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Effectiveness of McKenzie Extension Exercises in Reducing Radiated Low Back Pain: A Quasi-Experimental Comparative Trial

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A R T I C L E I N F O

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Abstract

Background: Low back pain (LBP) is a prevalent condition significantly impacting individuals' quality of life and daily activities. Radiated low back pain, particularly in acute or sub-acute stages, poses a challenge for effective management. The McKenzie Method, particularly McKenzie extension exercises (MEE), has been suggested as a beneficial intervention for alleviating radiated pain. This study evaluated the effectiveness of MEE on radiated lower back pain among patients in Iraq.

Aim: This study aimed to assess the impact of McKenzie exercises on radiated low back pain in patients with acute or sub-acute low back pain.

Methods: The study was conducted at the physiotherapy department of Rzgary Teaching Hospital in Iraq from October 20th, 2021, to March 1st, 2022. 51 patients (26 males and 25 females) with acute or sub-acute radiated lower back pain were conveniently sampled. Participants received McKenzie extension exercises as part of their treatment program. Assessments were conducted at 1 week, 3 weeks, and 3 months using a numerical rating scale (NRS) for pain and the Roland-Morris Disability Questionnaire (RMDQ) for disability resulting from low back pain.

Results: The study significantly improved radiated pain over the three months. The mean radiated pain score decreased from 1.863 at the pretest to 0.235 at three months, indicating substantial improvement. Significant improvements in radiated pain were observed at each assessment point, with p-values less than 0.001. Most participants reported intermittent pain, with bending as the most aggravating factor and lying down as a relieving factor. The sample included participants from various residential areas, predominantly married individuals with a lower educational background. The duration of low back pain among participants varied, indicating a mix of acute and sub-acute cases.

Conclusion: The findings suggest that McKenzie extension exercises effectively reduce radiated low back pain in patients with acute or sub-acute conditions. The intervention led to significant improvements in pain and disability over three months. Further research is warranted to explore McKenzie exercises' long-term effects and potential benefits in centralizing pain.

What is already known about the topic? McKenzie extension exercises are commonly used to manage radiated lower back pain, particularly in conditions like sciatica. These exercises focus on spinal extension movements that help centralize pain, reduce radiating symptoms, and improve mobility. Studies suggest they effectively alleviate pain and improve function in patients with disc-related issues, though results can vary based on individual patient factors.

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Introduction

Acute low back pain is a prevalent condition that can significantly impact individuals' quality of life and productivity. (Buchbinder *et al.*, 2018). It is characterized by the sudden onset of pain and discomfort in the lower back, often resulting from muscle strain, ligament sprain, or disc herniation. (Buchbinder *et al.*, 2018;Manchikanti *et al.*, 2014). The pain experienced in acute lower back pain typically lasts for less than six weeks. (Manchikanti *et al.*, 2014).

Numerous factors can contribute to the development of acute low back pain, including poor posture, a sedentary lifestyle, improper lifting techniques, and psychological stress. (Manchikanti *et al.*, 2014;Freburger *et al.*, 2009)). The condition can substantially impact an individual's physical functioning and may result in limitations in daily activities and work-related tasks. (Freburger *et al.*, 2009).

Various treatment options are available to effectively manage acute low back pain, including medication, physical therapy, and exercise interventions. (Foster *et al.*, 2018;Koes *et al.*, 2010). One exercise approach that has gained attention is the McKenzie Method, which focuses on specific movements and postures to centralize and reduce pain. (Foster *et al.*, 2018;Manchikanti *et al.*, 2014).

The McKenzie Method includes a series of exercises that target specific directions of movement based on the individual's pain response and clinical presentation. (Foster *et al.*, 2018). McKenzie proposes treating low back pain by evaluating symptoms and making alterations through repetitive spinal movements. Centralization is a phenomenon described by McKenzie, where distal symptoms either move closer to the midline of the spine or disappear altogether when specific directional movements are performed. (Petersen *et al.*, 2011)

Research studies have investigated the effectiveness of McKenzie Exercises in managing acute low back pain. For example, a randomized controlled trial by Manchikanti *et al.* (2014) Demonstrated that patients who received McKenzie Exercises experienced more significant pain reduction and improved functional outcomes compared to a control group. The McKenzie exercises effectively centralize pain and promote early recovery in acute low back pain patients (Manchikanti *et al.*, 2014).

People with low back pain face radiated pain in the lower part of the body, such as the buttocks, upper knee joint, and lower knee joint. This study aims to assess the effectiveness of McKenzie's exercises on the centralization of pain.

Patients and Methods

Study Design, duration, and Setting

A quasi-experimental comparative trial of pre-post study design was conducted. Patients were recruited from the physiotherapy department of Rzgary Teaching Hospital, Iraq, from October 20th, 2021, to March 1st, 2022. Rzgary Hospital is one of the teaching hospitals in Erbil city, a general hospital for managing different kinds of patients. Back pain is a health problem treated in Rzgary Teaching Hospital's physiotherapy department. The physiotherapy department is differentiated and has its staff. It has a separate male and female exercise hall. Each hall has at least five well-trained physiotherapists, most of whom graduated from the medical institute's physiotherapy department. Furthermore, some of them have recently graduated from the College of

Physiotherapy. They receive different cases such as stroke, shoulder pain, knee pain, hand problems, and back pain.

Sample and Sampling technique

The samples recruited in this study were 51, who were 26 males and 25 females. A non-probability-convenient sampling technique was used to select the patients. All patients have acute or sub-acute low back pain. Furthermore, the vast majority of cases have radiated pain downward. Patients received McKenzie extension exercises (MEE). Selected patients continued the program, and there were no withdrawal cases because the researchers worked with those patients closely and frequently.

Free online software G-power was used to determine the sample size for this study. Since the researchers decided to use a medium effect size, one tail testing, $\alpha=0.05$, $\beta=0.95$, and the sample size, N1, the total sample size will be computed as 45 samples; however, to elevate the power of the study, we assessed 51 samples from both sexes. (Kang, 2021).

Inclusion criteria

All adult patients with radiated acute or sub-acute low back pain, diagnosed acute low back pain patients by a specialist physician, present with a new episode of acute low back pain, are able and willing to visit the Physiotherapy department at Rzgary Teaching Hospital for commencement of the treatment program, a new episode of acute low back pain was defined as pain in the area between the 12th rib and buttock crease (with or without leg pain) of less than 12 weeks duration.

Exclusion criteria

Patients were excluded if they had any of the following: nerve root compromise, 'red flags' for severe spinal pathology (for example, infection, fracture), spinal surgery in the past six months, pregnancy, severe cardiovascular or metabolic disease, patients with psychological disorders, and who unwilling to participate in the current study.

Ethical consideration

The Ethical Committee of the College of Nursing at Hawler Medical University approved the study. Before the commencement of the study, written consent was obtained from all participants.

Procedure

Each participant will receive medical treatment following the recommended protocol for acute musculoskeletal pain at Rzgary Teaching Hospital. This guideline-based medical care includes informing patients about their potential for recovery from acute or sub-acute low back pain (LBP) and encouraging them to maintain an active lifestyle. Before the study, consent was obtained from each patient through a consent form. The therapist conducted a physical examination to collect the necessary data.

Pain assessment was performed using a Numerical Rating Scale (NRS) ranging from 0 to 10, with 0 indicating no pain and 10 indicating the worst imaginable pain. (Breivik *et al.*, 2008). This scale was used to determine the severity of pain and was particularly useful for patients who preferred to rate their pain numerically.

The disability resulting from acute or sub-acute LBP was assessed using the Roland-Morris Disability Questionnaire (RMDQ) (Roland & Morris, 1983). The questionnaire consisted of 24 items that reflected typical tasks challenging for patients due to low back pain. The greater the number of items selected, the higher the level of disability reported by the patient. Participants were asked to select the options that best described their disability during the assessment.

Subjects were grouped into three categories by the location of their initial symptoms as follows: Category I was defined as symptoms present in the low back with radiation of symptoms no lower than the gluteal fold; Category II was defined as symptoms present in the low back with radiation of symptoms no lower than the joint line of the knee; and Category III was defined as symptoms present in the low back with radiation of symptoms below the knee.

Following the initial assessment, participants were evaluated three times: after one week, three weeks, and three months (post I, II, and III). Throughout the study, participants were instructed to perform the prescribed exercises regularly and continuously, at least five times daily.

The Physiotherapy management

The methodology followed in this study was based on the protocol established by Elmahdy *et al.* (2022) Given the infrequent use of McKenzie exercises, the researchers incorporated this exercise into their study. Initially, a literature review was conducted to gather relevant information. Subsequently, an educational course was organized, focusing on McKenzie extension exercises, specifically designed for patients with acute or sub-acute low back pain. The patients included in the study were diagnosed with acute low back pain by a specialist physician, and the researcher assessed them to collect data.

The educational program provided information on the causes, signs, symptoms, and management methods for acute low back pain. Additionally, specific exercises suitable for each patient were recommended based on the McKenzie method. These exercises included:

1. Prone Exercise: Lying on the stomach with arms at the sides and the head turned to one side, maintaining this position for 5 to 10 minutes.
2. Prone on Elbows: Lying on the stomach with weight distributed evenly between the elbows and forearms, allowing the lower back to relax. This position should be held for 5 to 10 minutes. If any discomfort arises, reverting to the first exercise is advised.
3. Prone Press-Up: Starting from a prone position, place the hands at shoulder level and slowly push the shoulders up while keeping the hips on the ground and lowering the shoulders slowly. This exercise should be repeated ten times.
4. Progressive Extension with Pillows: Place a pillow beneath the chest while lying on the stomach and gradually add a second pillow after a few minutes if comfortable.

The extension exercise involved standing with hands at the waist and leaning back slightly to relax the back muscles. This routine included a 20-second hold followed by a rest period. It was particularly beneficial for individuals engaging in lifting, leaning over, or prolonged sitting activities.

The collected data were statistically analyzed using SPSS version 28 software. A significant level of p=0.5 was established for normal distribution, and the student t-test was employed for data analysis. Additionally, paired tests were conducted to assess the program's impact on individual patients.

Result

Table 1 presents the characteristics of the participants in the study. The table provides information on residence, gender, marital status, educational level, duration of low back pain, and the nature of the pain experienced by the participants.

The participants were from various residential areas, including rural

(31.4%), urban (52.9%), and sub-urban (15.7%) locations. The study included a relatively equal distribution of male (51.0%) and female (49.0%) participants. Most participants were married (94.1%), while a small percentage reported being single (5.9%). No participants indicated being divorced, separated, or widowed. The educational backgrounds of the participants varied. The most significant proportion of participants had completed primary school (41.2%), followed by illiterate (17.6%), intermediate school (21.6%), high school (13.7%), institute (3.9%), and bachelor's degree and above (2.0%).

Participants reported experiencing low back pain for different durations. The highest number of participants reported experiencing pain for 30-59 days (35.3%), followed by 23-29 days (21.6%), 0-7 days (19.6%), 60-90 days (9.8%), 8-14 days (9.8%), and 15-22 days (3.9%). The majority of participants experienced intermittent pain (82.4%), while a smaller percentage reported constant pain (17.6%). We found out that the majority of participants, 24 (47.1%), were obese, followed by 16 (31.4%) who were overweight, while only 11 (21.6%) of the cases were of a healthy weight.

Table 2 illustrates data related to the characteristics of the pain. It can be seen that the majority of participants experienced intermittent pain (82.4%), while a smaller percentage reported constant pain (17.6%). 21(41.2%) of participants pointed out that bending is the factor that aggravated their lower back pain, and only 2 (3.9%) of our participants indicated that their pain is worsened by lying down. However, 30 (58.8%) of patients mentioned that their pain is relieved by lying down; furthermore, standing and walking were two factors that minimized the pain. Stabbing and Achy were two characteristics of their pain 15(29.4%) and 14(27.5%), respectively.

Table 3 presents the improvement of radiated pain over three months. The table includes several data points, each representing a specific time point for measuring radiated pain and the corresponding mean, standard deviation (Std. Deviation), mean difference, standard difference (STD Difference), and p-value.

The pretest mean radiated pain score was 1.863, with a standard deviation 0.530. After one week, the mean score decreased to 1.020, indicating an improvement. The mean difference between the pretest and one-week scores was 0.843, with a standard difference of 0.418. The p-value, which measures the statistical significance of the difference, was less than 0.001, indicating a highly significant improvement in radiated pain.

Furthermore, the mean score after one week remained at 1.020, while the mean score after three weeks decreased to 0.510, indicating further improvement. The mean difference between these two-time points was 0.510, with a standard difference of 0.071. The p-value was again less than 0.001, indicating a significant improvement in radiated pain from one week to three weeks.

The mean score after three weeks was 0.510, while the mean score after three months decreased to 0.235, indicating continued improvement. The mean difference between these two-time points was 0.275, with a standard difference of 0.063. The p-value was less than 0.001, suggesting a statistically significant improvement in radiated pain from three weeks to three months.

The pretest mean score was 1.863; after three months, it decreased to 0.235, indicating a substantial improvement in radiated pain. The mean difference

between these two-time points was 1.627, with a standard difference of 0.101. The p-value was less than 0.001, indicating a significant improvement in radiated pain from the pretest to three months.

Overall, the table demonstrates a consistent pattern of improvement in radiated pain over the three months. The mean scores decrease over time, and the p-values indicate significant improvements in radiated pain for all the pairs of data points. These findings suggest that the intervention or treatment being studied effectively reduces radiated pain.

Figure 1: The bar chart displays the number of participants experiencing pain in different areas at different times: pretest, after one week, after three weeks, and after three months. At the pretest stage, no participants reported pain in the Central Back area. The Buttock area had 11 participants experiencing pain, the Upper Knee area had 36 participants, and the Lower Knee area had 4 participants.

After one week, the Central Back area had 8 participants reporting pain, the Buttock area had 34 participants, the Upper Knee area had 9 participants, and there were no reports of pain in the Lower Knee area.

Moving to the three-week mark, the Central Back area had 26 participants reporting pain, the Buttock area had 24 participants, the Upper Knee area had 1 participant, and there were no reports of pain in the Lower Knee area.

Finally, at the three-month stage, the Central Back area had 40 participants reporting pain, the Buttock area had 10 participants, the Upper Knee area had 1 participant, and there were no reports of pain in the Lower Knee area.

Indeed, the Central Back area consistently had the highest number of participants reporting pain throughout three months. The count increased from the pretest stage (0 participants) to the three-month stage (40 participants), indicating that pain in the peripheral parts of the patients returns to the central back and that these exercises significantly impact the centralization of the pain.

Table 1: Characteristics of participants

		N	%
Residence	Rural	16	31.4%
	Urban	27	52.9%
	Sub-urban	8	15.7%
Gender	Female	25	49.0%
	Male	26	51.0%
Marital State	Sigle	3	5.9%
	Married	48	94.1%
	Divorce	0	0.0%
	Separate	0	0.0%
	Widow	0	0.0%
Educational Level	Illiterate	9	17.6%
	Primary School graduate	21	41.2%
	Intermediate School	11	21.6%
	High school	7	13.7%
	Institute	2	3.9%
	Bachelor and above	1	2.0%
How long have you had low back pain	0-7days	10	19.6%
	8-14 days	5	9.8%
	15-22 days	2	3.9%
	23-29 days	11	21.6%
	30-59 days	18	35.3%
	60-90 days	5	9.8%
Body Mass Index	Underweight	0	0.0%
	Healthy weight	11	21.6%
	Overweight	16	31.4%
	Obese	24	47.1%

Table 2: Characteristics of pain			
		N	%
This pain is	Constant	9	17.6%
	Intermittent	42	82.4%
Aggravated Factors	Bending	21	41.2%
	Sitting and rising from	13	25.5%
	Standing	7	13.7%
	Walking	8	15.7%
	Lying	2	3.9%
Relieving Factor	Bending	5	9.8%
	Sitting and rising from	2	3.9%
	Standing	7	13.7%
	Walking	7	13.7%
	Lying	30	58.8%
Characteristics of pain	Sharp	3	5.9%
	Dull	5	9.8%
	Stabbing	15	29.4%
	Achy	14	27.5%
	Shooting	4	7.8%
	Throbbing	0	0.0%
	Burning	1	2.0%
	Cramping	0	0.0%
	Pressure like	5	9.8%
	Tingling	3	5.9%
	Numbness	1	2.0%

Table 3: Improvement of radiated pain over Three months						
		Mean	Std. Deviation	Mean Difference	STD Difference	P-value
Pair 1	pretest	1.863	0.530	0.843	0.418	<0.001
	After one week	1.020	0.583			
Pair 2	After one week	1.020	0.583	0.510	0.071	<0.001
	After three weeks	0.510	0.543			
Pair 3	After three weeks	0.510	0.543	0.275	0.063	<0.001
	After three months	0.235	0.473			
Pair 4	pretest	1.863	0.530	1.627	0.101	<0.001
	After three months	0.235	0.473			

Discussion

The current study aimed to examine the improvement of radiated pain over three months in a sample of participants. The findings from Table 3 demonstrated a consistent pattern of improvement in radiated pain, as indicated by decreasing mean scores and significant p-values for all pairs of data points. These results suggest that the intervention or treatment being studied effectively reduced radiated pain over time.

The mean radiated pain score at the pretest stage was 1.863, which decreased to 1.020 after one week. This initial improvement was statistically significant, with a mean difference of 0.843 and a p-value of less than 0.001. The trend continued as the mean score decreased to 0.510 after three weeks and 0.235 after three months. These reductions in mean scores were accompanied by statistically significant mean differences and p-values, indicating ongoing improvement in radiated pain.

The data presented in Table 3 align with the findings of previous studies. For example, Bybee *et al.* (2009) A study was conducted, and a significant decrease in radiated pain scores was reported among participants who received a similar intervention. The consistent findings across studies strengthen the evidence supporting the effectiveness of the intervention in reducing radiated pain.

In addition to the current study, Table 1 provided an overview of the participants' characteristics, including residence, gender, marital status, educational level, duration of low back pain, and the nature of the pain experienced. The diverse residential backgrounds of the participants, with representation from rural, urban, and suburban areas, suggest a broader applicability of the study findings to different populations.

Most participants were married, which might indicate that individuals with a stable marital status were more likely to participate in the study. However, caution should be exercised in generalizing these findings to unmarried individuals. Regarding educational background, most participants had completed primary school, suggesting that the sample predominantly represented individuals with a lower educational attainment.

The duration of low back pain varied among participants, with the highest number reporting pain for 30-59 days. This indicates that the sample consisted of individuals who experienced acute and sub-acute low back pain. The intermittent nature of pain reported by most participants is consistent with previous studies. (Cuesta-Vargas *et al.*, 2014) They suggest that the participants' experiences align with known patterns of low back pain.

Furthermore, Table 2 provided insights into the characteristics of the pain experienced by participants. Most participants reported intermittent pain, and bending was identified as the primary factor that aggravated their lower back pain. This finding is consistent with previous research highlighting the role of movements and postures in exacerbating symptoms of low back pain. (Wernli *et al.*, 2020). Additionally, pain relief while lying down and minimalizing pain with standing and walking align with established strategies for managing lower back pain. (Kripa and Kaur, 2021).

Figure 1, the bar chart representing the count of participants experiencing pain in different areas, provided a visual representation of the distribution of pain over time. The central back area consistently had the highest count of participants reporting pain throughout

the three months, suggesting that pain tends to centralize in this area. This observation is supported by previous studies highlighting the centralization phenomenon in low back pain patients. (Bybee *et al.*, 2009). The centralization of pain indicates that the intervention or treatment studied in this research significantly alleviates radiated pain and shifts its location back to the central back area.

In conclusion, the findings from this study indicate a significant improvement in radiated pain over three months. The intervention or treatment employed in the study effectively reduced radiated pain, as demonstrated by the decreasing mean scores and statistically significant differences.

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