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Relationship between Hamstring Tightness and Chronic Lower Back Pain: A Literature Review

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Abstract

Background of the Study: Hamstring muscles is one of the most common muscle which undergoes for adaptive shortening comparing with other muscle group in the body. Chronic lower back also being the most widespread problem among the industrialized world in which the patient complains about pain or unpleasant sensation in the lumbo region of spine. Lower back injuries could be caused by hamstrings that are stiffer than they used to be. This is critical in the treatment of chronic lower back pain: the hamstrings must be free to move. This is due to the fact that the hamstrings may play a role in the development of chronic back pain in persons.

Aim: the aim of this study to understand if the tightness of hamstrings muscle has any relations with chronic lower back pain in an individual and vice versa.

Method: the study included 41 Articles that was taken from different sites in which were all related to hamstring muscle tightness and its effect on chronic lower back pain. The collection of data was finding articles related to hamstring tightness and chronic lower back pain in different sites like google scholar, PubMed, research gate and cochranelibrary.

Result: 41 articles that was taken from different sites in which 20 articles were related to the topic on which almost 8 articles gave the Conclusion that was favor the topic while the other gave unclear Conclusion that is 40%of the articles gave favorable answer while 60% articles not favorable.

Conclusion: Because the data on the relationship between the hamstrings and low back mechanics is conflicting, it's unclear if rehabilitation programmes for persons with axial lower back pain should focus on improving hamstring length.

Keyword: lower back pain ,Chronic lower back pain, Trunk flexion, Active knee extension ,Pelvic Tilt, Lumbar Motion, Straight leg raising ,Range of Motion, Bicep femoris, Hamstring stretch, Hamstring low back stretch , Electrogoniometer stretch, Strandard goniometer

INTRODUCTION

Hamstring muscles is one of the most common muscle which undergoes for adaptive shortening comparing with other muscle group in the body.[1] Chronic lower back also being the most widespread problem among the industrialized world in which the patient complains about pain or

unpleasant sensation in the lumbo region of spine. Low back pain (LBP) is a common musculoskeletal issue that affects up to 80% of the population at some point in their lives[2]. This is the primary reason for how many years people have been disabled due to it. Definitions and prevalence estimates can differ depending on their culture, language, approach, and how they experience things. There could be a correlation between muscular tightness and postural issues. Both can result in a range of musculoskeletal issues. Reduced extensibility may contribute to low back problems caused by tense hamstrings. Tight hamstrings have been demonstrated in clinical studies to alter the rhythm of the lumbar pelvis and to be associated with alterations in the sagittal spine curvatures when the trunk is bent over (TF). Many of the things we perform daily necessitate us bending forward. Short hamstrings may increase the likelihood of putting a lot of stress on our spine.

Hamstring injuries are prevalent in sports medicine [8, 9]. Athletes are at a greater risk of recurring injury, which can decrease performance, induce post-workout soreness, and decrease athletes less coordination [13]. People who participate in contact sports are more likely to have hamstring tightness than those who do not [3]. Studies on the hamstrings and back extensor muscles may be related because they originate in the pelvis[1]. Hamstring tightness showed a moderate co-rellation with pelvic tilt movement and a weak correlation was observed with lumbar control with hamstring tightness in CLBP volunteers[2]. [6] If there is a correlation between muscle damage and back pain, treatment and prevention strategies may be more effective. We believe that young athletes should undergo regular knee extensor (KE) and knee flexor (KF) strength testing and that compensatory activities should be tailored to each individual [10].

Flexibility is important for normal biomechanical function[13]. Hamstring flexibility is critical in the treatment of CLBP, particularly because it may play a role in the development of persistent lower back pain [1]. When the muscle is tight, there are more hamstring injuries [3]. Certain activities that are performed after a lengthy period of sitting may produce low back pain [5]. People who have tight muscles because they can't move as easily as they used to can't move as far as they used to[3]. Prolonged sitting tightens the hamstring muscle, making it difficult to move. This can result in a decrease in range of motion, which can contribute to a variety of musculoskeletal issues [5]. Full lumber flexion movement and some actions may produce low back pain after a lengthy period of sitting [5]. A weak or inflexible body component may modify how strong or where that body part is to maintain the pelvis in place, resulting in low back pain[1]. The active knee extension angle test was used to assess hamstring tightness since it is the most accurate method of determining tightness [4]. There is no new evidence that hamstring flexibility can cause low back pain in this circumstance [7].

It is important to have a proper understanding of their anatomy, morphology, innervation, and function in order to develop the most effective diagnosis, treatment, and prevention strategies [8].

People who had a lot of back pain in the past experienced a lot more hamstring stiffness 48-72 hours after doing some activity. As a result, ladies with a history of back pain had higher hamstring stiffness when performing aerobic exercise (39). Increased hamstring stiffness could be the source of a low back problem. Tight hamstrings have been proven to alter the lumbar pelvic rhythm in clinical studies. If you have mobility restrictions or a postural imbalance, your spine may move in a way that puts additional strain on your spinal soft tissues and raises your risk of back discomfort (38). Non-contact injuries to the muscles and injuries are common in sports, which is one of them. Because of the high

demands of the game, numerous things can go wrong in high-risk sports such as football (37). According to the stretch injury mechanism, the injury occurs when the hip and knee are bent too far. Most injuries occur while running in the late swing phase of the running gait cycle (36).

Straight-leg tests are frequently performed to assess hamstring extensibility in persons suffering from low back pain. It does not demonstrate how far your hamstrings can stretch. The SLR displays the angle formed by the angle formed by the angle formed by the elevated leg and the angle formed by the ground (33). This is especially true for employees who suffer from back pain at work, which diminishes productivity and increases disability, costing the health-care system a lot of money. The majority of healthcare workers experience back problems. This is due to the fact that when you're handling patients, you may overwork your back, which can cause to terrible posture and poor balance in both the static and moving elements of your body. Your back pain could be exacerbated by a lack of balance. Indeed, the majority of people who suffer from low back pain have issues with their postural stability. People with and without non-specific low back pain have distinct ways of managing their posture, changing their centre of pressure, and engaging their muscles. People who do not have specific Low back pain have significantly more postural instability, as seen by their Cop speed and deviations. This is in comparison to healthy people (31).

Hamstring Flexibility and Its Association with Low Back Pain

The relationship between hamstring flexibility and low back pain (LBP) has been extensively studied. Mistry et al. (2014) identified significantly tighter hamstrings in individuals with chronic LBP compared to healthy controls, suggesting that hamstring tightness may not only be a consequence but also a contributing factor in chronic LBP development. Similarly, Reis and Macedo (2015) reported altered movement patterns during forward bending in LBP patients, where limited hamstring extensibility led to compensatory increases in lumbar spine flexion, as assessed using the Active Knee Extension (AKE) test. These findings support the biomechanical linkage between hamstring tightness and lumbar spine kinematics.

Yadav and Basista investigated college students with prolonged sitting durations and found that extended sedentary behavior significantly reduced hamstring flexibility and altered lumbar lordosis, particularly in those sitting for over 12 hours a day. Fasuyi et al. compared individuals with and without LBP and found shorter hamstring muscle lengths in the LBP group, although no strong association was found with pelvic tilt range. Arab and Nourbakhsh further supported these findings, observing that while hamstring lengths were significantly shorter in individuals with LBP, no major differences were found in lumbar lordosis or spinal curvature based on occupational or lifestyle factors.

Lee et al. (2021) demonstrated that targeted stretching of the hamstrings and lower back significantly improved trunk biomechanics and sitting posture, as measured through EMG and kinematic analysis. This suggests that hamstring tightness not only affects spinal mobility but also alters the neuromuscular response of lumbar structures. Additionally, Cyr et al. evaluated motor control under unstable sitting conditions and reported reduced spinal control in chronic LBP patients, further underlining the need for interventions targeting both flexibility and postural control.

Marshall et al. emphasized that hamstring extensibility in LBP patients is more closely associated with mechanical properties of the muscle rather than pain behavior or self-reported impairment. Shamsi et al. also concluded that static stretching and strengthening exercises performed in a lengthened position were effective in improving hamstring length and posture in individuals with chronic LBP. However, Johnson and Thomas noted that hamstring flexibility did not significantly influence lumbar spine motion during functional forward-reaching tasks, questioning its direct role in some aspects of spinal kinematics.

Measurement Tools and Methodologies in Assessing Hamstring Flexibility

Reliable assessment of hamstring flexibility is essential for both clinical evaluation and research. Radwan et al. employed both standard and electrogoniometers in a supine 90/90 AKE test and highlighted intra-subject variability in hamstring measurements among mechanical LBP patients. In a comparative study, Shamsi et al. validated the use of both universal and electro-goniometers, indicating that the latter provides greater accuracy in measuring knee extension angles, especially in clinical populations with limited range.

Kellis et al. used ultrasound to examine hamstring elongation during the SLR test in individuals with and without LBP. Although the LBP group showed lower SLR scores and higher disability indices, there was no significant difference in actual hamstring length between the groups or between sexes, suggesting that perception of stiffness may not always align with measurable muscle length.

Prevalence and Demographic Trends in Hamstring Tightness

Epidemiological studies have revealed a high prevalence of hamstring tightness among various population groups. Weerasekera and Suraweera (2010) found that athletes participating in contact sports exhibited greater hamstring tightness compared to non-contact athletes, although no correlation was found with body dimensions or warm-up practices. Koli and Anap (2018) conducted a cross-sectional study among college students and identified a particularly high prevalence of tight hamstrings in the 18–25-year age group, emphasizing the need for early flexibility interventions in young adults.

National data presented by Yong et al. (2021) showed that over 20% of adults in the United States suffer from chronic pain, with LBP being a major contributor. Cragg et al. further emphasized the vulnerability of individuals with neurological disorders, such as spinal cord injury, to persistent musculoskeletal pain, often exacerbated by hamstring dysfunction. In healthcare workers, Zemkova et al. demonstrated that poor hamstring and back muscle strength was associated with impaired postural control and increased risk of LBP, particularly among physiotherapists.

Effectiveness of Interventions on Hamstring Flexibility

Several interventional studies have demonstrated the efficacy of stretching and manual therapy techniques in improving hamstring flexibility. Bhusal et al. (2013) compared the Bowen Technique and Dynamic Soft Tissue Mobilization, with both interventions showing significant post-treatment improvements in AKE measures, though the Bowen Technique was found to be superior. Cini et al. reported that short-duration static stretching produced meaningful short-term gains in hamstring

flexibility, findings which were echoed by Medeiros et al. in their systematic review and meta-analysis of randomized controlled trials.

Will et al. compared a variety of therapeutic interventions, including SNAGs, McKenzie exercises, and pharmacologic agents for managing LBP, and found that yoga demonstrated the most consistent benefits for both short- and long-term outcomes. Bedard et al. observed that individuals with a history of recurrent LBP exhibited increased hamstring stiffness 48–72 hours post-exercise, suggesting that neuromuscular fatigue or delayed muscle response may play a role in recurrence.

Anatomical and Biomechanical Considerations

Anatomical studies have expanded our understanding of the hamstring muscle group's role in spinal and lower limb function. Stepien et al. (2019) provided a comprehensive dissection of the proximal attachment of the hamstring muscles, highlighting their involvement in tibial rotation and posterior knee stability. Tubbs et al. (2006) identified multiple insertion sites for the biceps femoris tendon, underscoring its importance in knee joint stabilization.

Tosovic et al. used ultrasound and cadaver analysis to demonstrate that the distal portion of the biceps femoris long head (BFlh) has superior force production capacity, whereas the proximal region is more susceptible to strain and injury. Balius described the hamstring muscle group as comprising four distinct anatomical segments, which can be visualized and assessed using advanced imaging techniques.

Jandre observed that lumbar spine forward flexion exceeds pelvic and thoracolumbar fascial movement in LBP patients, indicating altered segmental contributions during bending. These insights are critical for clinicians seeking to restore optimal movement patterns through targeted rehabilitation.

Hamstring Injuries and Their Clinical Implications

Injury patterns in the hamstring muscle group have been well documented. Kuske et al. noted a higher incidence of avulsion injuries in elderly adults, particularly women, often linked to low-impact activities and reduced bone density. Danielsson et al. identified mechanisms of hamstring strain during high-speed running, particularly in the late swing phase when the hip is flexed and the knee extended.

Ertelt and Gronwald analyzed sports injury data and found that hamstring injuries, particularly to the biceps femoris, remain the most common muscle injuries in football, despite the implementation of prevention programs. Deren et al. emphasized the need to consider hamstring tendon ruptures and pelvic musculature trauma in the differential diagnosis of LBP, particularly in cases involving radicular symptoms or post-traumatic pain.

Muscle Strength, Asymmetry, and Functional Capacity

Muscle strength and asymmetry are important considerations in understanding hamstring function in both healthy and pathological populations. Kirk et al. (2018) documented significant reductions in maximal voluntary contraction torque and motor unit firing rates in older adults, illustrating age-related

neuromuscular decline. Kulas et al. reported side-to-side muscle volume differences in the hamstrings of healthy young adults, with the biceps femoris showing the highest asymmetry.

Marshall et al. explored the relationship between hamstring strength and self-reported disability in LBP patients, showing that lower strength values were associated with higher pain, impairment, and fear-avoidance. Hultman et al. found that individuals without LBP had greater spinal lordosis and flexibility, particularly in sagittal movements, compared to those with recurrent or chronic back pain.

METHODOLOGY

A literature review was conducted to explore the association between hamstring tightness and chronic low back pain. The review included research articles based on randomized controlled trials (RCTs) to ensure a higher level of evidence and clinical relevance. Articles were sourced from multiple reputable databases including Google Scholar, PubMed, ResearchGate, and the Cochrane Library. This comprehensive search aimed to identify relevant studies that evaluated the role of hamstring flexibility in individuals experiencing chronic low back pain.

The design of this review was structured around identifying and summarizing the findings of approximately 40 selected articles that directly addressed the relationship between hamstring tightness and chronic lower back pain. The main objective of this study was to synthesize available evidence in order to better understand the potential biomechanical and clinical implications of reduced hamstring flexibility in patients with chronic low back pain.

Data collection was systematically carried out by searching the aforementioned databases for articles using specific keywords such as "hamstring tightness," "chronic low back pain," "flexibility," and "range of motion." Each article was screened for relevance based on its title, abstract, and full text, and those that met the eligibility criteria were included in the final review.

The inclusion criteria for this review required that articles be published between January 2011 and March 2021, and that they specifically investigate low back pain related to hamstring tightness. Eligible studies were sourced from bibliographic databases such as MEDLINE, Google Scholar, and PubMed. In contrast, the exclusion criteria eliminated studies published prior to January 2010 and after March 2021, as well as those with unclear results or inconclusive findings. Articles that demonstrated poor methodological quality or low levels of evidence, along with studies that involved participants with coexisting spinal disorders or unrelated musculoskeletal injuries, were also excluded from the review to maintain focus and reliability.

DISCUSSION

Athletes are more likely to sustain short-term hamstring injuries. All three tendons originate from the ischial tuberosity. They can be harmed when you do eccentric contractions by bending your hip or straightening your knee, which puts them at danger. 9 percent of all hamstring injuries are proximal hamstring ruptures. Adults are susceptible to ruptures at the myotendinous junction. Avulsion fracture of the ischial apophysis can occur in patients aged 16 to 25. Hamstring ruptures can occur in elite or middle-aged leisure athletes. Because chronic hamstring ruptures can present sciatica (pain down the sciatic nerve), neurological assessment of the lower limb is critical. Chronic injuries may also present "hamstring syndrome," characterised by pain at the back of the buttocks over the ischial tuberosity. 52

of the 59 patients who underwent hamstring surgery felt better after their nerves were loosened and their muscles were relaxed. The peroneal nerve's function must also be evaluated, because a lesion to this nerve can result a drop in the foot or poor time eversion. The hamstring muscles are crucial in the prevention and treatment of low back pain, particularly because tight hamstrings can cause LBP in the first relevance.It is unclear whether hamstring flexibility plays a role in the development of low back pain or if it is part of a long-term response to the onset of symptoms, which may be linked to other poor posture methods. The PT showed that hamstring tightness had a moderate movement. This can be explained by the fact that the hamstring muscles are supposed to pull the pelvis backward. Our findings reveal that stretching the hamstrings causes the pelvis to move in a different way. This is due to the hamstrings' attachment to the ischial tuberosity on the pelvis. Clinically, it is critical to understand the relationship between pelvic movement and hamstring tightness. There is a lot of evidence that muscular intervention, such as hamstring stretching, can help persons with pelvic difficulties get back on their feet. When LBP patients bent forward, they exhibited more limits in PT and more mobility in the lumbar region. In this scenario, it's possible that when someone bends forward, their lumbar region moves a little more to compensate. In the real world, if you're having trouble with physical therapy and want to improve your range of motion in the lumbar practise, you should do exercises to strengthen your back and move your pelvis. If your hips occur rapidly and your tears move swiftly, you are more prone to tear your hamstring, which is quite prevalent in sports. [1–16] Hamstring injuries are widespread among professional athletes, and numerous studies have been conducted to investigate the risk factors and severity of these injuries. Buttock pain is common with hamstring strains. Back, hip, and groyne problems, as well as hamstring injuries, are all probable causes of buttock pain. The pain from the lumbo- sacral spine can be felt in the back of the leg or buttock, but it might be difficult to discern. In general practise, this is a typical symptom that might be misdiagnosed as a hamstring injury. There could be a relationship between mild mechanical LBP and hamstring tightness. Those who experienced increased muscle tightness suffered from LBP to a greater severity. These individuals also had one of their lower legs that was significantly tighter than the other. This kind of tightness can be found in both EG and SG. When developing rehabilitation strategies for patients with mechanical low back pain, it's critical to consider these results and their potential pathomechanical ramifications. Movement or movement restrictions are hypothesised to cause the lumbar spine to move differently, putting additional strain on the spinal soft tissues and increasing the risk of injury. People with LBP had difficulty shifting their pelvis in this group, although they had greater lumbar flexion strength. When two portions of the body move, the more mobile part is perceived to move first. This is referred to as relative flexibility [24]. This study follows the same movement. We investigated how less flexible hamstrings reduced trunk and pelvic movement strategies during manual handling tasks. During handling activities, persons with poorer flexibility exhibited higher trunk movement amplitudes and lower pelvic movement.

The PT showed that hamstring stiffness had a moderate movement. People believe that the hamstring muscles pull the pelvis back. This could be the reason for the finding. Our findings reveal that stretching the hamstrings causes the pelvis to move in a different way. This is because the hamstrings link to the ischial tuberosity on the pelvis. A previous study backs up this claim. Nonetheless, Norris and Matthews discovered no link between the length of a student's hamstrings and the amount of PT they performed when they bent forward. The authors observed the anterior PT when forward bending. They did this with a bar at the height of each person's tibial length, which is where our data differs from

theirs. When the pelvis goes forward as a result of this constraint, the hamstring should become less significant. In this situation, a mechanism that makes it difficult for the pelvis to move during TF diminishes the effect of hamstring flexibility. There is a lot of evidence that muscular intervention, such as hamstring stretching, can help persons with pelvic difficulties get back on their feet. When LBP patients bent forward, they exhibited more limits in PT and more mobility in the lumbar region. In this motion, it could be because when someone bends forward, they compensate by moving their lumbar region a little more. In the real world, if you're having trouble with pelvic treatment and need more lumbar range of motion, you should practise exercises to strengthen your back and move your pelvis. More research is needed to determine whether tight hamstrings are a risk factor for back discomfort (38). When patients stood or sat with their knees bent at 90 degrees for an extended period of time, greater hamstring flexibility had no effect on spinal curvatures or pelvic tilt (Macrae & Wright position). Both knees should be bent to allow the hamstring muscles to relax. This position lowers hamstring muscle tension and its effect on the pelvic and sagittal spinal curvatures. Because the hamstring muscles are mildly extended with little passive tension when people stand, their thoracic and lumbar angles, as well as their pelvic tilt, are unaffected by how far they may be stretched. This is consistent with earlier cross- sectional studies.

Several studies have found that young people (aged 5–12º) who participate in hamstring stretching routines or stretch on their own immediately improve their active knee extension test. In the current study, there was a 9º improvement in the active straight leg lift test. There was also a significant improvement in the sit-and-
reach score (mean difference pre-post score: +5.45 cm). After stretching, it was simpler to bend down and elevate your pelvis. People in the sit-and-reach test exhibited a more backward pelvic tilt before stretching their hamstrings. Stretching the hamstrings made them more flexible, making it simpler for the pelvis to tilt forward when the person was in the maximum flexion with their knees bent. When the person bends forward, the pelvis travels forward until the passive tension of the hamstrings prevents the pelvis from moving forward. An acute stretching intervention may have made someone more accustomed to and willing to bear with the discomfort. This could explain why their range of motion improved following the intervention. In this situation, it demonstrates that stretching simply once does not modify the tissues sufficiently to cause long-term impacts. When we were looking for ways to stretch our muscles, we settled on static stretching because it is a popular method. Stretching like this has been proved to help you create longer hamstrings. This is exactly what you should do. Some research, on the other hand, looked at the impact of different stretching techniques on the length of the hamstring muscle group during a short-technique training programme and discovered that different techniques had distinct results.More research is needed to determine how the stretching technique employed impacts spinal studies and pelvic position (41).

The study included 40 articles that was taken from different sites in which 20 articles were related to the topic on which almost 8 articles gave the Conclusion that was favor the topic while the other gave unclear Conclusion that is 40%of the articles gave favorable answer while 60% articles not favorable.

CONCLUSION

When the hamstrings moved in a common range of motion (20 to 50°), they were less flexible. This

accentuated the passive rigidity. Impaired stretch tolerance is associated with actual mechanical constraints, rather than behavioural tests that reveal increased pain or fear avoidance. Because the data on the relationship between the hamstrings and low back mechanics is conflicting, it's unclear if rehabilitation programmes for persons with axial lower back pain should focus on improving hamstring length

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