

Effect of Hamstring Extensibility Training on Non-Specific Lower Back Pain Physiotherapy Management

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Abstract

Background: Non-specific low back pain (NSLBP) is a prevalent musculoskeletal condition associated with pain, reduced physical function, work limitations, and healthcare burden. Hamstring tightness may contribute to altered lumbopelvic movement and is commonly addressed during physiotherapy rehabilitation.

Objective: To evaluate the effect of adding hamstring extensibility training to conventional physiotherapy on pain intensity and hamstring flexibility in individuals with NSLBP.

Methods: A comparative pre–post study was conducted among 64 individuals with NSLBP. Participants were allocated into a control group (CG; n = 32) and an experimental group (EG; n = 32). Both groups received conventional physiotherapy for a duration of 1 week, consisting of electrotherapy, moist heat, manual therapy, lumbar mobility exercises, core and gluteal strengthening, non-hamstring stretching, and back-school education. In addition, the experimental group received hamstring-focused myofascial release and passive hold-relax PNF, and self-assisted hamstring stretching. The intervention was provided over 1 week. Pain was assessed using the Numerical Pain Rating Scale, while hamstring flexibility was assessed using active knee extension and passive straight-leg raise. Within-group pre–post changes were analysed using paired t-test.

Results: Statistical analysis suggests that both groups have significant improvement in hamstring range of motion after the treatment protocols. The experimental group shows a significant decrease in subjective pain scores

Conclusion: Hamstring extensibility training helped improve pain levels and hamstring range in NSLBP and may be used as an adjunct to the conventional treatment protocol.

Keywords: Non-Specific Low Back Pain; Hamstring Extensibility; Active Knee Extension; Passive Straight-Leg Raise

Introduction

Low back pain is one of the most common musculoskeletal complaints affecting adults worldwide. It is a major cause of disability, reduced participation in work and daily activities, healthcare utilization, and reduced quality of life[1]. While some individuals with low back pain have a recognizable structural, neurological, inflammatory, or systemic pathology, the majority are classified as having non-specific low back pain. NSLBP is localised in the lumbar region, for which a specific anatomical or pathological cause cannot be confidently determined[2].

NSLBP is a multifactorial condition and should be viewed within a biopsychosocial framework. Physical factors such as reduced spinal mobility, impaired lumbopelvic control, decreased trunk endurance, hip weakness, reduced lower-limb flexibility, physical deconditioning, and altered movement patterns may contribute to symptoms in some individuals. Psychological and social factors, including fear of movement, stress, sleep disturbance, work-related demands, low physical activity, pain catastrophizing, and reduced confidence in movement, may also influence pain persistence and disability[3].

Conservative physiotherapy is a usual treatment for NSLBP. Common physiotherapy interventions include patient education, ergonomic advice, graded activity, therapeutic exercise, lumbar mobility training, strengthening of trunk and hip musculature, manual therapy, and symptom-modulation techniques. Since NSLBP is heterogeneous, a multimodal rehabilitation program is often preferred over a single isolated intervention[4].

Hamstring muscle ranges are frequently assessed in cases of low back pain[5]. The hamstrings are made up of the biceps femoris, semitendinosus, and semimembranosus muscles. These muscles cross the hip and knee joints and may affect pelvic movement during forward bending, walking, lifting, running, and sports[6]. Reduced hamstring extensibility may limit anterior pelvic tilt during hip flexion and increase the relative contribution of lumbar flexion during bending. This change in the lumbopelvic movement pattern has been proposed as a possible contributor to lumbar discomfort in some individuals[7].

However, hamstring tightness should not be considered as the sole cause of NSLBP[8]. The relationship between hamstring flexibility and low back pain is complex, and reduced flexibility may be a contributing impairment, a protective response to pain, or simply a concurrent finding. Nevertheless, in individuals who present with NSLBP and clinically observable hamstring tightness, targeted hamstring extensibility training may be a useful adjunct to comprehensive physiotherapy rehabilitation.

Therefore, the present study aimed to investigate whether the addition of hamstring extensibility training to conventional physiotherapy could improve pain intensity and hamstring flexibility in individuals with NSLBP in 1 week. Pain was measured using the Numerical Pain Rating Scale, while flexibility was assessed using active knee extension and passive straight-leg raise testing.

Materials and Methods

A comparative pre–post intervention study was conducted among individuals with NSLBP, both males and females (aged 18–30 years). A total of 64 participants were included and divided equally into a control group and an experimental group, with 32 participants in each group.

Hamstring tightness was identified through clinical flexibility assessment, including active knee extension and passive straight-leg raise testing. Participants were excluded if they had a specific cause of low back pain, including spinal fracture, infection, malignancy, inflammatory spinal disease, spinal stenosis, serious neurological involvement, or clinically significant disc pathology. Individuals with recent spinal surgery, acute hamstring strain, major lower-limb injury, neurological deficits affecting testing, or contraindications to stretching, heat, electrotherapy, or manual therapy were also excluded.

All participants were informed about the treatment procedures, potential benefits, and the minor discomfort they might experience during stretching and exercise. Participants gave written informed consent prior to their participation in the study.

NPRS was used to measure pain intensity. This scale ranges from 0 to 10, where 0 represents no pain, and 10 represents the worst imaginable pain. The scale is easy to use and appropriate for evaluating changes in pain intensity over time[9].

AKE and PSLR were used to measure hamstring flexibility. For the AKE test, participants laid in supine with the hip and knee maintained at approximately 90° of flexion. Participants were asked to actively extend the knee while maintaining the hip position. The knee-extension angle was recorded using a goniometer. In the present study, higher values were interpreted as improved active knee-extension range and, therefore, improved hamstring extensibility.

For PSLR testing, participants were positioned in supine with the opposite lower limb maintained in extension. The examiner passively raised the tested straight leg until the participant reported a tolerable stretch sensation or discomfort in the posterior thigh. The hip-flexion angle was measured using a goniometer. Greater PSLR values indicated greater passive hamstring extensibility.

Both groups received conventional physiotherapy management over 7 days with 1 session per day. The conventional program included high-frequency transcutaneous electrical nerve stimulation (high TENS), moist heat application, manual therapy, lumbar mobility exercises, core strengthening, gluteal strengthening, lower-back strengthening, selected non-hamstring stretching exercises, and back-school education.

High-frequency TENS was administered for 15 minutes at a comfortable sensory intensity. Electrodes were placed bilaterally over the lumbar region surrounding the upper lumbar and lumbosacral levels[10]. Moist heat packs were applied over the lumbar area for 20 minutes[11].

Myofascial release of tight erector spinae muscles was performed with manual therapy and instrument assisted soft tissue mobilization (IASTM) with lubricant[12]. Lumbar mobility exercises included semi-prone spinal extension holds, prone spinal extension holds, cat-cow exercises, and child-pose-based spinal decompression movements. Stretching of the gluteal muscles and quadratus lumborum was also included. Strengthening exercises were directed at the trunk, gluteals, erector spinae, and multifidus. These exercises included half-crunch holds, dead bug holds, active straight-leg raises, bridge holds, clamshell holds, prone straight-leg raise holds, prone-kneeling kickbacks, and quadruped contralateral arm-and-leg raises. Back-school education also included advice on posture, lifting mechanics, activity modification, and ergonomic practices.

The experimental group received the same conventional physiotherapy program along with hamstring extensibility training. This consisted of hamstring myofascial release using instrument-assisted soft-tissue mobilization, therapist-assisted hold-relax hamstring Proprioceptive Neuromuscular Facilitation (PNF) stretching, and self-assisted hamstring stretching using a towel, scarf, or stretching belt.

Results

Statistical analysis was done using JASP 0.98.1.

Paired *t*-test was used to compare pre and post intervention scores within each group, with statistical significance set at $p < 0.05$.

Table 1: Comparison of Pain and Range Parameters before and after treatment in Control Group

Control Group (n=32)				
Variable	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	Paired <i>t</i>	<i>p</i>
NPRS	7.38 $\pm$ 1.13	4.91 $\pm$ 1.03	-10.21	0.06
AKE (°)	97.84 $\pm$ 7.49	123.52 $\pm$ 25.17	19.5	0.041
PSLR (°)	118.44 $\pm$ 8.14	135.56 $\pm$ 24.76	29.34	0.032

NPRS: Numerical Pain Rating Scale, AKE: Active Knee Extension Test, PSLR: Passive Straight Leg Raise

Analysis revealed a significant increase in AKE (pre= 97.84 ± 7.49 , post= 123.52 ± 25.17 , $t=19.5$, $p=0.041$), and PSLR (pre= 118.44 ± 8.14 , post= 135.56 ± 24.76 , $t=29.34$, $p=0.032$) after conservative treatment in the control group; therefore, this suggests an increase in range characteristics. However, NPRS scores (Pre= 7.38 ± 1.13 , post= 4.91 ± 1.03) showed a decreasing trend between pre and post evaluation but did not reach statistical significance ($p>0.05$).

Table 2: Comparison of Pain and Range Parameters before and after treatment in Experimental Group

Experimental Group (n=32)				
Variable	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	Paired t	p
NPRS	7.31 ± 1.00	2.44 ± 1.66	-10.98	0.003
AKE (°)	96.91 ± 14.63	163.47 ± 11.38	30.38	0.036
PSLR (°)	113.19 ± 10.41	176.94 ± 6.84	44.3	0.029

NPRS: Numerical Pain Rating Scale, AKE: Active Knee Extension Test, PSLR: Passive Straight Leg Raise Statistical analysis of the experimental group reveals a significant decrease in within group NPRS Scores (pre= 7.31 ± 1.00 , post= 2.44 ± 1.66 , $t=10.98$, $p=0.003$), an increase in AKE (pre= 96.91 ± 14.63 , post= 163.47 ± 11.38 , $t=30.38$, $p=0.036$), and PSLR (pre= 113.19 ± 10.41 , post= 176.94 ± 6.84 , $t=44.3$, $p=0.029$). This suggests an overall improvement in all parameters.

Discussion

All 64 participants completed the intervention period, with 32 participants in each group. Both groups showed reductions in pain intensity and improvements in hamstring flexibility following treatment.

The analysis showed increases in AKE ($t=19.5$, $p=0.041$) and PSLR ($t=29.34$, $p=0.032$). This indicated significant improvement in passive hamstring flexibility within the control group.

The experimental group showed a greater reduction in NPRS ($t=10.98$, $p=0.003$), indicating a statistically significant reduction in pain on evaluation of the data. AKE($t=30.38$, $p=0.036$) and PSLR ($t=44.3$, $p=0.029$). This suggests an overall improvement in pain and range parameters in the experimental group

The greater improvements in the experimental group may indicate a beneficial role of hamstring extensibility training as an addition to conventional NSLBP rehabilitation. Hamstring-focused myofascial release and stretching may improve tolerance to stretch, reduce perceived posterior-thigh stiffness, and allow greater hip flexion and knee extension during clinical flexibility tests[13]. Increased hamstring extensibility may also enhance the efficiency of pelvic movement during bending and functional tasks[13]. Also, the control group showed significant improvement, particularly in AKE and PSLR. These changes may be explained by the effects of conventional physiotherapy, including lumbar mobility exercises, trunk and hip strengthening, manual therapy, TENS, moist heat, graded activity, and education. Improvement in low back pain is often influenced by several factors, including increased activity tolerance, improved movement confidence, better trunk and hip capacity, reduced fear of movement, and symptom modulation[4].

It is important to recognize that the present findings do not establish hamstring tightness as a primary cause of NSLBP. NSLBP is multifactorial, and hamstring restriction should be assessed as one potentially modifiable impairment rather than the sole source of symptoms. Hamstring extensibility training may be most appropriate for individuals who have demonstrable flexibility limitations and whose symptoms or movement impairments appear to be influenced by restricted hip flexion or posterior-chain mobility.

Conclusion

The addition of hamstring extensibility training to conventional physiotherapy was associated with greater descriptive improvements in pain intensity, active knee extension, and passive straight-leg raise among individuals with NSLBP. The experimental group demonstrated a larger reduction in NPRS and greater gains in both measures of hamstring flexibility than the control group.

These findings suggest that hamstring-focused interventions (including passive prolonged stretching, self-assisted hamstring stretching, and hamstring myofascial release) may be useful adjuncts to conventional physiotherapy for selected individuals with NSLBP and reduced hamstring extensibility. However, treatment should still be individualized and part of a comprehensive rehabilitation program including education, graded activity, trunk and hip strength, mobility, movement confidence, and relevant psychosocial factors.

Various limitations were faced in this study, such as the subjectivity of pain scale, short duration of intervention and follow-up period. Future studies should use standardized intervention dosage and long term follow-up to determine the real clinical efficacy of hamstring extensibility training in NSLBP.

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