ORIGINAL ARTICLE

Comparison of Lumbar Stabilization Exercise and Flexibility Exercise on Lumbal Flexibility in Chronic Mechanical Lower Back Pain

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ABSTRACT

Background: Flexibility plays an important role in increasing a person's capacity to perform daily activities. Decreased lumbar spine flexibility is both a cause and a consequence of low back pain. Lumbar stabilization exercise and flexibility exercise are options that can be given for chronic mechanical low back pain.

Objective: In this study, motorcycle riders with persistent mechanical low back pain were compared to the effects of lumbar stabilization exercise (LSE) and flexibility exercise (FE) on lumbar flexibility.

Methods: 26 subjects who fulfilled the inclusion and exclusion criteria were randomly divided into the lumbar stabilization exercise group (n = 13) and the flexibility exercise group (n = 13). Each group was exercised five times a week for six weeks at home. Measurement of lumbar flexibility was performed using the modified-modified schober test and sit and reach test at baseline before the intervention and 6 weeks after the intervention.

Results: Comparison of the delta value of the modified-modified schober test (p = 0.029) and the delta value of the sit and reach test (p = 0.025) between groups showed significant differences in the lumbar stabilization exercise group compared to the flexibility exercise group.

Conclusion: The intervention of LSE and FE increased lumbar flexibility. However, the lumbar stabilization exercise intervention was better at increasing lumbar flexibility than flexibility exercise for online motorcycle drivers with chronic mechanical low back pain.

Keywords: Lumbar stabilization exercise, flexibility exercise, chronic mechanical low back

ABSTRAK

Latar Belakang: Fleksibilitas berperan penting dalam meningkatkan kapasitas seseorang untuk melakukan aktivitas sehari-hari. Berkurangnya fleksibilitas tulang belakang lumbal merupakan penyebab sekaligus konsekuensi dari nyeri punggung bawah. *Lumbar stabilization exercise* dan *flexibility exercise* merupakan pilihan latihan yang dapat diberikan pada nyeri punggung bawah mekanik kronik.

Tujuan: Dalam penelitian ini, pengendara sepeda motor dengan nyeri punggung bawah mekanik persisten, dibandingkan efek dari latihan stabilisasi lumbal (LSE) dan latihan fleksibilitas (FE) terhadap fleksibilitas lumbal.

Metode: Dua puluh enam subjek yang memenuhi kriteria inklusi dan eksklusi secara acak dikelompokkan ke kelompok LSE (n = 13) dan kelompok FE (n = 13). Setiap kelompok menyelesaikan *home program* lima kali seminggu selama enam minggu. Fleksibilitas lumbal diukur menggunakan *modified-modified schober test* dan *sit and reach test* pada awal dan enam minggu setelah perlakuan.

Hasil: Perbandingan delta nilai *modified-modified schober test* (p = 0,029) dan delta nilai *sit and reach test* (p = 0,025) antar kelompok menunjukkan perbedaan signifikan pada kelompok *lumbar stabilization exercise* dibandingkan dengan kelompok *flexibility exercise*.

Kesimpulan: Pemberian intervensi *lumbar stabilization exercise* maupun *flexibility exercise* meningkatkan fleksibilitas lumbal. Akan tetapi intervensi *lumbar stabilization exercise* memberikan pengaruh yang lebih baik terhadap peningkatan fleksibilitas lumbal dibandingkan *flexibility exercise* pada pengendara sepeda motor dengan nyeri punggung bawah mekanik persisten.

Kata kunci: *Lumbar stabilization exercise, flexibility exercise,* nyeri punggung bawah mekanik kronik, fleksibilitas lumbal.

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INTRODUCTION

Low back pain (LBP) is defined as pain, muscle tension, or stiffness in the muscles located in the back below the last rib and above the inferior gluteal fold, with or without radiating pain to the legs. LBP is a common musculoskeletal disorder in adults, about 50–80% of adults have experienced it.[1,2,3,4] Approximately 80-90% of chronic LBP is mechanical low back pain most likely caused by muscle tension.[1,3] Walker's study showed that the prevalence of LBP was around 12-33%.[5]

Indonesia is the 3rd largest country with motorbike drivers. Data from the Central

Statistics Agency (2018) shows the number of motorcycles in Indonesia reaches around 120 million. The number of online taxi motorcycle drivers in Indonesia is estimated at 2-2.5 million drivers.[6]

In M. Hafzi's study of motorbike drivers, it was found that LBP was 62.8%.[7] Akinbo et al reported the prevalence of LBP among commercial motorbike drivers in Lagos, Nigeria was 59.3%. Tamrin et al reported a 60.4% prevalence of LBP among commercial motorcyclists in Malaysia. This report shows that commercial motorcycle drivers are at high risk of experiencing LBP.[8,9]

Flexibility plays an important role in increasing a person's daily capacity performance. According to the study's findings, decreased lumbar spine mobility in the flexion and extension directions was connected with increased pain severity.[10]

Flexibility, muscle power, and joint ROM are all restricted by lumbar instability. The degree of lumbar muscular weakening in the paraspinal and multifidus muscles will increase in certain patients with LBP who restrict trunk movement to lessen discomfort in the lumbosacral area. These modifications will make the lumbar region more unstable and cause LBP to return more frequently. To increase lumbar stability, the abdominal muscles and spinal extensor muscles are crucial.

Due to diminished lumbar muscular strength, patients with LBP have decreased physical function and production activities. To treat LBP and improve daily living activities, LBP sufferers must engage in exercises that develop muscular strength and flexibility. [11]

Lumbar stabilization exercises (LSE) are exercises with components of stretching and strengthening core muscles. Because the intensity of pain, strength and endurance of trunk muscles, posture and stability of the lumbar region, affected lumbar flexibility, the LSE mechanism which has a stretching component and exercise with the principles of neuromuscular control, will increase muscle strength, and muscle endurance by maintaining dynamic spine posture and stability. The trunk will increase lumbar flexibility in chronic LBP.[12,13,14] In patients with persistent LBP, LSE considerably improved lumbar muscular strength and flexibility, according to Kwang et al.[15]

Flexibility exercise is a muscle stretching exercise that increases lumbar flexibility.[16] Masharawi's study shows that lumbopelvic flexibility exercise in a non-weight-bearing position provides increased lumbar flexibility and stability.[16,17]

SUBJECT AND METHOD

Twenty-six motorcycle drivers online with CLBP located in Semarang were recruited for this study. Subjects were randomly assigned to the lumbar stabilization exercise/LSE group (n = 13) or the flexibility exercise/FE group (n = 13). Participants who had neurological disorders, pathological conditions in the lumbar region, and a history of surgery in the abdominal or lumbar region were excluded.

The LSE group received a lumbar stabilization exercise home program intervention and the FE group received a home flexibility exercise program intervention for 30 minutes once a day, 5 times a week for 6 consecutive weeks.

Lumbar flexion flexibility was measured using the sit and reach test and lumbar extension flexibility was measured using the modified-modified schober test. Measurements were taken at the beginning, before, and at the end of the 6th week of treatment.

Using SPSS, a statistical analysis was carried out. Paired t-tests were used to analyze differences within groups, while independent

t-tests were employed to examine differences in dependent variables between groups. P < 0.05 is the probability level.

RESULT

Table 1 displays the participant baseline characteristics. The baseline values for the two groups did not differ significantly.

Table 1: Research Subject Characteristics

Variable	Group		p
	LSE	FE	
Age (tahun)	31,38 ± 5,67	32,08 ± 5,47	0,754§
BMI	23,02 ± 1,66	23,43 ± 1,46	0,457‡
Distance (km)	75,92 ± 23,98	73,85 ± 19,84	0,812§
VAS (mm)	69,69 ± 4,09	70,62 ± 4,45	0,587§
Lumbar extensor muscle strength	33,88 ± 10,26	32,56 ± 9,31	0,734§
IPAQ			
Moderate	11 (84,6%)	11 (84,6%)	1,000¥
High	2 (15,4%)	2 (15,4%)	

Description: * Significant (p < 0,05); ¥ Chi square; § Independent t; ‡ Mann whitney
BMI: Body Mass Index; VAS: *Visual Analog Scale*; IPAQ: *International Physical Activity Questionnaire*

Table 2. Comparison of MMST between LSE and FE. Groups

MMST	Kelompok		p
	LSE	FE	
Pre-intervention	1,20 ± 0,22	1,21 ± 0,22	0,929§
Post-intervention	2,19 ± 0,61	1,81 ± 0,53	0,099§
p	<0,001¶*	<0,001¶*	
Delta	0,99 ± 0,53	0,60 ± 0,39	0,029‡*

Description: * Significant (p < 0,05); § Independent t; ‡ Mann whitney; ¶ Paired t;
† Wilcoxon
MMST: *Modified-modified Schober test*; LSE: *Lumbar stabilization exercise*; FE: *Flexibility exercise*

Table 2 shows that the mean value of the MMST at the end of the study (6 weeks post-intervention) was greater than at the beginning of the study, there was a significant difference with p-value < 0.001 in both the FE group and the LSE Group., but there was no significant difference between the two groups with p-value = 0.099.

At the end of the study (6 weeks post-intervention), the mean change (delta) of the MMST in the LSE group was greater than the mean value of the MMST in the FE group, and there was a significant difference in the mean change between the two groups. group in pre-intervention and 6 weeks post-intervention with p-value = 0.029.

Table 3. Comparison of SRS between LSE and FE Groups

SRT	Kelompok		p
	LSE	FE	
Pre-intervention	23,27 ± 5,58	22,42 ± 5,41	0,698§
Post-intervention	30,12 ± 8,26	26,88 ± 7,64	0,311§
p	<0,001¶*	0,001¶*	

Delta	6,85 ± 4,15	4,46 ± 3,67	0,025‡*

Description: * Significant (p < 0,05); § Independent t; ‡ Mann whitney; ¶ Paired t
SRT: *Sit and reach test*; LSE: *Lumbar stabilization exercise*; FE: *Flexibility exercise*

In Table 3, it can be seen that the average value of the sit and reach test at the end of the study (6 weeks post-intervention) was greater than at the beginning of the study, both in the LSE group and the FE group; there was a significant difference with a p-value < 0.001 in the LSE group and a p-value = 0.001 in the FE group, but there was no significant difference between the two groups with a p-value = 0.311.

Six weeks after the intervention, the average change (delta) of the sit and reach test scores in the LSE group was greater than the sit and reach test scores in the FE group, and a significant difference was found in the mean changes between the two groups in the exercise group. pre-intervention and 6 weeks post-intervention with p-value = 0.025.

DISCUSSION

In the flexibility exercise group, there was a significant increase in the results of MMST and SRT at the end of the study compared to the beginning. In the current study, the FE group received static stretching exercises for the abdominal muscles, quadriceps, hamstrings, tensor fascia lata, piriformis, and quadratus lumborum muscles that play a role in lumbar flexibility.[14] Following the literature, flexibility exercise will increase the flexibility of the lower back through the mechanism of releasing the shortening of the tissue around the lower back. It is also inextricably linked to the neurological system's reaction to stretching. According to Helda et al., afferent activity is inhibited by protracted muscle spindle stretching, which lowers muscular tension. According to Fowles et al., prolonged static stretching triggers a reaction in the nociceptors and Golgi tendon organs (GTO), which reduces muscular tension and increases flexibility.[18]

Morse et al reported that the mechanism of acute changes after flexibility exercise is related to modifications in the suppleness of muscles and connective tissue. Similarly, Teramoto et al observed that the tendons also extended with flexibility exercise, while Cramer et al demonstrated how flexibility exercise caused the sarcomere of muscle fibers to stretch.[18]

In the lumbar stabilization exercise group, there was a significant increase in MMST and SRT results at the end of the study compared to the beginning. This is consistent with the study of Kwang et al who reported that lumbar stabilization exercise significantly increased the strength and flexibility of the lumbar muscles in patients with chronic LBP.[15] Arsalan et al in their study also reported the same results, a significant increase in the range of motion of the back extension joints in patients receiving stabilization exercises.[19]

The lumbar stabilization exercise given in the current study consists of two training components, core muscle stretching exercises and core muscle isometric exercises. Lumbar stabilization exercise activates not only the superficial paraspinal muscles / global muscles (spine erector muscles), but also deep muscles / local muscles (multifidus muscles, rotator muscles, interspinal muscles, and intertransverse muscles) simultaneously, including the transversus abdominis muscles. , rectus abdominis, erector spine, multifidus, internal oblique abdominal, and quadratus lumborum. The deep paraspinal muscles / local muscles are postural muscles that have more type 1 muscle fibers and play a role in maintaining postural stability of the lumbar joint when performing movements in the lumbar area.

These muscles are rich in muscle spindles (Nitz and Peck) and have been shown to function as proprioceptive joints in the lumbar spine, (McGill) thus playing an important role in controlling posture.[20]

Superficial paraspinal muscles / global muscles which have longer muscle fibers and are attached to the pelvis to the thorax play a role in carrying out dynamic lumbar movements. The close association of the abdominal muscles with the paraspinal muscles contributes to trunk stability, postural support, and spinal mobility. Lumbar stabilization exercise is an exercise that has a mechanism to increase neuromuscular control, co-contraction core muscle activity, stretching, strength, and muscle endurance exercises to maintain dynamic spinal movement, flexibility, and lumbar stability.[21,22]

Endurance core muscle correlates with lumbar flexibility. Biering-Sorensen identified a decrease in back extensor muscle endurance causing muscle fatigue.[23] Excessive use of muscle work can result in muscle fatigue and lack of mobility resulting in muscle shortening.[24] Decreased muscle endurance due to high levels of metabolite accumulation will cause prolonged muscle spasms and will cause vasoconstriction of blood vessels which results in ischemia and causes muscle tightness. In addition, this decrease in back extensor muscle endurance causes a longer muscle response time, impaired muscle coordination, imbalance, and muscle weakness, causing a decrease in the ability to tolerate loads. Uncontrolled excessive loads can cause tension in the muscles, facet joints, and passive structures of the lumbar spine that affect lumbar flexibility.[23,25]

Instability in the lower back is linked to weak core muscles, which will make the lumbar spine less flexible. Lumbar flexibility is also impacted by variations in motor control patterns, such as poor postural control and dysfunctional muscle recruitment patterns.[11]

The increase in MMST and SRT results in the LSE group was better than the FE group because the lumbar stabilization exercise intervention had a core muscle stretching exercise component that was given by the maximum exercise capacity of each individual through increasing the level of exercise every week which was not possessed by the flexibility exercise intervention. Lumbar stabilization exercise as an isometric core muscle exercise improves neuromuscular control and co-contraction activity so that the muscle contraction and the work of agonist and antagonist muscles will be balanced. Achieving a balance of abdominal muscle contraction and lumbar muscle function during lumbar mobilization and functional activities in the lumbar spine will facilitate control of lumbar movements. Lumbar stabilization exercise will increase muscle endurance to maintain dynamic spinal movement and lumbar flexibility. All of these mechanisms are not owned by flexibility exercises in increasing lumbar flexibility.[26]

CONCLUSION

The flexibility of lumbar extension and flexion is improved by performing LSE and FE. This study also shows that the lumbar stabilization exercise intervention has a better effect on increasing lumbar flexibility than flexibility exercise on online motorcycle taxi drivers with chronic mechanical low back pain.

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