
“A Comparative Study to See the Efficiency of Mackenzie Exercise & Dynamic lumbar Strengthening Exercises in Acute low Back Pain

¹Dr. Vikrampatidar, Assistant Professor, Department of Allied Health Care & Sciences, Vivekananda Global University, Orcid ID:<https://orcid.org/0009-0007-5160-6554>

²Dr. Nidhi Sharma*, Assistant Professor, Department of Allied Health Care & Sciences, Vivekananda Global University, Orcid ID:<https://orcid.org/0000-0002-2098-0734>

³Dr. Ritu Das, Assistant Professor, Department of Allied Health Care & Sciences, Vivekananda Global University, Orcid ID:<https://orcid.org/0009-0004-3293-7604>

⁴Dr. SanjanaSarna, Assistant Professor, Department of Allied Health Care & Sciences, Vivekananda Global University, Orcid ID:<https://orcid.org/0009-0005-1690-6856>

⁵Dr. Ajeet Singh, Assistant Professor, Department of Allied Health Care & Sciences, Vivekananda Global University

Introduction:

Low back pain (LBP) is the commonest reason for physician visits, affecting approx. 60 to 80% of people in their lifespan¹ A systematic review demonstrated an annual rate of adolescents suffering from low back pain of 11.8% to 33% .² Low back pain is a leading cause of long term work disability. Disability & costs related to pain, not to disease process.³ Low back pain or pain in the lumbosacral region is triggered by some combination of overuse, muscle strain & injury to the muscles, ligaments & discs that supports the spine⁴ Low back pain is usually categorized in 3 subtypes: acute, sub-acute & chronic low back pain. This subdivision is based on the duration of the back pain. Acute low back pain⁵

ALBP manifests in various forms, with symptoms ranging from aching to sharp or dull pain, often triggered by muscle strain, soft tissue injury, or spinal issues like herniated discs or compression fractures.⁶ This pain arises from a complex cascade of events, including inflammation & muscle tension, contributing to disability & work-related limitations. Additionally, risk factors such as physical exertion, psychological stress, & physiological factors like low fitness levels or obesity, exacerbate the likelihood of experiencing ALBP. Despite its prevalence & impact, effective management strategies for ALBP remain crucial yet varied.⁷

This study aims to investigate the efficacy of two exercise modalities, McKenzie exercises & dynamic lumbar strengthening exercises, in alleviating pain & reducing disability in individuals with ALBP. The objectives include evaluating the individual effectiveness of each exercise type & comparing their outcomes, aiming to provide evidence-based guidance for ALBP management.⁸ A review of existing literature underscores the importance of exercise therapy in reducing pain & improving function in chronic low back pain cases. While studies demonstrate promising results for various exercise programs, including lumbar stabilization, core stability training, & dynamic stretching, there is a need for further research, particularly in comparing the effectiveness of different exercise modalities like McKenzie exercises & dynamic lumbar strengthening. ⁹This study seeks to address this gap & provide valuable insights into optimizing ALBP management strategies.

Materials & methods

Participants:

A comparative study was conducted with the sample size consists of 40 patients, with a mean age of 32.5 ± 7 years, selected through simple random sampling from the outpatient physiotherapy department of Mahatma Gandhi Hospital Jaipur. Ethical approval was obtained from the participants. Patients fulfilling inclusion criteria, such as age between 25-45 years, experiencing symptoms of pain or numbness radiating to the buttocks & legs for 4-6 weeks, were included. Both genders were considered, while exclusion criteria comprised major trauma, systemic diseases, & specific conditions like fractures, neoplasms, or previous low back surgery.¹⁰ The study utilized floor mats, bed sheets, a pillow, & a treatment couch as materials. Outcome measures included the Ronald disability questionnaire & the visual analogue scale to assess pain & disability levels, respectively. The alternative hypothesis posits that McKenzie exercises are more effective than dynamic lumbar strengthening exercises in reducing pain & disability, while the null hypothesis suggests no significant difference between the two interventions.

Procedure:

In the study, 40 subjects diagnosed with acute low back pain (ALBP) were recruited from Mahatma Gandhi Hospital, Jaipur, & Medical Research Centre. Prior to enrollment, their suitability was determined based on inclusion & exclusion criteria, & written informed consent was obtained after explaining the study's advantages & disadvantages. Pre-test measurements of pain, numbness, & functional disability were assessed using the visual analogue scale (VAS), special tests, & the Roland Morris disability questionnaire (RDQ), respectively. Data collection occurred three times: before treatment initiation, after two weeks, & after four weeks.

The participants were divided into two groups: Group A & Group B, each comprising 20 subjects. Both groups received exercise sessions on alternate days for four weeks (four days a week), with each session lasting 15 minutes. Group A underwent McKenzie exercises, focusing on extension & flexion principles, involving various positions such as lying prone, lying prone in extension on elbows, & extension manipulation, among others. These exercises were performed three times a week with 10 repetitions each time.^{10, 11}

On the other hand, Group B received dynamic lumbar strengthening exercises consisting of 14 exercises targeting the extensor (erector spinae) & flexor (rectus abdominis) muscle groups. Each exercise involved holding the final static position for 10 seconds & performing 10 repetitions, with a 3-second pause between repetitions & a 60-second rest between exercises. The exercise intensity was gradually increased based on individual patient tolerance.¹² This exercise regimen aimed to evaluate the effectiveness of McKenzie exercises versus dynamic lumbar strengthening exercises in reducing pain & improving functional disability in ALBP patients over the four-week intervention period.

Outcome variables:

McKenzie exercises

McKenzie exercises developed by Robin McKenzie. Based on the direction of symptoms (flexion, extension, or lateral shift of the spine). The prevention step focuses on educating patients about regular exercise & self-care practices. Exercises for the lumbar spine are repeated to end-range in one direction. The extension principle is predominantly used for patients with derangement, where extension movements alleviate symptoms, while flexion exacerbates them. Extension exercises include procedures like extension in lying, standing, prone lying, & extension mobilization.^{11,13} A smaller subset of patients with derangement may require the flexion principle, where flexion movements alleviate symptoms, & exercises such as flexion in lying, sitting, standing, & rotation mobilization in flexion are utilized.

McKenzie Principle	Regime
Extension Principle	Include:
	- Extension in lying: Lying on the stomach & propping up on the elbows or hands to arch the back.
	- Extension in standing: Standing & gently leaning backwards, supporting hands on the lower back or a stable surface.
	- Prone lying: Lying flat on the stomach without propping up on the elbows or hands.
Flexion Principle	Include:
	- Flexion in lying: Lying on the back & pulling knees towards the chest to round the lower back.
	- Flexion in sitting: Sitting & bending forward to reach towards the toes, rounding the back.
	- Flexion in standing: Standing & bending forward at the waist, allowing the arms to hang loosely towards the floor.

Table 1. Demonstration of Mackenzie Principle

Dynamic lumbar strengthening exercises

The dynamic lumbar strengthening exercises comprised 14 sequential exercises aimed at targeting the deep lumbar stabilizing muscles, including the transversus abdominis, lumbar multifidi, & internal oblique. Each exercise was meticulously explained & demonstrated by the physical therapist, emphasizing the correct start & end positions. Subjects were instructed to engage in controlled breathing while performing a maneuver called "hollowing," where they gently drew in their lower abdomen without moving their upper stomach, back, or pelvis.^{15,16} Verbal instructions & tactile feedback from the therapist ensured proper muscle activation, with therapists palpating the multifidus muscle to confirm activation. Exercises involved holding the final static position was held with 10 repetitions in 10 seconds per exercise & a pause of 3-second was taken between the repetitions. A rest interval of 60 sec separated each exercise, & exercise intensity was gradually increased based on individual tolerance levels. These exercises aimed to strengthen both extensor & flexor muscle groups, promoting effective muscle activation & gradual progression in intensity over time.¹⁷

Statistical analysis

Data was collected at three intervals: before treatment initiation, after two weeks, & after four weeks. The data was managed & analyzed using SPSS software (version 16) & Microsoft Excel (professional edition 2007). Paired t-tests, was employed to compare changes in parameters such as the visual analogue scale (VAS) & functional disability among subjects with acute low back pain (ALBP). Ethical clearance has been obtained from the institution's ethical committee to conduct the necessary investigations & interventions for this study, ensuring compliance with ethical standards.

Result

Table 2 & Table 3 depicts the Trends of VAS Scale & functional disability score at various time interval i.e. before treatment, after 2 weeks & after 4 weeks in Group A. Table 4 & Table 5 depicts the between the group comparison of pain & RDQ (Group A & Group B). Within group comparison of pain & RDQ in Group B depicted in Table 6.

Table 2. Trend of VAS at different time intervals in group A

	Number of cases	Mean	SD	P value

Before Treatment	20	7.95	1.00	p<0.001 (S)
After 2 Weeks	20	6.05	1.23	
After 4 Weeks	20	4.50	1.19	p<0.001 (S)

Table 3. Trend of functional disability score at different time intervals in group A

	Number of cases	Mean	SD	P value
Before Treatment	20	20.70	2.18	
After 2 Weeks	20	17.65	2.13	
After 4 Weeks	20	15.40	2.19	p<0.001 (S)

Table 4. Between the group Comparison of pain (Group A & Group B)

	Group A		Group B		p value
	Mean	SD	Mean	SD	
Before Treatment	7.95	1.00	7.90	1.12	0.882 (NS)
After 2 Weeks	6.05	1.23	6.85	1.09	0.036 (S)
After 4 Weeks	4.50	1.19	5.80	1.06	0.0007 (S)

Table 5. Between the groups Comparison of RDQ (Group A & Group B)

	<u>Group A</u>		<u>Group B</u>		<u>p value</u>
	Mean	SD	Mean	SD	
Before Treatment	20.70	2.18	19.15	1.79	0.011
After 2 Weeks	17.65	2.13	18.10	1.29	0.428
After 4 Weeks	15.40	2.19	16.85	1.57	0.020

Table 6. Within the group Comparison of Pain &RDQ (GROUP B)

	PAIN			RDQ		
	Mean	SD	P value	Mean	SD	P value
Before Treatment	7.90	1.12	p<0.001 (S)	19.15	1.79	0.0025 (S)
After 2 Weeks	6.85	1.09		18.10	1.29	
Before Treatment	7.90	1.12	p<0.001 (S)	19.15	1.79	p<0.001 (S)
After 4 Weeks	5.80	1.06		16.85	1.57	

DISCUSSION

In Group A, where participants underwent McKenzie exercises, the mean values for pain, as measured by the visual analogue scale (VAS), decreased significantly over the course of the study. At the outset, the mean pain score was 7.95 ± 1.00 , which reduced to 6.05 ± 1.23 after two weeks, & further decreased to 4.50 ± 1.19 after four weeks of treatment. Paired t-tests revealed statistically significant differences in VAS readings for pain across the various stages of the study ($p < 0.001$). Similarly, functional disability, assessed using the Roland Morris disability questionnaire (RDQ), also showed a significant decrease over time in Group A. The mean RDQ score decreased from 20.70 ± 2.18 at baseline to 17.65 ± 2.13 after two weeks, & to 15.40 ± 2.19 after four weeks. Paired t-tests indicated significant differences in RDQ scores for functional disability at different stages of the study ($p < 0.001$). These findings suggest that McKenzie exercises were effective in reducing both pain & functional disability in participants with acute low back pain.

In group B, pain decreased from 7.90 ± 1.12 at day 0 to 5.80 ± 1.00 at four weeks, with intermediate measurements of 6.85 ± 1.09 at two weeks. Within-group comparisons using paired t-tests confirmed significant reductions in pain levels ($p < 0.05$). Similarly, in group A, pain decreased significantly over time, with readings at day 0, two weeks, & four weeks yielding statistically significant differences ($p < 0.001$). Functional disability, measured by the Rol-&Morris Disability Questionnaire (RDQ), decreased in group A from 19.15 ± 1.79 at day 0 to 16.85 ± 1.57 at four weeks, with significant reductions observed at all stages ($p < 0.001$). These findings indicate that both groups experienced significant improvements in pain & functional disability over the course of the study.

Both groups, A & B, showed significant reductions in pain & functional disability over four weeks. While group A's pain decreased from 7.95 ± 1.00 to 4.50 ± 1.19 & functional disability from 20.70 ± 2.18 to 15.40 ± 2.19 , group B's pain decreased from 7.90 ± 1.12 to 5.80 ± 1.06 & functional disability from 19.15 ± 1.79 to 16.85 ± 1.57 . Group B exhibited greater pain improvement at weeks 2 & 4 compared to group A. Both interventions effectively alleviated pain & disability, as evidenced by paired t-tests within each group ($p < 0.001$).

Our investigation aimed to compare the effectiveness of McKenzie exercises & Dynamic Lumbar Stabilization Exercises (DLSE) in reducing pain & functional disability among individuals with Acute Low Back Pain (ALBP). Our findings underscored the positive impact of McKenzie exercises on enhancing functional activities, as evidenced by a greater reduction in Roland-Morris Disability Questionnaire (RDQ) scores compared to the control group. This aligns with similar research by AnasMohd. Alhakkam, which observed significant improvements in pain & disability scores, particularly with McKenzie exercises.^{18,19} However, contrasting results were reported by Helen A. Clare (2004) & Alessandra NarcisckGarcia (2013), who found no significant difference between McKenzie & other exercise-based therapies. In our clinical trial involving 40 male & female subjects diagnosed with ALBP, both McKenzie exercises & DLSE demonstrated beneficial effects on parameters such as pain & functional disability. Overall, our study indicates a significant difference in the effectiveness of McKenzie exercises versus DLSE for ALBP, shedding light on the impact of these interventions on pain & functional outcomes in this patient population.

Conclusion:

The study concluded that McKenzie exercises & Dynamic Lumbar Stabilization Exercises (DLSE) were equally effective in treating Acute Low Back Pain (ALBP). As demonstrated by larger reductions in Roland-Morris Disability Questionnaire (RDQ) scores than in DLSE, our results demonstrate the noteworthy influence of McKenzie exercises in enhancing functional activities. These findings are consistent with other research showing the positive effects of McKenzie exercises on pain & disability in people with ALBP. It is noteworthy, nevertheless, that while our study agrees with certain studies, it differs from others, indicating the necessity for additional research & careful consideration of patient-specific factors. Further research is warranted to explore the long-term effects & optimal implementation of these interventions.

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