

Effectiveness of Quadratus Lumborum and Iliopsoas Strengthening Exercises Vs Conventional Physiotherapy Management in Subjects with Acute Unilateral Lumbar Strain

Ms. Shivanjali Mahadev Jadhav¹, Dr. Amrutkuvar Rayjade²

¹B. P. Th, D. Y. Patil College of Physiotherapy.

D. Y. Patil Education Society (Deemed to be University), Kolhapur.

²Principal, Professor, Head of Department of Orthopaedic Manual Therapy

D.Y. Patil College of Physiotherapy.

D.Y. Patil Education Society (Deemed to be University), Kolhapur.

Corresponding Author-Ms. Shivanjali Mahadev Jadhav

Abstract:- Background-Unilateral lower back pain results from lifting heavy objects and abruptly twisting the body in an awkward manner. Continues poor posture of the Quadratus Lumborum and Iliopsoas can result in unilateral lumbar pain. Aim of the study is to check the effectiveness of Quadratus Lumborum and Iliopsoas strengthening exercises vs Conventional Physiotherapy management in subjects with acute unilateral lumbar strain.

Methods-30 subjects presented with Unilateral Low Back Pain who meet the inclusion criteria were included in the study. The pre and post assessment and evaluation were done using Numerical Pain Rating Scale, Range of Motion, Manual Muscle Testing of Quadratus Lumborum and Iliopsoas and Modified Oswestry Disability Index. The data collection includes age, gender, occupation, site of pain and past medical history. Subjects were divided into two groups : Controlled and experimental group. In Group A (Controlled group): Electrical modalities (SWD, TENS) along with conventional lumbar stabilization exercises were given and in Group B (Experimental group) : Electrical modalities (SWD, TENS) along with Strengthening exercises for Quadratus Lumborum and Iliopsoas were given.

Results-Numerical Pain Rating Scale and Modified Oswestry Disability Index both shows indicated reduction in both the groups. The Manual muscle testing shows an improved grade in experimental group. However, the strengthening exercises of Quadratus Lumborum and Iliopsoas showed a significant reduction in pain, strength and disability.

Conclusion-The study's results suggest that there is significant effect of strengthening exercises of Quadratus Lumborum and Iliopsoas over conventional Physiotherapy Management in subjects with Acute Unilateral Lumbar Strain.

Keywords- Iliopsoas, Low Back Pain, Modified Oswestry Disability Scale, Quadratus Lumborum, Unilateral Lumbar Strain.

INTRODUCTION

Lifting heavy objects with too much force or abruptly twisting the body while bending down can result in lower back trauma, causing the lumbar muscles to contract forcefully and experience excessive strain.¹ This results in intense discomfort in the lower back and limited motion. Non-specific Low Back Pain is a state where there are no structural alterations involved, such as disc space narrowing, nerve compression, bone or joint damage, or musculoskeletal abnormalities like lordosis or scoliosis. In India, the prevalence of LBP in 2016 was 42.4%. LBP can be acute, sub-acute or chronic.² Straining while lifting objects or experiencing fatigue can often trigger lower back pain. This condition is more prevalent in females, while physical limitations are more common in older individuals compared to younger ones. According to systematic reviews of studies, weight of the load and the frequency of lifts elevate the risk.³ Non-Specific LBP presents with symptoms including pain alleviated by rest or lying down, absence of neurological and muscle contractions, muscle spasms, pain exacerbated by lumbar movements and exercise, but eased by changing positions.⁴

The muscles primarily responsible for providing support and stability to the low back are the Quadratus Lumborum and Iliopsoas. The most significant factor in low back pain is the involvement

of these muscles. When they become contracted due to any trauma, poor or altered posture, prolonged sitting, or stress, it can disrupt the normal biomechanics of the pelvis and lumbar, thoracic, and even cervical vertebrae, leading to back pain⁵ The Quadratus Lumborum muscle lies laterally to the lumbar spine, connecting the ilium to the twelfth rib and lumbar vertebrae. While it primarily causes lateral flexion, there's uncertainty regarding its role in extension. However, it's widely acknowledged as an important stabilizer of the lumbar spine.⁶ Often, the quadratus lumborum muscle compensates for weak muscles by taking over their functions. This muscle can extend the lower back when it contracts bilaterally, effectively picking up the slack⁷ The iliopsoas functions primarily as the primary hip flexor. Literature suggests that decreased hip motion contributes to lumbar pain and disability.^{8,9}

The effects of LBP on individuals and society, which include pain, disability, and the associated costs of diagnosis and treatment, emphasize the necessity of prevention and effective treatment. Physical factors, like decreased muscle strength and endurance, serve as prognostic indicators. The strength and endurance of the trunk muscles are vital in diminishing pain, improving stability, and preserving spinal function.¹⁰ A noticeable reduction in the strength and elongation of the iliopsoas muscle results in tension within it, contributing to non-specific lower back pain (LBP). Essential elements of lower back treatment include physical therapy, exercises to strengthen the muscles, and stretching.^{11,12}

Although interventions like pharmaceuticals and manual therapies can assist in managing pain and disabilities associated with long-term, non-specific lower back pain, there is currently no definitive treatment to cure it. Selective atrophy of the paraspinal muscles can occur, especially in patients with unilateral lower back pain, often displaying atrophy on the symptomatic or ipsilateral side. However, this specific atrophy may stem from force imbalances, where the inhibition of paraspinal muscles on the symptomatic side triggers compensatory hypertrophy of unaffected paraspinals.¹³

Study considered the treatment approach initially by relieving pain and then strengthening the Quadratus Lumborum and Iliopsoas muscles. Acute pain in the lumbar motion segment can trigger muscle responses that, if persistent, may change the patient's movement patterns, leading to continued strains on the lumbar

spine. In individuals experiencing low back pain, physiotherapy aims to eliminate pain, restore lost range of motion, improve function, and enhance overall quality of life.^{10,11,14} Ganesh Sundaram Subramanian et al mentions in article, Transcutaneous electrical nerve stimulation (TENS) is utilized as a therapeutic approach because of its non-invasive character, effectively easing both acute and chronic pain by affixing two or more electrical pads onto the skin. Two theories elucidate the mechanism behind TENS pain relief: the gate control theory and the stimulus-triggered release of endogenous endorphins.¹⁴

Shortwave diathermy (SWD) is a method of deep heating that is applied adequately to deliver warmth to the deep tissues. It has been utilized for therapeutic purposes, enhancing vasodilation to boost blood flow and improving the flexibility of connective tissue. This ultimately increases joint range and reduces joint stiffness.¹⁵ Due to the deep nature of the quadratus lumborum muscle and the deep heating capabilities of shortwave diathermy (SWD), SWD is administered over a hot pack to ensure adequate penetration and therapeutic effect on the muscle. There is a growing emphasis on exercises designed to preserve this stability.^{8,14}

The exercises included in the study for strengthening of Quadratus Lumborum and Iliopsoas are Side plank, trunk rotation using resistive band, isometric resistance to iliopsoas, eccentric resistance to iliopsoas and standing on bosu ball with straight leg. Engaging in side plank training activates the lateral oblique muscles and the quadratus lumborum (QL), allowing individuals to retrain their spine for improved alignment. Therefore, it serves as a highly effective exercise to address weaknesses in stability.^{16,17} The initial intensity and subsequent progressions were tailored to each individual subject. This was done to ensure that each participant engaged in sufficient activity.¹⁸ Whereas, isometric resistance to iliopsoas, eccentric resistance to iliopsoas and standing on bosu ball with straight leg were given to strengthen Iliopsoas muscle.

Ganesh Sundaram Subramanian concluded the study by stating that the results showed MET combined with TENS could effectively reduce pain intensity and improve disability.^{14,17} Priyanka Rishi et al. proposed a research hypothesis suggesting that individuals who underwent training with Muscle Energy Technique (MET) alongside a supervised exercise program would experience greater

improvement in pain and functional disability compared to those who only received the Muscle Energy Technique for chronic nonspecific low back pain.^{5,17}

The study is undertaken to check the effectiveness of Quadratus Lumborum and Iliopsoas strengthening exercises vs Conventional Physiotherapy management in subjects with acute unilateral lumbar strain.

The objectives are to plan exercises for Unilateral Lumbar Pain and to find effectiveness of strengthening exercise of unilateral Quadratus Lumborum and Iliopsoas over conventional Physiotherapy management in subjects with Acute Unilateral Lumbar Strain.

METHODOLOGY

Study Design: Experimental

Sample size: 30

Study population: 20 – 40 years

Intervention Duration: 2 weeks

Sampling Design: Convenience Sampling

Selection criteria :

Inclusion criteria:

1. Age 20 - 40 years
2. All genders
3. Subjects with Acute Unilateral Lumbar Strain
4. Subjects willing to participate
5. NPRS score between 4-7
6. Patients coming to Physiotherapy OPD; Both referred or non-referred

Exclusion criteria:

1. Any type of Pathological pain
2. Any recent spine surgery
3. Any spinal deformity
4. Use of analgesics

PROCEDURE

The study included individuals between the ages of 20 and 40, regardless of gender, who were experiencing Acute Unilateral Lumbar Strain and expressed willingness to participate. Specifically, participants with Numeric Pain Rating Scale (NPRS) scores falling within the range of 4 to 7 were eligible for inclusion. This criterion ensured a specific level of pain severity among the subjects. Moreover, the study welcomed both referred and non-referred patients attending the Physiotherapy Outpatient Department (OPD).

Participants who exhibited any form of pathological pain, recent spine surgery, spinal deformity, or were using analgesics were excluded from the study. This exclusion criteria aimed to establish a more homogeneous study group.

Patients were provided with an explanation of the study, and a data collection sheet was completed to gather demographic information, including name, age, and gender. This step ensured that essential demographic details were recorded accurately for each participant, facilitating proper documentation and analysis of the study data.

The subjects were assessed and evaluated using Range of motion of lumbar and hip movements, Manual muscle testing for Quadratus Lumborum and Iliopsoas, Numerical Pain Rating Scale and disability using Modified Oswestry Disability Index.

The study consisted of a control group and an experimental group. The control group received conventional physiotherapy management, while the experimental group performed strengthening exercises targeting the Quadratus Lumborum and Iliopsoas muscles. Both groups engaged in their respective interventions for one session every alternate day over a period of two weeks, totaling seven sessions.

Using convenience sampling, 30 subjects were divided into 15 in controlled group and 15 in experimental group'

1. Controlled group

SWD (Short Wave Diathermy) and TENS (Transcutaneous Electrical Stimulation) were given with following conventional lumbar exercises :

1. Static abdominals
2. Pelvic lifts
3. Pelvic bridging
4. Static Back
5. Cat and camel exercise

2. Experimental group

SWD (Short Wave Diathermy) and TENS (Transcutaneous Electrical Stimulation) were given with following with Quadratus Lumborum and Iliopsoas strengthening exercises:

1. Side plank
2. Trunk rotation using resistive band
3. Isometric resistance to Iliopsoas
4. Eccentric resistance to Iliopsoas
5. Standing on BOSU ball with a straight leg

The statistical analysis conducted in the study utilized appropriate biostatistical tools.

RESULTS

The research enrolled 30 participants, consisting of 13 males (43%) and 17 females (57%), all experiencing unilateral lumbar pain. Their ages varied between 20 and 40 years, with an average age of 26.73 (±6.05) years. The study excluded individuals who had undergone recent spine surgery, had spinal deformities, or had any other underlying pathology.

The exercise status of the participants was assessed, revealing that 13 individuals exercised daily or often, representing 43% of the total, while 17 individuals did not exercise daily, accounting for 57%. This data highlights the distribution of exercise habits among the study population, indicating that a significant portion engages in regular exercise while a slightly larger proportion does not.

The comparison of pain levels between Group A (control) and Group B (experimental) was assessed pre and post-treatment using the Numerical Pain Rating Scale (NPRS). Both groups showed a significant decrease in pain levels after treatment.

The p-values for the comparison of pain levels pre and post-treatment were 0.18 for rest and 0.44 for activity in Group B, indicating no significant difference.

These findings suggest that both conventional physiotherapy management (Group A) and Quadratus Lumborum and Iliopsoas strengthening exercises (Group B) were effective in reducing pain levels in individuals with acute unilateral lumbar pain. However, there was no statistically significant difference in pain reduction between the two treatment groups.

TABLE 1 : Comparison of Pain between Group A and Group B

			Group A			Group B			P value
			Mean	SD	P Value	Mean	SD	P Value	
NPRS	On rest	Pre	2.27	1.22	3.81E-07	2.00	1.07	2.04E-05	0.18
		Post	0.67	0.82		0.40	0.74		
	On activity	Pre	5.07	0.88	2.69E-10	5.13	1.06	1.65E-08	
		Post	2.20	1.01		2.13	1.41		

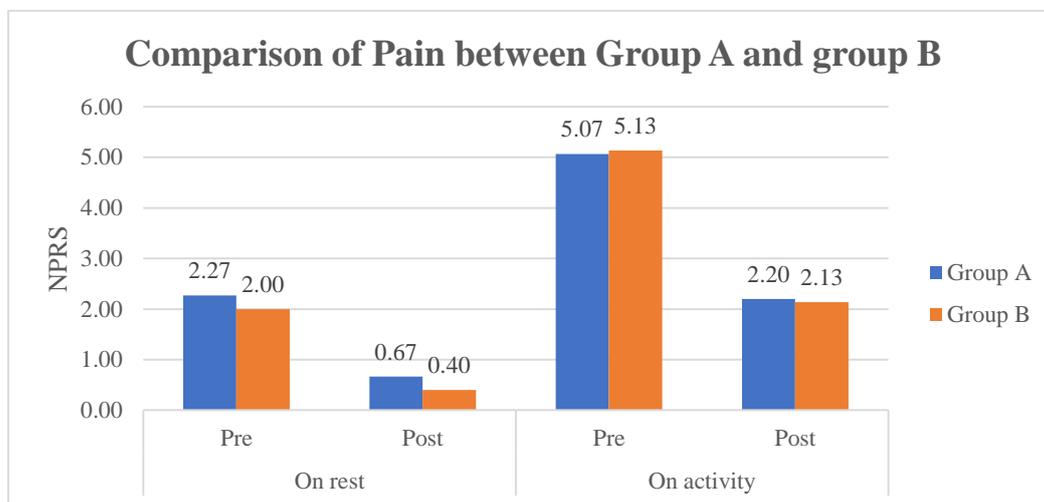
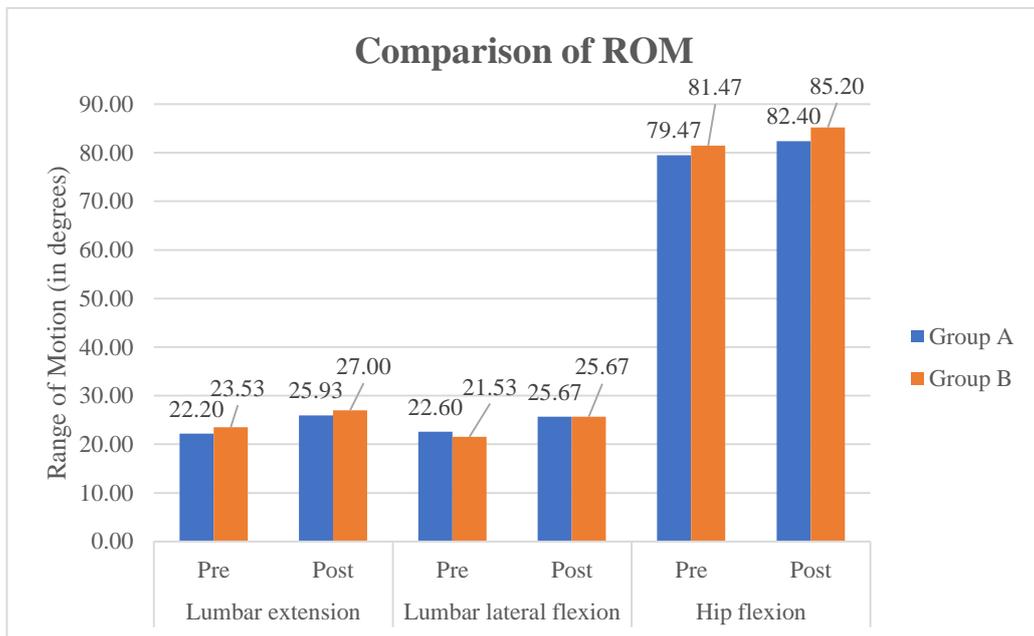


TABLE 2 : Comparison of ROM

			Group A			Group B			P value
			Mean	SD	P Value	Mean	SD	P Value	
ROM	Lumbar extension	Pre	22.20	3.82	2.8744E-05	23.53	2.29	7.01E-06	0.099
		Post	25.93	2.43		27.00	1.96		
	Lumbar lateral flexion	Pre	22.60	2.35	1.94E-07	21.53	2.33	3.39E-07	
		Post	25.67	2.97		25.67	2.19		

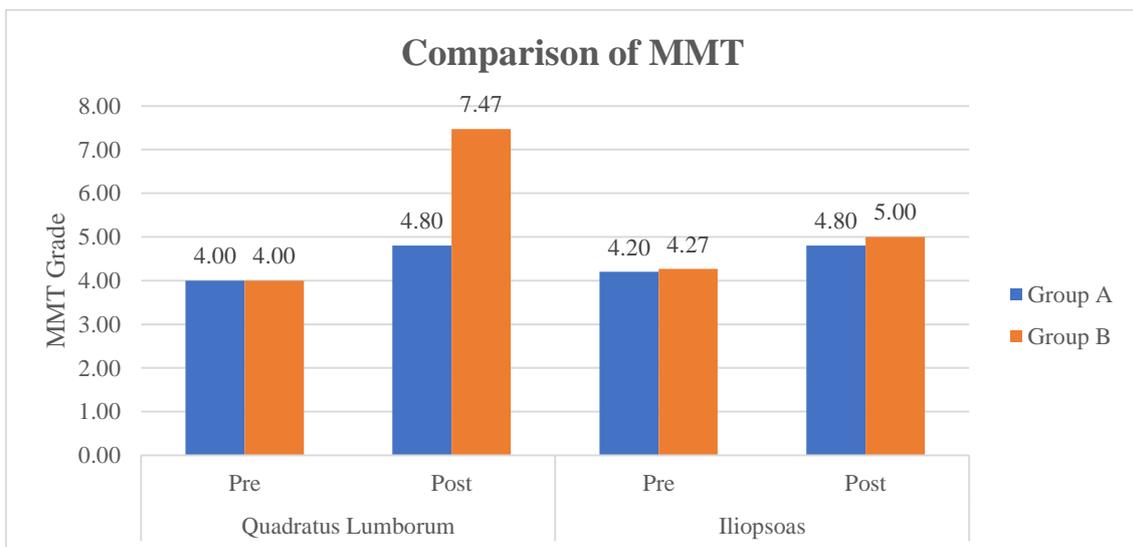
Hip flexion	Pre	79.47	4.14	0.0001627	81.47	2.88	4.81E-05	0.008
	Post	82.40	3.54		85.20	2.34		



The data indicates that the treatment or intervention had a statistically significant effect on hip flexion for Group A but did not have significant effects on lumbar extension or lateral flexion for either group.

TABLE 3: Comparison of MMT

MMT			Group A			Group B			P value
			Mean	SD	P Value	Mean	SD	P Value	
Quadratus Lumborum	Pre	4.00	0.00	0.0412	4.00	0.00	8.35E-08	2.7323E-05	
	Post	4.80	1.66		7.47	1.41			
Iliopsoas	Pre	4.20	0.41	0.0002	4.27	0.46	1.15E-05	0.036	
	Post	4.80	0.41		5.00	0.00			



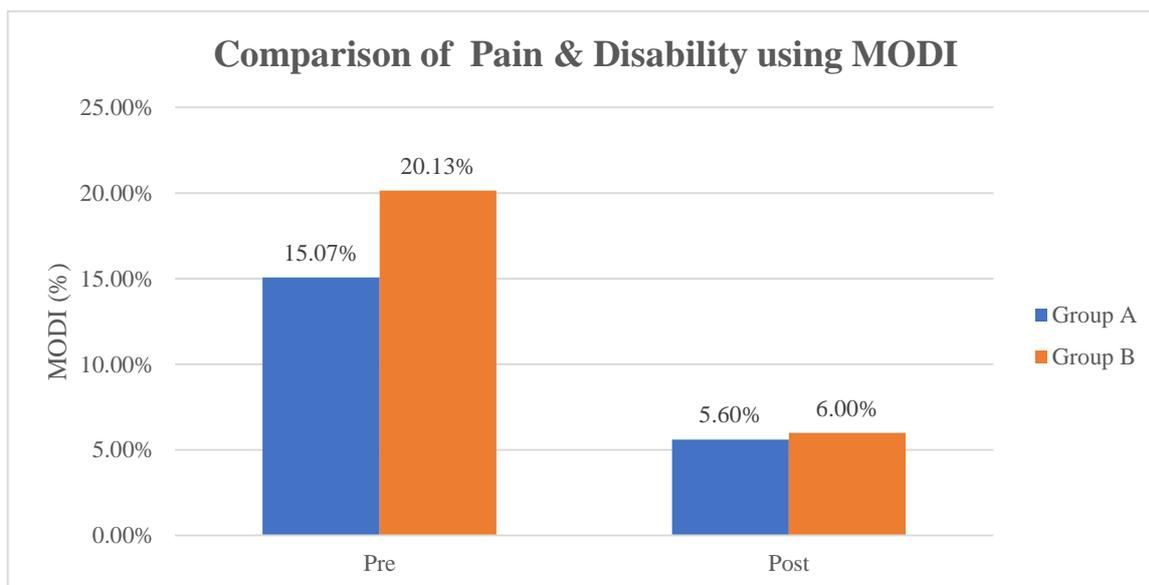
The study conducted a comparative analysis before and after Manual Muscle Testing (MMT) for Quadratus Lumborum and Iliopsoas among two groups, A and B. For Quadratus Lumborum, the pre-MMT mean muscle strength in Group A was 4.00 with a standard deviation of 0.00, increasing to 4.80 post-MMT with a standard deviation of 1.66. In Group B, the pre-MMT mean was also 4.00 with a standard deviation of 0.00, but significantly increased to 7.47 post-MMT with a standard deviation of 1.41, with a p-value of 2.7323E-05, indicating a statistically significant improvement.

For Iliopsoas, the pre-MMT mean muscle strength in Group A was 4.20 with a standard deviation of 0.41, rising to 4.80 post-MMT with the same standard deviation. In Group B, the pre-MMT mean was 4.27 with a standard deviation of 0.46, increasing to 5.00 post-MMT with a standard deviation of 0.00, with a p-value of 0.036, showing a statistically significant difference.

In summary, both Quadratus Lumborum and Iliopsoas showed significant improvements post-MMT in both groups, with Group B experiencing particularly notable enhancements compared to Group A.

TABLE 4: Comparison of Pain and Disability using MODI

MODI		Group A			Group B			P value
		Mean	SD	P Value	Mean	SD	P Value	
	Pre	15.07%	9.35%	3.68E-06	20.13%	10.21%	2.59E-07	0.4212
	Post	5.60%	4.85%		6.00%	6.00%		



The pre MODI (Modified Oswestry Disability Index) mean of group A was 15.07% (± 9.35) and post it was 5.60% (±4.85) and pre mean of group B was 20.13% (±10.21) and post it was 6.00% (± 6.00) with a P value of 0.4212.

There were improvements in MODI mean for both groups, these improvements were not statistically significant. This suggests that the treatment or intervention did not have a significant effect on Modi mean for either group

DISCUSSION

Individuals with acute lumbar strain may encounter limitations in their ability to move their lower back and may find it challenging to bend their spine.¹ The study was carried out to check effectiveness of Quadratus Lumborum and Iliopsoas strengthening exercises compared to conventional physiotherapy management in individuals with acute unilateral lumbar pain. The unilateral lumbar pain is more common to occur in both the groups. Study suggests it occurs more commonly in females.⁴ In our study, among the enrolled participants 13 were male and 17 were female, indicating a higher occurrence among females

The literature indicates that nonspecific low back pain is more prevalent among adults. Therefore, our study focuses on a population within the age range of 20 to 40 years old with a mean age of 26.73 (± 6.05) years, as this demographic is particularly affected by this type of back pain according to existing research.^{5,7,19}

Nonspecific low back pain affects individuals across various professions, including those engaged in physically demanding labor, repetitive work tasks, and prolonged periods of sedentary activity. In the context of occupational work and working hours, individuals with physically demanding jobs, such as construction workers or healthcare professionals, may be at increased risk due to the repetitive lifting, bending, and carrying associated with their work tasks. Conversely, individuals with sedentary jobs, such as office workers or truck drivers, may experience low back pain as a result of prolonged sitting and poor posture. Moreover, individuals who work long hours, whether in physically demanding or sedentary occupations, may experience fatigue and musculoskeletal strain, further contributing to the development of nonspecific low back pain. Therefore, ergonomic factors are addressed.^{3,5} As outlined in the literature, the demographic questionnaire encompassed details regarding the employment status of participants. The data revealed a mean working hours of 7.47 (± 1.59) hours, highlighting the diversity in participants' occupational engagements.

Our study revealed a notable predilection towards the right side in cases of unilateral low back pain, indicating a higher occurrence or impact of symptoms on this particular side compared to the left side. Engaging in recreational physical activities has been linked to a 10%–15% decrease in the likelihood of experiencing chronic lower back pain and lumbar radicular pain. Additionally, a comprehensive review of randomized controlled trials has shown that regular exercise lowers the risk of developing lower back pain.^[20] In our research, we observed that out of 17 participants with unilateral low back pain, none were engaging in exercise, while 13 were either consistently or intermittently involved in physical activity. Additionally, our study observed participants' previous medical history, revealing that 8 out of 30 individuals had a documented history of experiencing low back pain before.

Both Group A (Controlled) and Group B (Experimental) received treatments involving

transcutaneous electrical nerve stimulation (TENS) and shortwave diathermy (SWD). TENS, a non-drug intervention, triggers a intricate network of neurons to alleviate pain by stimulating the descending inhibitory system. SWD induces deep heat within the tissue, surpassing the efficacy of hot packs and other superficial heating methods, as evidenced in the literature.^{14,15} These lead to decrease in pain intensity and Disability in both the groups.

Group A (Controlled) participants underwent conventional exercise protocols. Many exercise programs targeting instability have underscored the significance of improving muscle control in the lumbar spine area. According to the referenced authors, patients should progress to a higher difficulty level of exercises when they can maintain an isometric contraction for 10 seconds without feeling fatigued.¹¹ The exercises included were static abdominals, pelvic lifts, static back, pelvic bridging and cat and camel exercises. This lead to decrease in disability score.

Group B (Experimental) participants underwent Quadratus Lumborum and Iliopsoas strengthening exercises. The muscles primarily responsible for providing support and stability to the lower back are the iliopsoas and quadratus lumborum. When these muscles are affected, particularly through factors like injury, prolonged sitting, poor posture, or stress, it can lead to alterations in the normal biomechanics of the pelvis and various segments of the spine, including the lumbar, thoracic, and even cervical vertebrae. This alteration can result in the onset of back pain.⁵ The strengthening exercises included in the study were side plank, trunk rotation using Resistive Band, isometric resistance to iliopsoas, eccentric resistance to iliopsoas and using bosu ball. Activation of the psoas major muscle is linked to both compressive and shear forces exerted on the spine, while also serving as a stabilizer for the lumbar spine.⁸

The outcomes of the current study reveal significant advancements in reducing pain levels and decreasing disability among participants in both groups. However, it is noteworthy that the experimental group exhibited substantial enhancements in the strength of both the quadratus lumborum and iliopsoas muscles. These findings emphasize the potential effectiveness of interventions focusing on improving the strength and functionality of these muscles in mitigating and managing low back pain.

Consequently, incorporating targeted exercises aimed at strengthening the QL and iliopsoas muscles.

CONCLUSION

The research examined individuals suffering from unilateral low back pain, assigning Quadratus lumborum and iliopsoas strengthening exercises to the experimental group and conventional exercises to the control group. Pain, strength, and disability were evaluated using NPRS, MMT, and MODI, respectively. Demographic variables such as age, gender, occupational status, exercise history, and previous medical records were identified. The findings demonstrated a notable enhancement in muscle strength within group B compared to group A, with no significant divergence in pain levels or disability observed between the two groups.

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