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Comparing the Effects of Home-Based McKenzie and Back School Exercises on Pain, Flexibility, Range of Motion, and Disability in Patients with Non-Specific Chronic Low Back Pain: A Randomized Controlled Trial

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ABSTRACT

Sungkamanee S, Ladawan S, Maharan S, Sriraksa N, Janyacharoen T. Comparing the Effects of Home-Based McKenzie and Back School Exercises on Pain, Flexibility, Range of Motion, and Disability in Patients with Non-Specific Chronic Low Back Pain: A Randomized Controlled Trial. **JEPonline** 2023;26(3):107-121. Non-specific chronic low back pain refers to lower back and lumbar region pain that lasts more than 12 weeks. This condition can lead to reduced trunk movement and activities of daily living. Exercises, especially McKenzie exercises and back school exercises, are a potential treatment for non-specific chronic low back pain. However, comparing the effects of these two types of exercise is still limited. The purpose of this study was to compare the effects of home-based McKenzie and back school exercises on the pain scale, pressure pain threshold

(PTT), back flexibility, range of motion (ROM) of the lumbar spine, and disability in patients with non-specific chronic low back pain. A total of 40 non-specific chronic low back pain patients 30 to 65 years of age were randomly assigned to perform McKenzie exercises (n = 20) or back school exercises (n = 20). All participants in both groups performed the exercises at home for 45 minutes per day for 4 weeks. The parameters such as pain scale, PTT, back flexibility, ROM of the lumbar spine, and disability were evaluated at baseline and after the above-described exercise. The above-listed outcomes were measured via a numerical pain rating scale (NPRS), a digital pressure algometer, a Flex-meter, a fluid inclinometer, and the Roland-Morris Disability Questionnaire, respectively. Statistical significance was regarded at an alpha level of $P<0.05$. Four weeks of home-based McKenzie and back school exercises showed that participants in both groups reduced pain scales, increased pressure pain thresholds, improved back flexibility, and improved disability. The McKenzie exercise group showed significant improvement in ROM of the lumbar spine in all directions except right lateral flexion. However, the Back School Exercise Group showed no significant improvement. There was no significant difference between the 2 Groups except, the McKenzie Exercise Group had a greater improvement in ROM of the right and left lumbar lateral flexion ($P = 0.041$ and $P = 0.048$). In conclusion, McKenzie exercise and back school exercise was found to reduce the pain scale, increase the pressure pain threshold, as well as improve back flexibility and disability. Interestingly, the McKenzie exercise improved lumbar spine ROM more than the back school exercise.

Key Words: Back Flexibility, Back School Exercises, Disability, McKenzie Exercises, Non-Specific Chronic Low Back Pain, Pain Scale, Pressure Pain Threshold

INTRODUCTION

Low back pain has been classified as one of 10 disorders that affect physical and mental health, which can result in disability, absence from work, and loss of treatment expenditures that ultimately threatens the country's economic system (5,14,17,25). Between 60% and 80% of adults will experience back pain at some point in their lives (34). The prevalence of musculoskeletal disorders in the lower back in Thailand was found to be 33.45%, the majority of whom are working and aged 20 to 39 (20,21). Severity of back pain can be divided into 3 phases: (a) acute pain lasting less than 6 weeks; (b) sub-acute pain lasting 6 to 12 weeks; and (c) chronic pain lasting longer than 12 weeks. Pain in the chronic phase leads to limited activity, resulting in disability and affecting quality of life in the long run (4,15,16,18, 23,33). Low back pain is typically divided into two categories: (a) specific pain caused by distinct or unusual pathophysiologic mechanisms (such as disc herniation, tumor, osteoporosis, arthritis, disease, trauma, mechanical disorders, or spinal pathology); and (b) non-specific pain not attributable to a recognizable known specific pathology that accounts for over 85% of all low back pain (10,23,24,27).

Non-specific chronic low back pain is typically characterized by discomfort, muscle tension, or stiffness localized below the costal margins (ribs) and above the inferior gluteal folds, with or without leg pain (sciatica) (23). Current treatment for low back pain attempts to alleviate pain, preserve normal muscle and joint function, increase activity capacity, and prevent future structural degradation (8,9,10,13,26,41). Patients with chronic low back pain typically receive exercise therapy (6,39), such as the McKenzie exercises and back school exercises. The McKenzie exercises support the spine's natural alignment by reducing back discomfort and

strengthening deep back muscles. After 4 and 8 weeks of intervention, McKenzie exercises have been shown to improve pain intensity, pressure pain threshold (PPT), and disability in patients with non-specific chronic low back pain. Additionally, this exercise decreases pain and functional disability, and it is believed to produce better treatment results than conventional exercise (7). However, the effect of McKenzie exercises on back flexibility and lumbar spine range of motion in non-specific chronic low back pain remains modest.

Back school exercises are those that help patients learn how to take care of their backs and use their backs in their daily lives properly (28). These exercises include both physical activity and educational components that are intended for the treatment or prevention of low back pain. They are also widely used in nonpharmacological interventions in an occupational health setting (37). It was reported that participating in back school programs for 6 and 12 weeks reduced low back pain and enhanced functional status among rice farmers. Furthermore, it has been reported that participants who performed back school exercises had less pain and functioned more effectively than a control group (32). The back school program enhanced pain intensity, functional disability, and spine mobility after 16 weeks. These parameters also improved more than a control group in patients with non-specific chronic low back pain (36).

A previous study by Garcia et al. (1) compared the efficacy of McKenzie exercises versus the back school exercises in non-specific chronic low back pain by evaluating pain intensity, disability, quality of life, and ROM of trunk flexion. They found that McKenzie exercises were slightly more effective after one month than the back school exercises in reducing disability, but McKenzie exercises had no effect on pain intensity, range of motion of trunk flexion, and quality of life (1). However, there has not been any research comparing the effects of McKenzie exercises and back school exercises on back flexibility, pressure pain threshold (PPT), and range of motion of the lumbar spine in different directions. These outcomes play a critical role in assessing patients' health by estimating how effectively the patients are doing their everyday tasks.

It has been proposed that flexibility of the muscles, tendons, and ligaments in the back promotes a range of motion and aids in patient functional mobility (34). The PPT was low in patients with chronic low back pain at the locations physically connected to the lumbar spine. Additionally, a low PPT is linked to disability that decreases quality of life (19). Therefore, the purposes of this study were to compare the benefits of home-based McKenzie exercises versus back school exercises in non-specific chronic low back pain by evaluating the pain scale, PPT, back flexibility, lumbar range of motion (ROM), and disability.

METHODS

Study Design

This study was a randomized controlled trial with single-blinded participants. It was registered on the Thai Clinical Trials Registry (TCTR), identification number is TCTR20230424003, and was conducted in accordance with the International Conference on Harmonization (ICH) for Good Clinical Practice (GCP) and in compliance with the Declaration of Helsinki and its further amendments. All protocols were reviewed and approved by the University of Phayao Ethical Committee on Human Research. The approval number is 2/169/60.

Subjects

The participants' data were gathered from the medical record department database at Phayao Hospital in Phayao Province, Thailand between January 2017 and January 2018. The inclusion criteria included males or females from 9 primary care units who: (a) were 30 to 65 years of age; (b) had been diagnosed with non-specific chronic low back pain with a duration of pain greater than 12 weeks; and (c) had a pain scale of less than 8 out of 10. Participants with an underlying illness and serious health issues (that included cancer, bone fractures, and inflammatory diseases) were excluded, as were volunteers who had undergone spinal surgery, had nerve root compression that caused pain to radiate to their legs and feet, cognitive impairment, were pregnant, regularly exercised more than 3 times per week, and had taken painkillers or muscle relaxants. Participants with specific pain brought on by disc herniation, malignancy, osteoporosis, arthritis, trauma, or spinal pathology were also excluded from the study. The sample size for this study was calculated using G*Power with a power of 0.90, an effect size of 0.52, and an alpha of 0.05 (28).

Procedures

The eligibility of 122 possible participants with chronic low back pain was reviewed. This study included 40 people with non-specific chronic low back pain. They were divided into 2 Groups using a simple random raffle: (a) the McKenzie Exercise Group; and (b) the Back School Exercise Group. During the initial visit, a researcher who is a physiotherapist guided the participants through each type of exercise correctly. For 4 weeks the participants were required to do an exercise treatment at home. The physiotherapist met with the participants once a week for 4 weeks to ensure that they were doing the exercises properly. The researcher also conducted 3 weekly phone follow-ups. Before and after the 4-week exercise intervention, outcome variables including the pain scale, pressure pain threshold (PPT), back flexibility, range of motion of the lumbar spine, and disability were measured.

McKenzie Exercises Group

The McKenzie exercises prescribed for the participants in the present study were modified from the 2013 Garcia et al. study (1). The exercises consisted of trunk flexion when lying down, sitting, and standing, as well as trunk extension when lying down, standing, and standing with support from the upper arms. Each exercise position was repeated 10 times every set, 3 sets per treatment, and 1 treatment per day that lasted approximately 45 minutes. Also, the researcher suggested to the participants the proper posture for work and lifting.

Back School Exercises Group

The back school exercises used in the present study were modified from the Garcia et al. (1) study, which included diaphragmatic breathing, stretching of the erector spine muscles, stretching of the posterior lower-limb muscles with a towel in the supine position, stretching of the anterior hip muscle in the side-lying position, kinesthetic training (anterior and posterior pelvic tilting), and abdominal muscle strengthening. The strengthening of the abdominal muscles began by crook reclining with both arms flat, elevating the head and flexing the body while inhaling, and then straightening one leg at a 45-degree angle while flexing another leg and bringing it close to the chest while exhaling. Participants alternated between both legs. Each exercise motion was carried out 10 times every set, 3 sets per treatment, once per day, for an average of 45 minutes (1). Furthermore, the researcher suggested the proper posture

for work and lifting as well as educating the participants about the pathology, causes, and prevention of back pain.

Data Collection

The demographic and clinical characteristics of the participants were collected before the intervention. This data included age, weight, height, body mass index (BMI), educational status, pain scale, duration of pain, pain medication used, and the direction of pain. The outcome variables were collected at baseline and after the 4-week intervention period. For the sake of reiteration, outcomes included the pain scale or numerical pain rating scale (NPRS), pressure pain threshold (PPT), back flexibility, lumbar range of motion, and disability.

Outcome Variables Measurement

Numeric Pain Rating Scale (NPRS)

Through an interview, the lower back pain perception of each participant was evaluated. The 0 to 10 points Numerical Pain Rating Scale (NPRS) is the tool used to measure pain. 0 represents no pain, 0 to 3 suggests mild pain, 4 to 6 indicates moderate pain, 7 to 10 indicates severe pain, and 10 denotes the worst pain (1)

Pressure Pain Threshold (PPT)

The pressure pain threshold is the lowest pressure that generates pain in deep tissue. It is employed in experimental and medical research to assess the sensitivity of deep muscle tissue. The test determines the amount of pressure over a specific area at which a continually growing non-painful pressure stimulus transforms into a painful pressure sensation. Previous studies have suggested that those with low back pain may have a lower threshold for pain under pressure than healthy individuals (43). Therefore, an assessment of the pressure pain threshold with the digital pressure algometer (JTEC medical algometer) of non-specific chronic low back pain patients was used in this study. The participant was laid out prone and allowed to relax before the researcher located the lower back discomfort region on paravertebral muscle. Once the participant experienced a transition from pressure to a painful sensation, the researcher measured the pressure at the location of the most sensitive pain spots, stopped the test, and recorded the result. The average value in kilograms per square centimeter was determined after this method was conducted three times (43).

Back Flexibility

Back flexibility was evaluated by the sit-and-reach test using a trunk flex-meter. Participants performed long sits with straight knees and feet together to the wall of the flex-meter. The participants moved their arms forward, both hands above the flex-meter, and their trunk forward, bending until they reached their limit motion, which they held for 2 seconds. The researcher took a measurement from the zero scales to the tip of the middle finger. The subject was tested twice, and the subject with the highest centimeter (cm) score was picked. Tests to measure back flexibility had an accuracy of 1.00 and a confidence value of 0.96 (42).

Range of Motion of Lumbar Spine

The range of motion of the lumbar spine, including lumbar flexion, lumbar extension, and right and left lumbar lateral flexion was assessed using a fluid inclinometer.

1. Lumbar Flexion

The participants started in a standing position with their backs straight and their feet spaced equally apart from their shoulder joints. In this study, a double inclinometer was used, and the spinous process of S2 served as the reference point for placing it. The inclinometer was subsequently placed 15 centimeters above the spinous process of S2, with the dial turned to zero (set zero). The researcher then instructed the participants to stretch their backs and read the value. Readings from both inclinometers were taken by subtracting the result of the lower reference point from the value of the upper reference point. For healthy people, the reference range for this angle was 55 to 60 degrees (29).

2. Lumbar Extension

The starting position of the participant and reference point for the inclinometer are the same for the lumbar flexion. However, for the lumbar extension, the researcher told the participants to extend their backs and take the readings of both inclinometers by taking the value from the upper reference point, deleting the lower reference point, and recording the result. For healthy people, the reference range for this direction was 19 to 30 degrees (29).

3. Right and Left Lumbar Lateral Flexion

The participants began in the same position and used the same reference points for the lumbar flexion and extension. This evaluation employed two inclinometers. The participants were instructed to tilt to the right and left while the researcher read the values from both inclinometers. The range was calculated by subtracting the value from the upper reference point from the value from the lower reference point and then recording the result. For healthy individuals, the reference range for this orientation was 30 to 35 degrees (29).

Disability

Disability is assessed using the Thai version of the Roland-Morris Disability Questionnaire (RMDQ). A total of 24 questions are asked in this questionnaire on back pain disabilities related to both physical and mental activities using the yes-or-no format. All "yes" answers lead to a point. This questionnaire has a maximum 24-point score. A high score means that people with back pain may find it more difficult than usual to accomplish several daily tasks, which may lead to disability. The Cronbach's alpha value varied from 0.71 to 0.93, indicating that it was reliable for assessing functional impairment in Thai patients with low back pain (40).

Statistical Analyses

All data were presented as mean ± SD and analyzed using the SPSS version 23. The Shapiro-Wilk Test was used to examine the normal distribution of the outcome variables. In the case of normal distributions, a parametric test; dependent and independent student *t*-tests were employed to examine the mean difference within and between the Groups, respectively. Analyses of outcome variables not normally distributed within and between the Groups were carried out using the Mann-Whitney U Test and the Wilcoxon Signed-Rank Test. A P-value of less than 0.05 was set as the level of statistical significance.

RESULTS

The eligibility of 122 possible participants with chronic low back pain was reviewed. Only 40 people were included in the study (male 6, female 34) and were randomly assigned to 1 of 2 Groups: McKenzie Exercises or Back School Exercises, each with 20 participants. Table 1 presents information about the participants' demographic and clinical features. The data revealed no statistically significant differences between the 2 Groups (P>0.05).

Table 1. Demographic and Clinical Characteristics of the Participants.

Variables	McKenzie Exercises (n = 20)	Back School Exercises (n = 20)	P-value
Sex			
Female	16 (80%)	18 (90%)	-
Male	4 (20%)	2 (10%)	-
Age (y)	52.55 ± 8.20	56.90 ± 7.22	0.083
Weight (kg)	56.85 ± 9.33	60.30 ± 12.21	0.985
Height (cm)	156.05 ± 4.96	156.45 ± 8.04	0.851
BMI ($kg \cdot m^{-2}$)	23.33 ± 3.52	24.91 ± 4.28	0.211
Education Status (y)	8.45 ± 5.78	7.15 ± 4.48	0.432
NPRS (0-10 cm)	6.10 ± 1.17	5.75 ± 0.97	0.308
Duration of Pain (m)	38.80 ± 35.86	41.75 ± 52.66	0.837
Pain Medication is Used	8 (40%)	7 (35%)	-
Direction of Pain			
Lumbar Flexion	10 (50%)	10 (50%)	-
Lumbar Extension	7 (35%)	7 (35%)	-
Right and Left Lumbar Lateral Flexion	1 (5%)	1 (5%)	-
Right and Left Lumbar Lateral Extension	2 (10%)	2 (10%)	-

Categorical variables are expressed as number (%), continuous variables are expressed as mean ± SD (n = 20/group). Abbreviation: **kg** = Kilogram, **cm^2** = Square Centimeter, **y** = Year, **cm** = Centimeters, **NPRS** = Numeric Pain Rating Scale, **m** = Month

The effects of home-based McKenzie Exercises and Back School Exercises on outcome variables are presented in Table 2. A 4-week intervention was compared to baseline, the numeric pain rating scale (NPRS), pressure pain threshold (PPT), back flexibility, and disability improved in both Groups. Additionally, the McKenzie Exercises Group's lumbar range of motion significantly increased in all directions except for right lumbar lateral flexion (the ROM for this direction is trending to increase). However, there was no significant difference in the lumbar range of motion in the Back School Exercises Group.

Table 2. The Mean Outcome Variables were Compared at Baseline and After a 4-Week Period in Each Group.

Group	Outcome Variables	Baseline	After 4-Weeks	P-value
McKenzie Exercises Group (n = 20)	**1. NPRS** (0-10 cm)	6.10 ± 1.17	4.60 ± 1.60***	<0.001
	2. PPT (kg·cm^{-2})	12.72 ± 10.75	15.87 ± 9.94***	<0.001
	3. Back flexibility (cm)	5.37 ± 7.78	10.06 ± 5.84***	<0.001
	4. ROM of Lumbar (◦)			
	ROM of Lumbar Flexion (◦)	69.25 ± 16.72	75.30 ± 9.94*	0.036
	ROM of Lumbar Extension (◦)	12.55 ± 5.90	17.05 ± 5.84**	0.002
	Right Lumbar Lateral Flexion (◦)	24.45 ± 6.40	26.45 ± 4.60	0.082
	Left Lumbar Lateral Flexion (◦)	23.00 ± 6.86	27.05 ± 4.74***	<0.001
	5. Disability (0-24 score)	9.70 ± 5.19	6.45 ± 4.16***	<0.001
Back School Exercises Group (n = 20)	**1. NPRS** (0-10 cm)	5.75 ± 0.97	4.30 ± 0.92***	<0.001
	2. PPT (kg·cm^{-2})	11.56 ± 3.37	13.05 ± 3.63***	<0.001
	3. Back Flexibility (cm)	8.94 ± 8.83	9.92 ± 8.50***	0.001
	4. ROM of Lumbar			
	ROM of Lumbar Flexion (◦)	72.25 ± 16.42	80.15 ±14.34	0.122
	ROM of Lumbar Extension (◦)	13.75 ± 6.25	14.20 ± 6.05	0.449
	Right Lumbar Lateral Flexion (◦)	22.85 ± 5.16	23.10 ± 5.39	0.330
	Left Lumbar Lateral Flexion (◦)	23.35 ± 7.61	23.95 ± 7.43	0.104
	5. Disability (0-24 score)	8.00 ± 5.32	5.50 ± 4.67***	<0.001

Values are expressed as mean ± SD (n = 20/group). Data were analyzed using a paired *t*-test, *, **, *** P-value < 0.05,0.01, 0.001, respectively, compared to baseline. Abbreviation: **kg** = Kilogram, **cm²** = Square Centimeter, **cm** = **C**entimeters, **NPRS** = Numeric Pain Rating Scale, **PPT** = Pressure Pain Threshold, (◦) = Degree

Table 3 presents the outcome variables of the home-based McKenzie Exercises compared to the Back School Exercises. The range of motion of the lumbar spine in the right and left lateral flexion of the McKenzie Exercises Group was significantly higher than that of the Back School Exercises Group. Otherwise, there was no statistically significant difference between the Groups at baseline and after the 4-week intervention.

Table 3. The Mean Outcome Variables were Compared Between Groups.

Outcome Variables	Times	McKenzie Exercises Group (n = 20)	Back School Exercises Group (n = 20)	P-value
1. NPRS (0-10 cm)	Baseline	6.10 ± 1.17	5.75 ± 0.97	0.308
	4 weeks	4.60 ± 1.60	4.30 ± 0.92	0.474
2. PPT ($kg \cdot cm^{-2}$)	Baseline	12.72 ± 10.75	11.56 ± 3.37	0.648
	4 weeks	15.87 ± 9.94	13.05 ± 3.63	0.240
3. Back Flexibility (cm)	Baseline	5.37 ± 7.78	8.94 ± 8.83	0.183
	4 weeks	10.06 ± 5.84	9.92 ± 8.50	0.954
4. ROM of Lumbar				
ROM of Lumbar Flexion (°)	Baseline	69.25 ± 16.72	72.25 ± 16.42	0.570
	4 weeks	75.30 ± 9.94	80.15 ± 14.34	0.221
ROM of Lumbar Extension (°)	Baseline	12.55 ± 5.90	13.75 ± 6.25	0.536
	4 weeks	17.05 ± 5.84	14.20 ± 6.05	0.138
Right Lumbar Lateral Flexion (°)	Baseline	24.45 ± 6.40	22.85 ± 5.16	0.389
	4 weeks	26.45 ± 4.60	23.10 ± 5.39*	0.041
Left Lumbar Lateral Flexion (°)	Baseline	23.00 ± 6.86	23.35 ± 7.61	0.880
	4 weeks	27.05 ± 4.74	23.95 ± 7.43*	0.048
5. Disability (0-24 score)	Baseline	9.70 ± 5.19	8.00 ± 5.32	0.313
	4 weeks	6.45 ± 4.16	5.50 ± 4.67	0.501

Values are expressed as mean ± SD (n = 20/group). Data were analyzed using independent student *t*-test, *, **, *** P-value < 0.05, 0.01, 0.001, respectively, compared between groups. Abbreviation: **kg** = Kilogram, **cm** = Centimeters, **NPRS** = Numeric Pain Rating Scale, **PPT** = Pressure Pain Threshold, (◦) = Degree

DISCUSSION

In the present study, patients with non-specific chronic low back pain who reside in the Muang Phayao district, Phayao province, Thailand were evaluated using a pain scale, pressure pain threshold, range of motion of the lumbar spine, and disability. The benefits of home-based McKenzie Exercises and Back School Exercises were compared. The results within the 2 Groups showed that after 4 weeks the McKenzie Exercise Group had a

substantial improvement in all directions except right lumbar lateral flexion, which tended to rise. In contrast, after 4 weeks of training, there was no significant change in the lumbar ROM in the Back School Exercises Group. However, when the 2 Groups were compared, there was no significant difference except for the direction of right and left lumbar lateral flexion in the McKenzie Exercise Group, which had much better ROM than the Back School Exercises Group.

McKenzie Exercises

The improvement in the pain scale, pressure pain threshold, and level of disability in the McKenzie Exercise Group corresponds to the previous findings reported by Dhrubaprasad et al. in 2018. They also showed that using McKenzie Exercises for 4 to 8 weeks produced superior outcomes compared to conventional exercises (7). In addition, our findings aligned with Alhakami's and colleagues' systematic review (3). They proposed that the McKenzie exercises could help individuals with non-specific, persistent low back pain by decreasing their pain and functional disability. Previous studies demonstrated that McKenzie Exercise can reduce pain in middle-aged women with back pain, increase spine flexibility, and alleviate pain in low back pain patients (11,22).

In addition, it was found that the McKenzie method decreased pain in the short term, while the disability measures determined that the McKenzie method is better at enhancing function in the long term (12). The possible mechanism is that McKenzie exercises enhance muscular strength around the lumbar spine and abdominal cavity that serve primarily to stabilize the spine and balance the pelvis, thus resulting in pain control and disability improvement (22). In contrast, previous studies revealed that the McKenzie method has a poor effect on reducing pain in patients with non-specific low back pain, which is only 0.44 times compared to other interventions or no intervention (2,38). However, data on the effect of McKenzie exercises on back flexibility and ROM specific to the lumbar spine in non-specific chronic back pain is currently scarce. Nowadays, the results about the effect of McKenzie exercise are still conflicting, so we are interested in continuing this study to draw a clear conclusion.

Back School Exercises

Back school exercises are non-pharmacological therapies that are frequently utilized, particularly in the occupational health setting to treat or prevent low back pain. They include both exercise and educational components. However, previous studies do not support their usage for treatment and prevention of low back pain. Nonetheless, future varieties of back school exercises may have different outcomes and will need to be examined (31). Our results show that following a 4-week intervention of back school exercises, the pain scale, PPT, back flexibility, and disability can be improved.

A similar study conducted in 2019 by Noisuwan et al. (32) revealed that receiving back education programs for 6 and 12 weeks helped lessen low back pain and enhanced functional status among rice farmers. Additionally, the back school group in the study of Noisuwan and colleagues (32) was able to reduce pain and improve functional status better than the control group. Sahin et al. (30) also found that after 3 months of treatment, pain, and disability in patients with chronic low back pain was improved. Similarly, the Andrade et al. (36) study indicated that after 16 weeks of treatment, the participants' levels of pain severity, functional impairment, and spine mobility were improved. Additionally, among patients with non-specific persistent low back pain, these measurements were improved in comparison to

the control group at 4 and 16 weeks. Although our study demonstrated positive results, the short duration (4 weeks of exercise) may be due to weekly follow-ups at home to ensure that subjects did the exercise.

McKenzie Exercises Versus Back School Exercises

McKenzie Exercises and Back School Exercises are common treatments for patients suffering from chronic low back pain, particularly non-specific low back pain. The protocol patterns for these two exercises differed. However, studies comparing the effects of both exercises are still limited. Therefore, we compared the effects of a 4-week home-based McKenzie Exercises to the Back School Exercises on the pain scale, pressure pain threshold, lumbar range of motion, and disability in individuals with non-specific chronic low back pain. We found that McKenzie Exercises could increase the lumbar region's range of motion in the direction of right and left lumbar lateral flexion.

Our findings differ from those of a previous study by Garcia et al. (2003). They found the McKenzie Exercises were marginally superior to the Back School Exercises for reducing disability in participants with chronic low back pain (1). However, they acknowledged that it was impossible to supervise the home exercise program, and that the therapists and participants were not blinded. In our study, patients participating in a home exercise program had their performance evaluated once a week, and phone follow-up was done 3 times a week. Participants aged 30 to 65 should be able to follow the program. The participants were likewise blinded to the type of exercise they were asked to do. Our findings are like those of prior research, which found that the McKenzie exercises had no better effect on pain-induced disability than other exercises. Thus, the effects of the McKenzie Exercises and the Back School Exercises were comparable regarding disability. This study demonstrated that the McKenzie Exercises were more effective than the Back School Exercises at increasing the ROM of the lumbar region in the direction of right and left lumbar lateral flexion. This outcome may occur because McKenzie exercises generate lateral shift and spinal rotation, which promote lateral flexion (35). The limitation of our research is not blind to the therapist. Longer-term outcomes should also be investigated.

CONCLUSIONS

A 4-week home base McKenzie Exercise program and a Back School Exercise program reduced the pain scale, improved the pressure pain threshold, and improved flexibility and disability. Interestingly, the McKenzie Exercises had a greater improvement in ROM of the lumbar spine than the Back School Exercises.

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