Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 23s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Biomechanical Analysis of Mckenzie Method Therapy for Low Back Pain Patients

Moh. Afif Nashrullah[1,2*], Muhammad Iqbal Basri[1], Sitti Rafiah[1], Nirwana Fitriani Walenna[1], Nirwana Fitriani Walenna[1], Muhammad Rustam HN[1]

[1]Department of Anatomy, Faculty of Medicine, Graduate School Hasanuddin University, Indonesia, Makassar, Sulawesi Selatan, Indonesia

[2]Kendari Orthophysio Clinic, Kendari, Southeast Sulawesi, Indonesia

Email ID: afifnashrullah22@gmail.com

Cite this paper as: Moh. Afif Nashrullah, Muhammad Iqbal Basri, Sitti Rafiah, Nirwana Fitriani Walenna, Nirwana Fitriani Walenna, Muhammad Rustam HN, (2025) Biomechanical Analysis of Mckenzie Method Therapy for Low Back Pain Patients. *Journal of Neonatal Surgery*, 14 (23s), 735-748.

ABSTRACT

Low Back Pain (LBP) is one of the most common musculoskeletal complaints and can interfere with daily activities. Various therapeutic methods have been developed to alleviate LBP symptoms, including the McKenzie Method and Core Stability Exercise. This study aims to analyze and compare the effectiveness of the McKenzie Method and Core Stability Exercise in reducing pain, improving range of motion (ROM), and decreasing disability levels in patients with LBP. This experimental study used a pretest-posttest control group design with a total sample of 33 patients diagnosed with non-specific LBP who met the inclusion criteria. The experimental group received McKenzie therapy, while the control group underwent Core Stability Exercise, each for 12 sessions (three times per week). Evaluations were conducted using the Oswestry Disability Index (ODI), Visual Analog Scale (VAS), and lumbar ROM measurements (flexion, extension, right and left lateral flexion). The results showed that both therapy methods were effective in reducing pain and improving mobility. However, the McKenzie Method demonstrated significantly greater improvements, especially after 12 therapy sessions (ODI $p=0.001$; VAS movement $p=0.000$; ROM extension $p=0.005$). McKenzie therapy also showed significant improvements in right and left lateral flexion and other functional aspects such as personal care, sitting, standing, and social life ($p<0.05$). Conversely, although CSE produced faster results in the early phase, its long-term effectiveness was relatively lower than that of the McKenzie Method. Therefore, the McKenzie Method is more recommended as a therapeutic option for managing LBP due to its ability to provide more optimal long-term recovery.

Keywords: *Low Back Pain, McKenzie Method, Core Stability Exercise, Oswestry Disability Index, Visual Analog Scale, Range of Motion*

1. INTRODUCTION

Low back pain (LBP) is one of the most common health problems and has a significant impact on the quality of life of sufferers (Freitas et al., 2024). LBP can occur in anyone regardless of age, gender or socioeconomic background. Low back pain (LBP) is pain that occurs in the lower back area (lumbosacral) and can be localized or radicular pain, in both acute and chronic forms, which is a common health problem (Lei et al., 2024). Based on data from WHO (2011), approximately 70-80% of the population in developed countries have experienced LBP, with 15-45% of adults experiencing this condition annually, including acute cases requiring hospitalization. In Indonesia, the prevalence of LBP varies between 7.6% and 37% (Putri et al., 2023). This high incidence emphasizes the importance of effective management strategies to reduce pain and improve patient function.

Various approaches have been developed to treat LBP, ranging from conventional medical therapy to surgical intervention. However, non-invasive interventions such as physiotherapy are increasingly becoming the first choice, especially for chronic and recurrent LBP cases (Iwata et al., 2024). One popular approach in physiotherapy to treat LBP is the McKenzie Method, also known as Mechanical Diagnosis and Therapy (MDT). This method was developed by Robin McKenzie in the 1950s, which is based on the principle that certain movements and exercises can help reduce pressure on the back structures to reduce pain and prevent recurrence (Takasaki, 2023). Clinical studies show that patients who undergo McKenzie therapy experience significant pain reduction as well as improved mobility and quality of life (Chen et al., 2024).

The McKenzie Method offers an effective and proactive approach to the management of LBP. Through proper training and support, this method can help patients not only reduce pain, but also avoid recurrence (Pires et al., 2024). The success of the

McKenzie method depends on the patient's active involvement in the exercise routine. Consistency of exercise is often an obstacle, especially if the patient does not feel immediate improvement. A proper initial evaluation by the physiotherapist is also very important to tailor the exercises to the patient's condition. Therefore, continuous education and support from medical personnel is required to keep patients motivated (Rhon et al., 2024). In addition, further research is needed to assess the long-term effectiveness of this method, especially if it is not combined with other interventions such as lifestyle changes or additional exercise. A multidisciplinary approach may be needed for optimal results in the management of LBP (Namnaqani et al., 2019).

In Indonesia, research on the McKenzie method is still limited, although clinical reports show that LBP is one of the most common conditions found in physiotherapy facilities, including at the Kendari Orthophysio Clinic, Southeast Sulawesi. In a report of the top 10 disease cases at the clinic in the period February-July 2024, LBP ranked top, followed by frozen shoulder and piriformis syndrome. Factors such as heavy physical workload, non-ergonomic posture, and lack of physical activity contribute to the high incidence of LBP in this region.

This study is important to evaluate the biomechanical effectiveness of McKenzie method therapy in treating LBP, given that the success of therapy is greatly influenced by a better understanding of how the intervention affects body structure and function. In addition, this study may help identify the characteristics of patients who are most likely to respond well to this therapy, allowing for a more targeted and personalized approach to LBP treatment. Ultimately, the results of this study are expected to contribute to the development of more evidence-based clinical guidelines and support better clinical decisions for healthcare practitioners (Alrwaily M et al, 2016). In addition, this study also sought to evaluate the characteristics of patients most likely to benefit from McKenzie therapy, in order to improve the precision of therapeutic approaches and support the development of more evidence-based clinical guidelines.

2. RESEARCH METHODS

This study was conducted from January to February 2025, at the Kendari Orthophysio physiotherapy service clinic, Kendari City, Southeast Sulawesi. The research method used was experimental pretest-posttest control group design. The population in this study were all patients diagnosed with non-specific low back pain aged 20-60 years, and were undergoing McKenzie therapy. The sampling technique used was purposive sampling, where researchers selected samples from the population based on inclusion and exclusion criteria relevant to the study. Exclusion criteria in this study include patients with other medical conditions that may affect their low back pain (eg: tumors, infections, psychogenic or serious neurological conditions); Patients who are undergoing other pain therapies besides McKenzie therapy such as drug therapy or surgical interventions; Patients with a history of severe trauma to the low back area that requires different interventions; Patients who are not compliant or willing to follow the entire therapy process please make in paragraphs and shorten. A minimum of 28 patients were used in the intervention group (McKenzie) and in the control group (core stability exercise) obtained based on calculations using paired categorical comparative equations (Dahlan, 2010), by using the proportion size of a case control study by (Mbada et al., 2024) and (Chan, 2003).

This design involves two groups that will be tested at two times: pre-intervention (before therapy begins), and post-intervention (after 4 weeks of intervention). The experimental group will receive McKenzie therapy, with a frequency of 3 times per week which focuses on extension mobilization, flexion mobilization, and lateral shift correction techniques. Doctors and or physiotherapists will teach movement and mobilization techniques to reduce low back pain and improve movement function. In this study, the McKenzie movements given were adjusted to the nature of the pain experienced by the patient. While the control group will receive core stability exercise therapy which includes core strengthening exercises with exercises such as the “superman” movement, bridging and also the ‘cat’ and “camel” movements with a frequency of 3 times per week.

The data collection method used is by using the instrument explanation sheet and Informed Consent, Pain Scale (VAS) to assess the intensity of pain in the lower back before and after the intervention, the level of disability (Oswestry Disability Index/ODI) to assess the level of disability experienced by patients due to low back pain at pretest and posttest, Range of Motion (ROM) to measure the range of motion of the lumbar joint using a goniometer before and after the intervention and Questionnaires related to the characteristics of respondents consisting of identity and medical history. Data obtained from measurements of pain, disability, muscle thickness, and ROM will be analyzed using statistical software, such as SPSS.

3. RESULTS

Research Characteristics

Research CharacteristicsThe research sample was patients with complaints of Low Back Pain consisting of the intervention group (McKenzie) and the control group (core stability exercise). The demographic characteristics of patients in the two groups above are presented in the following table 1.

Table 1. Patients with McKenzie method therapy

No.	Variable	Frequency (N=17)	Percentage (%)
1.	**Gender**		
	Female	6	35.3
	Male	11	64.7
2.	**Muscle Condition**		
	Centralization on Ekstension	1	5.9
	Hyperlordosis	3	17.6
	Muscle Spasm	8	47.1
	None	5	29.4
3.	**Age**		
	20-30 Year	10	58.8
	31-40 Year	3	17.6
	41-50 Year	2	11.8
	51-60 Year	2	11.8
4.	**Body Mass Index**		
	Normal	6	35.3
	Obesitas	3	17.6
	Overweight	6	35.3
	Underweight	2	11.8
5	**Type of LBP**		
	Dearangement Syndrome	1	5.9
	Postural Syndrome	14	82.4
	Postural syndrome & Dysfunctional Syndrome	2	11.8
6.	**Duration of LBP**		
	Acute	8	47.1
	Chronic	9	52.9

The majority of patients who underwent McKenzie therapy were male, as many as 11 people (64.7%), while female patients numbered 6 people (35.3%). The most common muscle condition in patients was muscle spasm (47.1%), followed by no muscle problems (29.4%), hyperlordosis (17.6%), and centralization on extension (5.9%). Most of the patients who underwent McKenzie therapy were in the age range of 20-30 years (58.8%), followed by 31-40 years (17.6%), as well as the 41-50 years and 51-60 years age groups at 11.8% each. This data shows that LBP is more common in young to early adulthood. This can be caused by various factors such as poor physical activity patterns, poor posture due to sedentary work or lifestyle, and prolonged sitting. The distribution of body mass index (BMI) showed that 35.3% of patients were normal weight, 35.3% were overweight, 17.6% were obese, and 11.8% were underweight. This indicates that most patients with

LBP were in the overweight to obese category. Being overweight puts additional pressure on the spine and increases the risk of LBP due to changes in body biomechanics, especially in the structure of intervertebral discussions and facet joints. Meanwhile, underweight patients can also experience LBP due to a lack of muscle mass that supports spinal stability. In this study, the most common type of LBP found was Postural Syndrome (82.4%). In addition, there were 11.8% of patients who experienced a combination of Postural Syndrome & Dysfunctional Syndrome, and Derangement Syndrome was only experienced by 5.9% of patients. Based on pain duration, 52.9% of patients experienced chronic LBP, while 47.1% experienced acute LBP.

Table 2. Patients with Core Stability Exercise Therapy

No.	Variable	Frequency (N=16)	Percentage (%)
1.	**Gender**		
	Female	9	56.3
	Male	7	43.8
2.	**Muscle Condition**		
	Hyperlordosis + Muscle Spasm	6	37.5
	Muscle spasm	6	37.5
	Tidak Ada	4	25.0
3.	**Age**		
	20-30 Year	10	62.5
	31-40 Year	5	31.3
	51-60 Year	1	6.3
4.	**Body Mass Index**		
	Normal	4	25.0
	Obesitas	3	18.8
	Overweight	6	37.5
	Underweight	3	18.8
5	**Type of LBP**		
	Postural syndrome	15	93.8
	Postural syndrome & Dysfunctional Syndrome	1	6.3
6.	**Duration of LBP**		
	Acute	2	12.5
	Chronic	14	87.5

The 16 patients who underwent core stability exercise therapy, the majority were women (56.3%), while men amounted to 43.8%. In terms of muscle condition, 37.5% of patients had a combination of hyperlordosis and muscle spasm, 37.5% had muscle spasm, and 25% had no muscle disorders. The majority of patients were in the age group of 20-30 years (62.5%), followed by after 31-40 years (31.3%), and 51-60 years (6.3%). This predominance of young and productive age indicates that LBP is increasingly occurring due to sedentary lifestyle, prolonged sitting, and lack of physical activity that strengthens the core muscles. The Body Mass Index (BMI) of patients was mostly overweight (37.5%), normal weight (25%), and obese and underweight (18.8%). In terms of LBP type (LBP Core Stability Exercise), 93.8% of patients experienced Postural Syndrome, while 6.3% experienced a combination of Postural Syndrome & Dysfunctional Syndrome. In terms of pain duration, 87.5% of patients experienced chronic LBP, while 12.5% experienced acute LBP.

Evaluation of the Results of McKenzie Therapy and Core Stability Exercise in Low Back Pain Patients

The analysis used the Kruskal-Waliis non-parametric test with the results of data that were not normally distributed (p-value <0.05). This test is used to determine whether there is a statistically significant difference in the McKenzie intervention group and core stability exercise control group in the data of each observation variable. The results of the Kruskall Wallis test are shown in Table 3

Table 3. Kruskal-wallis Test Results McKenzie Therapy Group and Core Stability Exercise Control

No.	Observation Variable	McKenzie	Core Stability Exercise
1.	Score ODI in %	0.000	0.000
2.	VAS Movement	0.001	0.000
3.	VAS Immobile	0.000	0.000
4.	Flexi Lumbal	0.000	0.022
5.	Lumbar Extension	0.000	0.016
6.	Lumbar Right Lateral Flexion	0.000	0.024
7.	Lateral Flexi Left Lumbar	0.000	0.012

Kruskal-Wallis test results showed significant differences in all parameters between McKenzie therapy and Core Stability Exercise ($p<0.05$). ODI%, Immobile, Flexi, Extension, Right Lateral Flexi and Left Lateral Flexi scores showed very significant changes in the McKenzie group. While the Core Stability Exercise therapy showed significant changes in the ODI score in %, VAS movement and VAS immobile which indicates the effectiveness of both therapies in reducing disability.

The data from the questionnaire results were also reviewed regarding differences in pain in low back pain patients who underwent therapy with 3 examinations, presented in table 4.

Table 4. Pain Level of Low Back Pain in Patients Undergoing Therapy Based on Questionnaire Results

No.	Item Kuesioner	McKenzie	Core Stability Exercise
1.	Pain intensity	0.000	0.010
2.	Personal care	0.000	0.003
3.	Lifting	0.002	0.597
4.	Walking	0.061	1.000
5.	Sitting	0.000	0.000
6.	Standing	0.000	0.000
7.	Sleeping	0.000	0.380
8.	Sex life	0.101	0.663
9.	Social life	0.000	0.104
10.	Travelling	0.000	0.001

The McKEnzie group provided more significant changes based on 10 questionnaire items than the core stability exercise group. In the pain intensity, personal care, sitting, standing, sleeping, social life, and traveling questionnaire items, McKenzie therapy has a smaller p value ($p \leq 0.05$), indicating a significant improvement after therapy. Meanwhile, Core Stability Exercise also provided improvements in several aspects such as pain intensity, personal care, sitting, standing, and traveling, but with a lower significance level than McKenzie. Some variables such as lifting and sleeping showed significant improvement in McKenzie therapy, but not in Core Stability Exercise. In addition, walking, sex life, and social life variables

did not show significant changes in Core Stability Exercise therapy. Thus, it can be concluded that the McKenzie method is more effective in reducing pain and improving the quality of life of patients with Low Back Pain compared to Core Stability Exercise.

Analysis of Differences in McKenzie Therapy and Core Stability Exercise in Low Back Pain Patients during Intervention

Data from the Kruskal-wallis test results in both groups of patients that are significant, then pairwise comparisons test is carried out to find out which groups experience statistically significant differences in McKenzie and core stability exercise observation variables. The following pairwise comparisons test results can be seen in table 5.

Table 5. McKenzie Therapy Group pairwise comparisons test results

Group	Sig.	Conclusion
Score ODI in %		
Examination 12 times-Examination 6 times	0.000	Significantly different
12 times check-up-Initial check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.115	Not significantly different
VAS Movement		
Examination 12 times-Examination 6 times	0.023	Significantly different
12 times check-up-Initial check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.124	Not significantly different
VAS Immobile		
Pemeriksaan 12 Kali-Pemeriksaan 6 Kali	0.001	Significantly different
Pemeriksaan 12 Kali-Pemeriksaan Awal	0.000	Significantly different
Pemeriksaan 6 Kali-Pemeriksaan Awal	0.436	Not significantly different
Flexi Lumbal		
Initial Examination-Checkup 6 Times	0.127	Not significantly different
Initial Examination-Examination 12 Times	0.000	Significantly different
6 times inspection-12 times inspection	0.000	Significantly different
Lumbar Extension		
Initial Examination-Checkup 6 Times	0.011	Significantly different
Initial Examination-Examination 12 Times	0.000	Significantly different
6 times inspection-12 times inspection	0.002	Significantly different
Lumbar Right Lateral Flexion		
Initial Examination-Checkup 6 Times	0.026	Significantly different
Initial Examination-Examination 12 Times	0.000	Significantly different
6 times inspection-12 times inspection	0.032	Significantly different
Lateral Flexi Left Lumbar		
Initial Examination-Checkup 6 Times	0.201	Not significantly different
Initial Examination-Examination 12 Times	0.000	Significantly different
6 times inspection-12 times inspection	0.002	Significantly different

The results of the pairwise comparisons test showed that there were significant differences ($p<0.05$) in most parameters between the initial examination, after 6 times, and after 12 times of therapy, especially in the ODI% score, VAS movement, VAS immobile, flexion, extension, and lateral flexion right and left lumbar. The most obvious difference was seen between the initial examinations and 12 times of therapy, indicating the effectiveness of therapy in the long term. However, some parameters such as ODI% score, VAS movement and VAS immobile did not show significant differences between the initial examination and 6 treatments ($p>0.05$), indicating that significant changes were seen after 12 treatments compared to 6 treatments. This suggests that McKenzie therapy has a more pronounced impact in the long term than its short-term effects.

Table 6. Results of pairwise comparisons test of Core Stability Exercise Therapy Group

Group	Sig.	Conclusion
Score ODI in %		
Examination 12 times-Examination 6 times	0.041	Significantly different
12 times check-up-Initial check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.015	Significantly different
VAS Movement		
Examination 12 times-Examination 6 times	0.074	Not significantly different
12 times check-up-Initial check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.011	Significantly different
VAS Immobile		
Examination 12 times-Examination 6 times	0.019	Significantly different
12 times check-up-Initial check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.002	Significantly different
Flexi Lumbal		
Initial Examination-Checkup 6 Times	0.164	Not significantly different
Initial Examination-Examination 12 Times	0.006	Significantly different
6 times inspection-12 times inspection	0.170	Not significantly different
Lumbar Extension		
Initial Examination-Checkup 6 Times	0.250	Not significantly different
Initial Examination-Examination 12 Times	0.004	Significantly different
6 times inspection-12 times inspection	0.089	Not significantly different
Lumbar Right Lateral Flexion		
Initial Examination-Checkup 6 Times	0.573	Not significantly different
Initial Examination-Examination 12 Times	0.010	Significantly different
6 times inspection-12 times inspection	0.043	Significantly different
Lateral Flexi Left Lumbar		
Initial Examination-Checkup 6 Times	0.502	Not significantly different
Initial Examination-Examination 12 Times	0.004	Significantly different
6 times inspection-12 times inspection	0.030	Significantly different

The results of the pairwise comparisons test in the Core Stability Exercise group showed that significant differences ($p<0.05$) mainly occurred between the initial examination and after 12 times of therapy in all parameters, such as ODI%, movement, immobile, flexion, extension, and lateral flexion right and left lumbar scores. However, the difference between the 6-time and 12-time examinations was not significant in some parameters ($p>0.05$), indicating that major changes were more pronounced after the mid-term therapy. Some parameters such as extension, and flexion showed insignificance between baseline and 6-time examinations, as well as between 6-time and 12-time examinations, indicating that improvements in these aspects occur gradually and require longer duration of therapy for significant results.

Results of Low Back Pain Level in Patients Undergoing Therapy Based on the Results of the ODI Questionnaire

Data from the questionnaire results related to differences in pain in low back pain patients who underwent McKenzie therapy and core stability exercise with 3 times the examination, are presented in the table below.

Table 7. Results of pairwise comparisons test of McKenzie Therapy Group Based on Questionnaire

Group	Sig.	Conclusion
Pain Intensity		
Examination 12 times-Examination 6 times	0.002	Significantly different
12 Check-ups-Initial Check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.299	Not significantly different
Personal Care		
Examination 12 times-Examination 6 times	0.000	Significantly different
12 times check-up-Initial check-up	0.000	Significantly different
6 times check-up-Initial check-up	0.743	Not significantly different
Lifting		
Examination 12 times-Examination 6 times	0.103	Not significantly different
12 Check-ups-Initial Check-up	0.001	Significantly different
6 times check-up-Initial check-up	0.067	Not significantly different
Sitting		
12x checkup-6x checkup	0.000	Significantly different
12x Examination-Initial Examination	0.000	Significantly different
6x Examination-Initial Examination	0.636	Not significantly different
Standing		
12x checkup-6x checkup	0.008	Significantly different
12x Examination-Initial Examination	0.000	Significantly different
6x Examination-Initial Examination	0.128	Not significantly different
Sleeping		
Initial Examination-Checkup 6 Times	0.000	Significantly different
Initial Examination-Examination 12 Times	0.000	Significantly different
6 times inspection-12 times inspection	1.000	Not significantly different
Sosia Life		

12x checkup-6x checkup	0.000	Significantly different
12x Examination-Initial Examination	0.000	Significantly different
6x Examination-Initial Examination	0.543	Not significantly different
Travelling		
12x checkup-6x checkup	0.000	Significantly different
12x Examination-Initial Examination	0.000	Significantly different
6x Examination-Initial Examination	0.248	Not significantly different

Kruskal-wallis test results on significant questionnaire items were subjected to pairwise comparisons. The results of the pairwise comparisons test show that McKenzie therapy provides significant differences in several aspects after 12 examinations compared to the initial examination and after 6 examinations. Variables of pain intensity, personal care, sitting, standing, social life, and traveling experienced significant improvement after 12 times of therapy ($p \leq 0.05$), indicating that this therapy is effective in reducing pain and improving patients' quality of life. However, between the initial examination and after 6 times of therapy, most variables such as pain intensity, personal care, lifting, sitting, standing, and social life did not show significant differences, indicating that significant improvements occurred after undergoing therapy for a longer period of time (12 times). In the aspect of sleeping, significant differences were seen between the initial examination and after 6 and 12 times of therapy, but there was no significant difference between the 6th and 12th examination, which means that improvement occurred earlier in therapy. Overall, these results confirm that McKenzie therapy provides greater benefits after 12 sessions, so it can be recommended as an effective method in treating patients with Low Back Pain.

Table 8. Results of pairwise comparisons test of Core Stability Exercise Therapy Group Based on ODI Questionnaire

Group	Sig.	Conclusion
Pain Intensity		
Examination 12 times-Examination 6 times	0.009	Significantly different
12 Check-ups-Initial Check-up	0.009	Significantly different
6 times check-up-Initial check-up	1.000	Not significantly different
Personal Care		
Examination 12 times-Examination 6 times	0.003	Significantly different
12 times check-up-Initial check-up	0.003	Significantly different
6 times check-up-Initial check-up	1.000	Not significantly different
Sitting		
12x checkup-6x checkup	0.306	Not significantly different
12x Examination-Initial Examination	0.000	Significantly different
6x Examination-Initial Examination	0.004	Not significantly different
Standing		
12x checkup-6x checkup	0.829	Not significantly different
12x Examination-Initial Examination	0.000	Significantly different
6x Examination-Initial Examination	0.000	Significantly different
Travelling		
12x Examination-Initial Examination	0.001	Significantly different

12x checkup-6x checkup	0.001	Significantly different
Initial Examination-6x Examination	1.000	Not significantly different

In the Core Stability Exercise therapy group, it was seen that significant changes only occurred after 12 treatments, especially in the variables of pain intensity, personal care, sitting, standing, and traveling ($p \leq 0.05$). This suggests that this method takes longer to provide effective results than McKenzie. There was no significant difference between the initial examination and after 6 times of therapy on the variables of pain intensity and personal care, indicating that this therapy has not had a significant impact at the beginning of therapy. Meanwhile, improvements began to be seen in sitting and standing after 12 times of therapy. In addition, the traveling variable showed significant improvement after 12 treatments, but there was no significant difference between the initial examination and after 6 treatments. Overall, effective Core Stability Exercise therapy tends to be slower than McKenzie and only shows less improvement in 10 parameters of the questionnaire items.

Comparison of the Effectiveness of McKenzie Therapy and Core Stability Exercise in Low Back Pain Patients

Comparison of effectiveness between the two therapy methods in patients with Low Back Pain was evaluated at initial examination, after 6 times of therapy, and after 12 times of therapy. The results of the statistical analysis of the description of therapy methods that are more effective in reducing disability and increasing mobility of patients with Low Back Pain are shown in Table 9.

Table 9. Comparison of the Effectiveness of McKenzie Therapy and Core Stability Exercise in Low Back Pain Patients

No.	Variable Observation	Inspection (*P-Value*)		
		Early	**6 Times**	**12 Times**
1.	Score ODI in %	0.028	0.063	0.001
2.	VAS Movement	0.015	0.014	0.000
3.	VAS Immobile	0.736	0.127	0.002
4.	Flexi Lumbal	0.683	0.657	0.292
5.	Ekstensi Lumbal	0.510	0.053	0.005
6.	Lateral Flexi Kanan Lumbal	0.157	0.001	0.002
7.	Lateral Flexi Kiri Lumbal	0.102	0.011	0.003

Based on the results of the comparison of the effectiveness of McKenzie therapy and Core Stability Exercise in Low Back Pain patients, it can be seen that there are significant differences in several variables, especially after 12 examinations. In the early stages, differences were already seen in the ODI Score in %, and Movement variables ($P < 0.05$), indicating differences in the level of disability and ability to move between therapy methods. After 6 examinations, some variables such as movement, Extension and Lateral Flexion began to show significant differences, indicating that each therapy began to have a different impact. After 12 examinations, almost all variables showed highly significant differences ($P < 0.05$), especially in ODI%, Movement, Immobile, Extension, and Lateral Flexi, indicating that the two methods have different effectiveness in the long term regarding biomechanical outcomes of LBP therapy.

Results of Low Back Pain Levels in Patients Who Undergoing Therapy Based on the Results of the ODI Questionnaire

Data from the questionnaire results related to differences in pain in low back pain patients who underwent therapy with 3 examinations, are presented in table 10 below.

Table 10. Pain Level of Low Back Pain in Patients Undergoing Therapy Based on Questionnaire Results

No.	Questionnaire	Inspection (*P-Value*)		
		Early	**6 Times**	**12 Times**
1.	Pain intensity	0,083	1,000	0,195
2.	Personal care	0,163	0,332	0,215

3.	Lifting	0,008	0,284	0,883
4.	Walking	0,399	0,334	0,178
5.	Sitting	0,090	0,001	0,624
6.	Standing	0,184	0,124	0,370
7.	Sleeping	0,004	1,000	1,000
8.	Sex life	0,726	0,482	0,265
9.	Social life	0,163	0,065	0,058
10.	Travelling	0,042	1,000	0,124

Based on the results of the Kruskal-Wallis test on the questionnaire regarding the level of low back pain, there were significant variations in several parameters measured at different times (initial, 6 times, and 12 times of examination). In the Lifting questionnaire, the p value showed significance at the initial examination (p = 0.008), but was not significant at the 6 times (p = 0.284) and 12 times (p = 0.883) examinations, indicating a significant change at the beginning but not continuing at subsequent examinations. For the Sitting-related questionnaire, the test results showed a significant p value at the 6-time check (p = 0.001), but at the baseline (p = 0.090) and 12-time check (p = 0.624) showed no significant difference.

Some other question items, such as Pain intensity, Personal care, and Standing, did not show significant differences at all measurement times, with p values greater than 0.05. In the Sleeping-related questions, although there was a significant p value at the initial examination (p = 0.004), there was no significant change at subsequent examinations (p = 1.000). Meanwhile, in the questionnaire related to Traveling, there was a significant difference at the initial examination (p = 0.042), but not significant at the 12th examination (p = 0.124). These test results indicate that the effect of low back pain on various aspects of patients' lives may vary over time, with some factors showing significant improvement or change, while others show no significant change.

4. DISCUSSION

This study shows that both therapy approaches, namely Core Stability Exercise (CSE) and the McKenzie method, are effective in treating low back pain (LBP), with different response characteristics in each therapy phase.

Therapeutic Effectiveness Based on Disability Score (ODI)

Kelompok CSE menunjukkan penurunan skor Oswestry Disability Index (ODI) yang lebih besar pada fase awal terapi, dari 16% menjadi 11% setelah enam sesi. Penurunan ini mencerminkan perbaikan fungsi akibat aktivasi neuromuskular otot-otot stabilisator lumbal seperti *transversus abdominis* dan *multifidus* (Khan et al., 2022; Hlaing et al., 2021). This exercise improves segmental stability and motor synchronization, which plays an important role in early disability reduction.

In contrast, McKenzie therapy showed a more significant decrease in ODI after 12 therapy sessions, from 18% to 6%. This effectiveness was only seen to be optimal after the mid-to-late phase of therapy, suggesting that McKenzie works better cumulatively, especially through the mechanisms of centralization and correction of directional preference (Lam et al., 2018; Mann et al., 2023). This strategy helps direct peripheral pain towards the center of the spine and improves intra-discal pressure distribution.

Pain Reduction Based on VAS Scale

McKenzie therapy showed a more significant reduction in pain after 12 sessions, both in VAS movement (from 4.0 to 2.0) and VAS immobile (up to 50% reduction). Repetitive exercises with a focus on extension movements can improve disc position and reduce pressure on posterior structures, thereby reducing pain and muscle spasm (Louw et al., 2022; Asmara et al., 2021).

CSE also showed a decrease in pain (VAS movement from 6.0 to 3.7), reflecting the process of neuromuscular adaptation to segmental stabilization exercises (Xu et al., 2024). Activation of the core muscles increases intra-abdominal pressure, strengthens the thoracolumbar fascia, and improves segmental stability of the spine (Narouei et al., 2020; Frank et al., 2013).

Comparison of Range of Motion (ROM)

The McKenzie group experienced greater ROM improvement, especially in flexion (+22°), extension (+11°), and right lateral flexion (+9°). Mobilization exercises and posture correction helped relieve structural impediments such as spasm and discogenic mechanical disorders (Mann et al., 2023; Albert et al., 2012).

CSE also contributes to Increased ROM, albeit to a smaller extent. These exercises focus on neuromotor control and

strengthening of deep muscles, such as the erector spinae and diaphragm, which play a role in maintaining stability and symmetrical movement patterns (Rahmadi et al., 2024; Naveen et al., 2024).

Respondent Characteristics and Clinical Relevance

The majority of respondents were men of productive age (20-30 years) with chronic LBP, postural syndrome, and BMI above normal. These factors are in accordance with the literature which states that poor posture, heavy physical work, and being overweight increase biomechanical risks to the spine (Kumbea et al., 2021; Heuch et al., 2024; Russeng et al., 2021).

5. CONCLUSIONS AND SUGGESTION

This study shows that Core Stability Exercise (CSE) and the McKenzie method are equally effective in reducing pain and disability in Low Back Pain (LBP) patients, with different effectiveness characteristics. CSE provides a faster clinical response in the early phase of therapy through improved neuromuscular control and segmental stability. Meanwhile, the McKenzie method showed stronger cumulative effectiveness in the advanced phase, especially in reducing pain through centralization mechanisms and postural biomechanical improvements. Significant improvements in Oswestry Disability Index (ODI), Visual Analog Scale (VAS), and lumbar range of motion (ROM) scores were found in both groups, with the McKenzie group showing higher long-term results. Patient characteristics, including productive age, postural syndrome, and above-normal body mass index, played a role in the response to the intervention.

Based on the results of this study, it is recommended that McKenzie therapy be used in the early phase of Low Back Pain (LBP) treatment to reduce pain quickly, while Core Stability Exercise (CSE) is more suitable to be applied in the advanced phase to improve stability and prevent recurrence. The combination of both approaches can be an effective rehabilitation strategy, especially in chronic LBP cases. To strengthen these findings, further studies with a larger sample size and longer follow-up duration are needed. In addition, it is important to educate patients on good posture and weight management as part of long-term prevention of LBP.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research

RESPONDENT'S CONSENT FOR PUBLICATION

The authors have obtained informed consent from each respondent regarding research and publication

ETHICS APPROVAL

This study has received a recommendation for ethical approval from the Health Research Ethics Commission of the Faculty of Medicine, Halu Oleo University with Number 009/UN29.17.1.3/ETIK/2025

REFERENCES

[1] Chan, Y. H. (2003). Randomised controlled trials (RCTS) - Sample size: The magic number? *Singapore Medical Journal*, *44*(4), 172–174.

[2] Chen, J., Huang, Y., Yang, Y., Wang, Z., Zhao, D., Luo, M., & Pu, F. (2024). *Vertebral bone quality score was associated with paraspinal muscles fat infiltration , but not modic classification in patients with chronic low back pain : a prospective cross-sectional study*. 1–8.

[3] Dahlan, M. S. (2010). *Sample Size and Sampling Methods in Medical Research 3rd Edition* (A. Suslia (ed.)). Salemba Medika.

[4] Freitas, J. P., Corrêa, L. A., Bittencourt, J. V., Armstrong, K. M., Meziat-Filho, N., & Nogueira, L. A. C. (2024). One spinal manipulation session reduces local pain sensitivity but does not affect postural stability in individuals with chronic low back pain: a randomised, placebo-controlled trial. *Chiropractic and Manual Therapies*, *32*(1), 1–12. https://doi.org/10.1186/s12998-024-00541-4

[5] Iwata, S., Hashizume, H., Yoshimura, N., Oka, H., Iwahashi, H., Ishimoto, Y., Nagata, K., Teraguchi, M., Kagotani, R., Sasaki, T., Tanaka, S., Yoshida, M., & Yamada, H. (2024). Osteoporosis , spinal degenerative disorders , and their association with low back pain , activities of daily living , and physical performance in a general population. *Scientific Reports*, 1–10. https://doi.org/10.1038/s41598-024-64706-0

[6] Lei, Y., Zhan, E., Chen, C., Hu, Y., Lv, Z., He, Q., Wang, X., Li, X., & Zhang, F. (2024). ALKBH5 -mediated m6A demethylation of Runx2 mRNA promotes extracellular matrix degradation and intervertebral disc degeneration. *Cell and Bioscience*, *14*(1), 1–19. https://doi.org/10.1186/s13578-024-01264-y

[7] Mbada, C., Olanipekun, O. O., Ademoyegun, A., & Egwu, M. O. (2024). Effectiveness of telerehabilitation - based mckenzie method versus manual therapy in low - back pain management : a randomised controlled trial. *Bulletin of Faculty of Physical Therapy*. https://doi.org/10.1186/s43161-024-00218-2

[8] Namnaqani, F. I., Mashabi, A. S., Yaseen, K. M., & Alshehri, M. A. (2019). The effectiveness of McKenzie method compared to manual therapy for treating chronic low back pain: A systematic review. *Journal of Musculoskeletal Neuronal Interactions*, *19*(4), 492–499.

[9] Pires, D., Duarte, S., Rodrigues, A. M., Caeiro, C., Canhão, H., Branco, J., Alves, J., Marques, M., Aguiar, P., Fernandes, R., Sousa, R. D., & Cruz, E. B. (2024). MyBack - effectiveness and implementation of a behavior change informed exercise programme to prevent low back pain recurrences: a hybrid effectiveness-implementation randomized controlled study protocol. *BMC Musculoskeletal Disorders*, *25*(1), 1–12. https://doi.org/10.1186/s12891-024-07542-7

[10] Putri, R., Sari, I. P., Delidios, & Ruswaldi. (2023). *The Relationship Of Work Attitude And Duration Of Riding With Low Back Pain (LBP) In Online Ojek Motorcycle Drivers In Pekanbaru City*. *1*(3).

[11] Rhon, D. I., Fritz, J. M., Greenlee, T. A., Dry, K. E., Mayhew, R. J., Laugesen, M. C., Dragusin, E., & Teyhen, D. S. (2024). *Correction : move to health-a holistic approach to the management of chronic low back pain : an intervention and implementation protocol developed for a pragmatic clinical trial*. 12967.

[12] Takasaki, H. (2023). *Predictors of 1-Year Perceived Recovery , Absenteeism , and Expenses Due to Low Back Pain in Workers Receiving Mechanical Diagnosis and Therapy : A Prospective Cohort Study*. 1–11.

[13] Khan, J., khan, P., Arshad, M. U., Javed, A., Zia, wajeeha, Iqbal, A., & Jamshaid, G. (2022). Comparative effects of Core Stability Exercises and Endurance Training in Patients with Mechanical Low Back Pain. *Pakistan BioMedical Journal*, *5*(1), 332–336. https://doi.org/10.54393/PBMJ.V5I1.193

[14] Lam, O. T., Strenger, D. M., Chan-Fee, M., Pham, P. T., Preuss, R. A., & Robbins, S. M. (2018). Effectiveness of the McKenzie Method of Mechanical Diagnosis and Therapy for Treating Low Back Pain: Literature Review With Meta-analysis. *The Journal of Orthopaedic and Sports Physical Therapy*, *48*(6), 476–490. https://doi.org/10.2519/JOSPT.2018.7562

[15] Mann, S. J., Lam, J. C., & Singh, P. (2023, July). *McKenzie Back Exercises*. StatPearls; StatPearls Publishing.

[16] Hlaing, S. S., Puntumetakul, R., Khine, E. E., & Boucaut, R. (2021). Effects of core stabilization exercise and strengthening exercise on proprioception, balance, muscle thickness and pain related outcomes in patients with subacute nonspecific low back pain: a randomized controlled trial. *BMC Musculoskeletal Disorders*, *22*(1), 1–13. https://doi.org/10.1186/S12891-021-04858-6/TABLES/2

[17] Louw, A., Farrell, K., Nielsen, A., O'Malley, M., Cox, T., & Puentedura, E. J. (2022). Virtual McKenzie extension exercises for low back and leg pain: a prospective pilot exploratory case series. *The Journal of Manual & Manipulative Therapy*, *31*(1), 46. https://doi.org/10.1080/10669817.2022.2092822

[18] Asmara, S., Marya, D., Putri, M., Kristiyanto, A., & Prasetya, H. (2021). Meta-Analysis the Effectiveness of McKenzie Exercise to Reduce Pain in Patients with Non-Specific Low Back Pain. *Journal of Epidemiology and Public Health*, *6*(1), 33–41. https://doi.org/10.26911/JEPUBLICHEALTH.2021.06.01.06

[19] Xu, S., Wang, R., Ma, S., & He, B. (2024). Interventional effect of core stability training on pain and muscle function of youth with chronic non-specific lower back pain: A randomized controlled trial. *Heliyon*, *10*(12), e32818. https://doi.org/10.1016/J.HELIYON.2024.E32818

[20] Narouei, S., Barati, A. hossein, Akuzawa, H., Talebian, S., Ghiasi, F., Akbari, A., & Alizadeh, M. hossein. (2020). Effects of core stabilization exercises on thickness and activity of trunk and hip muscles in subjects with nonspecific chronic low back pain. *Journal of Bodywork and Movement Therapies*, *24*(4), 138–146. https://doi.org/10.1016/J.JBMT.2020.06.026

[21] Frank, C., Kobesova, A., Kolar, P., & Permanente, K. (2013). Dynamic Neuromuscular Stabilization and Sports Rehabilitation. *International Journal of Sports Physical Therapy*, *8*(1), 62.

[22] Albert, H. B., Hauge, E., & Manniche, C. (2012). Centralization in patients with sciatica: are pain responses to repeated movement and positioning associated with outcome or types of disc lesions? *European Spine Journal : Official Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*, *21*(4), 630–636. https://doi.org/10.1007/S00586-011-2018-9

[23] Rahmadi, R., Pradita, A., Endaryanto, A. H., & Fau, Y. D. (2024). Efektifitas Core Stability Terhadap Fleksibilitas Otot Lumbal Pada Kasus Low Back Pain Di Klinik Pupuk Kujang Cikampek. *Jurnal Kesehatan Panrita Husada*, *9*(1).

[24] Naveen, G., Ashraf, Y., Mahesh, R., Ramamoorthy, V., Rai, B. K. D., Indhu, R., & Anusuya, D. (2024). Effectiveness of Movement Control Exercise and Core Stability Exercise on Reducing Pain, Improving Range of Motion and Functional Activities in Patients with Mechanical Low Back Pain. *International Journal of Health Sciences and Research (Www.Ijhsr.Org)*, *14*(7), 409. https://doi.org/10.52403/ijhsr.20240753

[25] Kumbea, N. P., Sumampouw, O. J., & Asrifuddin, A. (2021). Complaint of Low Back Pain in Fishermen.

Indonesian Journal of Public Health and Community Medicine, *2*(1), 021–026. https://doi.org/10.35801/IJPHCM.2.1.2021.33580

[26] Heuch, I., Heuch, I., Hagen, K., & Zwart, J. A. (2024). Overweight and obesity as risk factors for chronic low back pain: a new follow-up in the HUNT Study. *BMC Public Health*, *24*(1), 2618. https://doi.org/10.1186/S12889-024-20011-Z/TABLES/6

[27] Russeng, S. S., Saleh, L. M., Wahyulianti, W. N., & Palutturi, S. (2021). The Effect of Age and Workload on Work Posture toward Musculoskeletal Disorders Complain on Loading and Unloading Workers. *Open Access Macedonian Journal of Medical Sciences*, *9*(E), 1115–1121. https://doi.org/10.3889/OAMJMS.2021.7277

[28] Frizziero, A., Pellizzon, G., Vittadini, F., Bigliardi, D., & Costantino, C. (2021). Efficacy of Core Stability in Non-Specific Chronic Low Back Pain. *Journal of Functional Morphology and Kinesiology 2021, Vol. 6, Page 37*, *6*(2), 37. https://doi.org/10.3390/JFMK6020037

[29] Gill, G., Jagga, V., & Pal, S. (2024). Efficacy and Effectiveness of McKenzie Exercises in Chronic Low Back Pain Management: A Comprehensive Review. *International Journal of Health Sciences and Research*, *14*(9), 212–220. https://doi.org/10.52403/IJHSR.20240927