following the intervention.

### Statistical Analysis

Utilizing the proper statistical procedures, compare the ODI scores before and after the intervention, both within and across groups. The data were analyzed using SPSS software version 25. The results were presented as descriptive statistics, such as mean and standard deviation, for each group. Normality and homogeneity assumptions were assessed, and based on their results, a non-parametric approach

was used, including independent tests (Mann-Whitney U test, Kruskal-Wallis's test) and paired tests (Wilcoxon and Friedman Tests), to evaluate the methods for each follow-up. Statistical analysis revealed significant differences among the three intervention groups before and after treatment ( $p < 0.001$ ). The Combined group of Therapeutic Exercise and Physical Therapy Modalities showed the greatest improvement in pain intensity, while the Therapeutic Exercise group demonstrated the greatest reduction in overall pain score. This suggests that patients benefited most from the combined approach for reducing pain intensity, and from exercise alone for improving overall pain perception.

**Follow-up:** To determine whether benefits are sustainable, conduct two follow-up evaluations after 5 sessions of Intervention and at the end of the intervention (After 10 sessions).

## Results

**Demographic characteristics of patients:** The result of Table 1 shows that the percentage of female (59.7%) is higher than the percentage of male (40.3%). The largest age group being those between 30 and 39 years old (27.7%), followed by participants aged 50–59 years (22.6%) and 40–49 years (20.8%). Individuals aged 60 and above account for 17.0%, while the youngest group, those under 30, represent the smallest proportion (11.9%). Occupation-wise, nearly half of the participants are housewives (49.1%), with employees forming the second-largest group (34.0%). Teachers (9.4%), students (4.4%), and others (3.1%) make up smaller segments. Most participants are married (92.5%), with only 7.5% being single. Geographically, a significant majority reside in the city center (67.3%), while the remaining 32.7% live in urban areas outside the city center.

**Table 1.** Descriptive Statistics for demographic characteristics.

		Number	%
Age group	less than 30	19	11.9%
	30 - 39	44	27.7%
	40 - 49	33	20.8%
	50 - 59	36	22.6%
	60 +	27	17.0%
Gender	Male	64	40.3%
	Female	95	59.7%
Occupation	Housewife	78	49.1%
	Teacher	15	9.4%
	Employer	54	34.0%
	Student	7	4.4%
	Others	5	3.1%
Marital Status	Married	147	92.5%
	Single	12	7.5%
Address	City Center	107	67.3%
	Urban	52	32.7%

**Patients pain score rate:** The scores are declined steadily from 7.472 (Before) to 5.755 (After 5 sessions) and further to 3.472 (After the full intervention) in the Therapeutic Exercise group. This demonstrates a significant improvement or reduction in reducing back pain over time. The scores also show a decrease,

starting at 8.075 (Before), dropping to 5.151 (After 5 sessions), and further reducing to 4.283 (After the full intervention) in the Physical Therapy Modalities group. Therapeutic Exercise and Physical Therapy Modalities approach is showing the most substantial improvement, with scores declining from 7.491 (Before) to 4.434

(After 5 sessions) and finally to 2.769 (After the full intervention). This suggests that combining the two interventions was the most effective strategy as shown in figure 1. Table 2 demonstrates a statistically significant difference in the mean ranks of the three therapeutic interventions before the start of the intervention on pain intensity, as the p-value (0.001) is much smaller than the significance level of  $\alpha = 0.05$ , for example, the mean rank increased from Therapeutic Exercise (68.05) to Physical Therapy Modalities (94.92), followed by Therapeutic Exercise and Physiotherapy Modalities Combined (77.03). This suggests that participants in the Physical Therapy Modalities group had the highest baseline severity, while those in the Therapeutic Exercise group had the lowest, with the Therapeutic Exercise and Physiotherapy Modalities Combined group falling in between. Then there is a statistically significant difference in the mean ranks of the three therapeutic interventions after five sessions of the intervention on pain intensity, as the p-value (0.000) is much smaller than the significance level of  $\alpha = 0.05$ , for example, the mean rank increased from Therapeutic Exercise (82.54) to Physical Therapy Modalities (98.81),

and then declined into Therapeutic Exercise and Physiotherapy Modalities Combined (85.65). The results presented in the table indicate a statistically significant difference in the mean ranks of the three therapeutic interventions after the intervention on pain intensity, as evidenced by a p-value of 0.000, which is well below the commonly accepted significance threshold of  $\alpha = 0.05$ . Specifically, the Therapeutic Exercise and Physiotherapy Modalities group achieved the lowest mean rank of 66.25, indicating that participants in this group reported the greatest improvement in outcomes compared to the other two groups Therapeutic Exercise (71.13) and Physical Therapy Modalities (102.62) respectively. These findings suggest that, after the intervention, participants in the Physical Therapy Modalities group experienced the most significant improvement in their condition, while those in the Therapeutic Exercise and Physiotherapy Modalities Combined group showed the least. The Therapeutic Exercise group fell in between, demonstrating a moderate level of improvement. This highlights the differential effectiveness of the three therapeutic approaches in reducing pain or disability associated with low back pain.

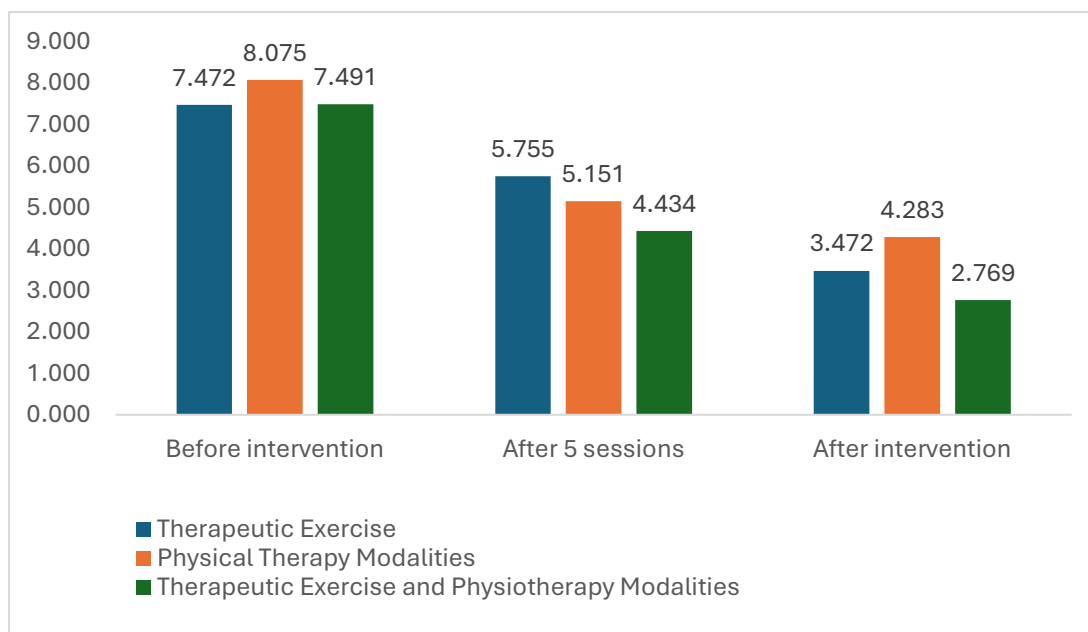


Figure 1. Descriptive Statistics for pain score.

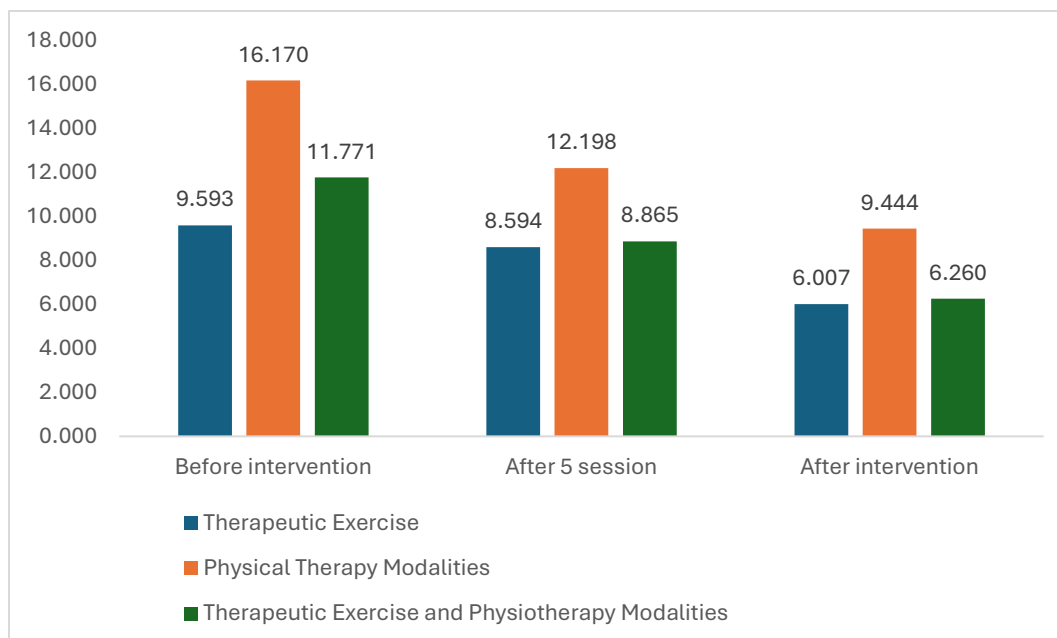
**Table 2.** Descriptive statistics for Pain Score.

	Before intervention			After 5 sessions			After intervention		
	Mean Rank	Chi-square	p-value	Mean Rank	Chi-square	p-value	Mean Rank	Chi-square	p-value
Therapeutic Exercise	68.05	14.5	0.001	82.54	23.739	0.000	71.13	23.52	0.000
Physical Therapy Modalities	94.92			98.81			102.62		
Therapeutic Exercise and Physiotherapy Modalities	77.03			58.65			66.25		

**Measurement of patients' duration of morning stiffness:**

The results of this study compare the mean and standard deviation among before intervention, after 5 sessions, and after the intervention, respectively. For Therapeutic Exercise, the scores decreased progressively from 9.593 (Before intervention) to 8.594 (After 5 sessions) and further to 6.007 (After the intervention), indicating a steady improvement. Similarly, Physical Therapy Modalities is showing a significant reduction, with scores dropping from 16.170 to 12.198, and finally to 9.444, demonstrating its effectiveness over time. The combination of Therapeutic Exercise and Physical Therapy Modalities is also showing consistent improvement, with scores reducing from 11.771 to 8.865 and then to 6.260 as shown in Figure 2. These results suggest that all three approaches were effective in improving the measured condition, with the combination of interventions yielding slightly better outcomes than the individual treatments. The post-intervention results show that the Therapeutic Exercise has the lowest mean pain score (6.007), followed by Therapeutic Exercise and Physiotherapy Modalities (6.260) and Physical Therapy Modalities (9.444). The study examined the effects of Therapeutic Exercise, Physical Therapy Modalities, and their combination on pain intensity and morning stiffness in patients with mechanical low back pain. Pain scores

decreased across all groups over time. In the Therapeutic Exercise group, scores dropped from 7.472 before the intervention to 3.472 after completion. The Physical Therapy Modalities group showed a reduction from 8.075 to 4.283. The combined group demonstrated the greatest improvement, with scores declining from 7.491 to 2.769, indicating that combining both treatments was the most effective strategy. Statistical analysis showed significant differences between groups ( $p < 0.001$ ). Initially, the Physical Therapy Modalities group had the highest pain levels, while the Therapeutic Exercise group had the lowest. By the end of the intervention, the combined group reported the greatest improvement in pain reduction. Regarding morning stiffness, all groups also showed progress. The Therapeutic Exercise group improved from 9.593 to 6.007, and the Physical Therapy Modalities group from 16.170 to 9.444. The combined group improved from 11.771 to 6.260. These results suggest that all three treatments were effective, with the combination offering slightly better outcomes overall.



**Figure 2.** Descriptive Statistics for the duration of Morning Stiffness.

**Assessing disability average in different therapeutic interventions over time:**

Table 3 compares the disability averages for patients with low back pain undergoing three different therapeutic interventions over time. According to Therapeutic Exercise, the average disability score before intervention is 6.340, indicating a high level of disability among participants. After 5 sessions, it declines to 5.434, then drops further to 4.057, reflecting sustained improvement and the lowest final disability score among the three interventions. According to Physical Therapy Modalities, the mean disability score before intervention is 6.981, the highest among the three interventions, indicating that participants in this group started with greater levels of disability. The mean after 5 Sessions is 5.868, indicating a modest improvement. The average after Intervention decreased to 5.038, but this was the least improvement among the interventions. Table 3 demonstrates a statistically significant difference in the mean ranks of the three therapeutic interventions before the start of the intervention on overall pain score, as the p-value (0.000) is much smaller than the significance

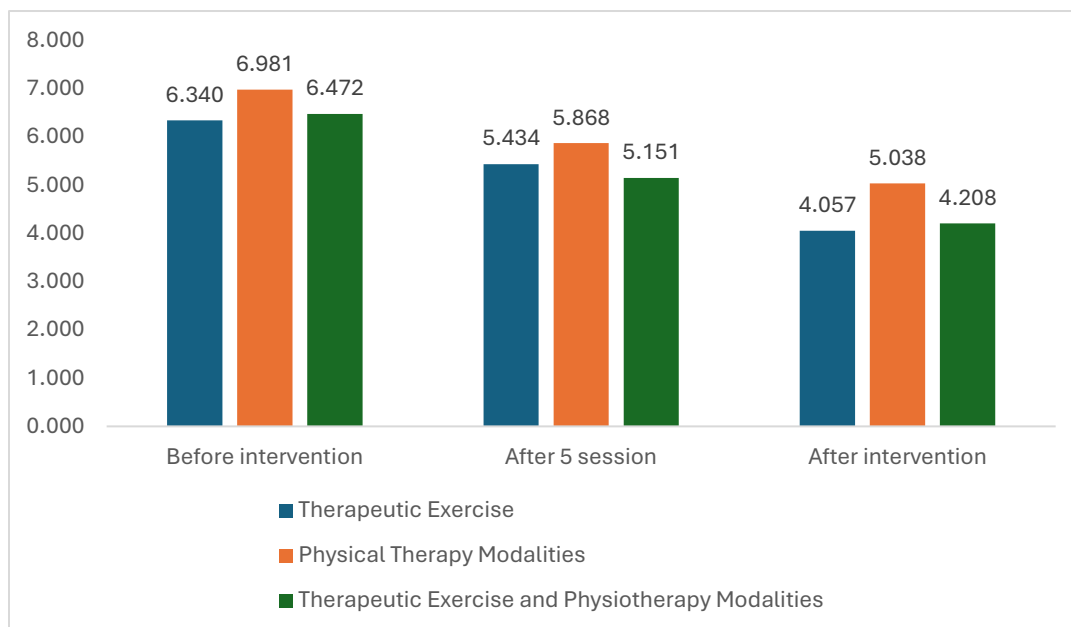
level of  $\alpha = 0.05$ , for example, the mean rank increased from Therapeutic Exercise (56.66) to Physical Therapy Modalities (113.35), followed by Therapeutic Exercise and Physiotherapy Modalities Combined (69.99). This suggests that participants in the Physical Therapy Modalities group had the highest baseline severity, while those in the Therapeutic Exercise group had the lowest, with the Therapeutic Exercise and Physiotherapy Modalities Combined group falling in between. Then there is a statistically significant difference in the mean ranks of the three therapeutic interventions after five sessions of the intervention on overall pain score, as the p-value (0.000) is much smaller than the significance level of  $\alpha = 0.05$ , for example, the mean rank increased from Therapeutic Exercise (78.60) to Physical Therapy Modalities (103.08), and then declined into Therapeutic Exercise and Physiotherapy Modalities Combined (58.32). The results demonstrate a statistically significant difference in mean ranks among the three therapeutic interventions for the overall pain score after intervention (p-value = 0.000,  $\alpha = 0.05$ ). The Therapeutic Exercise group showed

the greatest improvement, with the lowest mean rank (58.85), followed by the Therapeutic Exercise and Physiotherapy Modalities Combined group (82.75) and the Physical Therapy Modalities group (98.40). Depending on Therapeutic Exercise and Physiotherapy Modalities: The average disability score before intervention is 6.472, moderately high, and

between the other two groups. The average after 5 Sessions decreased to 5.151, indicating a faster rate of improvement compared to Physical Therapy Modalities alone. The final score after Intervention was 4.208, indicating significant improvement, though slightly higher than that of Therapeutic Exercise alone, as shown in Figure 3.

**Table 3.** Descriptive statistics for low back pain in Disability Average in different therapeutic interventions over time.

	Before intervention			After 5 sessions			After intervention		
	Mean Rank	Chi-square	p-value	Mean Rank	Chi-square	p-value	Mean Rank	Chi-square	p-value
Therapeutic Exercise	56.66	44.2	0.000	78.60	25289	0.000	58.85	19.98	0.000
Physical Therapy Modalities	113.35			103.08			98.40		
Therapeutic Exercise and Physiotherapy Modalities	69.99			58.32			82.75		



**Figure 3.** Descriptive Statistics for Low Back Pain Disability Average.

## Discussion

Chronic low back pain (CLBP) affects function and quality of life. Exercise therapies, including resistance and motor control training, help reduce pain, improve strength, and ease psychological symptoms. Multidisciplinary programs are especially effective and support return to daily activities and work. The GBD study subsequently showed that, globally, the point prevalence was 9.4%. It had a higher prevalence in males compared to females: males, 10.1%, while females, 8.7%. Among adults within the past 12-month prevalence, it yielded a ratio above 50%, within a range, while those in adolescence reflected a pattern between 13.1% and 19.5%. Lastly, the range for chronic back pain point prevalence in the general population was mostly 4.2%-14.7% across the studies examined in this topic (11). These may be related to biological differences in immune function and provide an explanation for possible divergences in the therapeutic outcome of LBP in men and women. In fact, females have a higher prevalence of chronic pain disorders compared with males, even though both sexes are influenced by social and psychological factors. Some of the causes for these differences include differences in cell populations, for example, T lymphocytes, variable suppression of hormones, and different cellular responses between the sexes. It is due to these sex differences in chronic pain that cause disparity in human biological responses. The identification of mechanisms for sex differences in pain would likely lead to improvements in the selection of treatments for patients (12). The VAS scores after combined exercise and core body stability exercise in both groups decreased significantly. It is perceived that due to the reactivation of core body muscles, both rehabilitation therapies significantly enhanced the back muscles and core body stability which reduced the pain in the back. This study established that rehabilitation therapy could

decrease the level of pain significantly in individuals experiencing backache if done regularly (13). After this intervention, the results of a 12-month follow-up assessment showed that Debora significantly alleviated depressive symptoms and pain self-efficacy, indicating alleviation of these symptoms as patients had high levels. Lastly, one of the most robust modulators of the rehabilitation outcome for people having CLBP has been in regard to the degree of discomfort (14). In most musculoskeletal disorders, including neck and back pain and arthritic conditions, reducing stiffness is a primary goal of therapy because it is a strong predictor of disability. Among these, LBP is the most prevalent condition worldwide. Considering the increase in healthcare costs, clinical outcomes are remaining well below optimal, thus setting a call to revisit the underlying mechanisms of LBP and its symptoms, most prominently stiffness (15). It has also been demonstrated that ultrasound improves muscular spasms and stiffness of the connective tissue (16). The aim of exercise therapy is the improvement in the range of motion, muscle function, and the strength of the joint and muscles. This will promote faster recovery and return to normal activities with less pain and disability. Exercise therapies are various treatments prescribed or taught by health professionals and include several forms of exercises, duration, and delivery systems (17). For LBP, exercises are an essential conservative management for pain reduction and functional disability. In comparison to an appropriate control or therapist hands-on treatment, exercise therapies like resistance training, multimodal exercise therapy, and stabilization or motor control exercises have proved effective in pain and disability reduction in patients with LBP (18). Thus, the benefits in the activity/participation domain were added to the rehabilitation-induced positive effects on muscle strength, which were related to improvements in sensory-motor

performance and a reduction in adverse psychological symptoms. The advantages that patients experienced in the many areas of functioning were not commensurate with their baseline deficiencies. In patients with CLBP, the limitations/restrictions in activities and involvement were mainly because of range of motion and anxiety/depression of the patients (19). The systematic reviews have established the fact that MBR programs are more effective than either active physical therapies or standard therapy in reducing pain and disability in patients with chronic low back pain (20). Diseases of the lower back are associated with long-term or recurring disability. Physiotherapy-based rehabilitation offers a valid alternative and is rightly considered less hazardous for the patient (21). Quality of life, pain, incapacity, and avoiding fear. Similarly, walking or exercise can be beneficial for patients with chronic low back pain. Walking may be regarded as an alternative to other exercises (22).

### Conclusion

This study confirms that rehabilitation plays a significant role in improving functional outcomes for patients with mechanical low back pain. While all three interventions, Therapeutic Exercise, Physical Therapy Modalities, and their combination, led to improvements in pain intensity and morning stiffness, the combined therapy group demonstrated the most substantial reductions across both measures. These results highlight the superior effectiveness of combining exercises with modalities such as Transcutaneous Electrical Nerve Stimulation (TENS), ultrasound, and infrared radiation. The observed synergistic effect supports the value of a customized, multi-modal rehabilitation approach, especially for chronic cases. These findings carry important clinical implications, emphasizing the need to tailor treatment strategies to maximize patient recovery and quality of life. It was recommended that healthcare providers implement

comprehensive, individualized rehabilitation programs that integrate exercise, manual therapy, and patient education. Enhancing patient access to rehabilitation services, especially in underserved areas, and promoting early intervention are crucial for preventing chronic disability. Emphasizing patient education on proper posture, ergonomics, and self-management strategies will empower patients to maintain long-term functional improvements. Finally, future rehabilitation protocols should prioritize a patient-centered approach to ensure better engagement and outcomes.

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## تأثير إعادة التأهيل على العجز الوظيفي لدى المرضى المصابين بآلام الظهر الميكانيكية وتقييم مدى فعاليته

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### المخلص

**الخلفية:** يُعد ألم الظهر الميكانيكي حالة شائعة تؤثر بشدة على الأداء اليومي ونوعية الحياة. وغالبًا ما يتجلى ذلك في شكل ألم وتيبس وتقييد في الحركة، مما يؤدي إلى إعاقة وظيفية لدى الأفراد المصابين.

**الأهداف:** مقارنة النتائج بين إعادة التأهيل النشط والإعاقة الوظيفية، وبين مرضى آلام أسفل الظهر الميكانيكية مع المتابعة.

**المرضى والطرق:** دراسة تجريبية تم فيها اختيار ١٥٩ مشاركًا يعانون من آلام الظهر الميكانيكية من عيادات العلاج الطبيعي للمشاركة في هذه الدراسة الاستكشافية. تلقت المجموعة الأولى تمارين العلاج الطبيعي، وتلقت المجموعة الثانية أساليب العلاج الطبيعي المتمثلة في التحفيز الكهربائي العصبي عبر الجلد، والموجات فوق الصوتية، والأشعة تحت الحمراء، والعلاج الحراري بالموجات القصيرة، وتلقت المجموعة الثالثة مزيجًا من التمارين والأساليب. قُسم المشاركون إلى ثلاث مجموعات عشوائيًا. خضع الجميع لعشر جلسات علاجية. استُخدم مؤشر أوز ويستري للإعاقة لقياس مستويات الضعف الوظيفي والألم قبل العلاج وبعده.

**النتائج:** كشف التحليل عن فروق ذات دلالة إحصائية بين مجموعات التدخل العلاجي الثلاث من حيث شدة الألم والعجز الوظيفي قبل العلاج وبعده (قيمة الاحتمال > ٠,٠٠١). في البداية، أظهر المشاركون في مجموعة أساليب العلاج الطبيعي أعلى مستويات الألم والعجز. بعد خمس جلسات علاجية، أظهرت المجموعة التي جمعت بين التمارين العلاجية وأساليب العلاج الطبيعي أكبر انخفاض في شدة الألم، بمتوسط تصنيف بعد التدخل بلغ ٦٦,٢٥، مما يشير إلى تحسن سريري كبير. في المقابل، حققت مجموعة التمارين العلاجية أكبر انخفاض ملحوظ في الدرجة الكلية للألم، بمتوسط تصنيف بلغ ٥٨,٨٥، مما يعكس فعاليتها المحددة في إدراك الألم. وفيما يتعلق بالعجز الوظيفي، أظهرت المجموعة التي جمعت بين التمارين والعلاج الطبيعي مرة أخرى أكبر تحسن، مما يشير إلى أن دمج التمارين مع الأساليب البدنية يوفر فوائد علاجية أوسع. تؤكد هذه النتائج على التأثير المتفاوت لكل تدخل، حيث أظهر النهج المشترك التحسن الأكثر ثباتًا في كل من الألم والنتائج الوظيفية.

**الاستنتاج:** حددت هذه الدراسة فعالية العلاج الطبيعي في الحد من الضعف الوظيفي لدى المرضى الذين يعانون من آلام الظهر الميكانيكية. أشارت النتائج إلى تحقيق أقصى تحسن في تخفيف الألم وتحسين الحركة الوظيفية عند دمج تمارين العلاج الطبيعي مع وسائل علاجية أخرى مثل التحفيز الكهربائي العصبي عبر الجلد، والموجات فوق الصوتية، والأشعة تحت الحمراء.

**الكلمات المفتاحية:** آلام الظهر، إعادة التأهيل، الإعاقة الوظيفية، العلاج الطبيعي.

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