IMPACT OF DSTM OF HAMSTRING ON LOW BACK PAIN IN COLLEGIATE LEVEL BASKETBALL PLAYERS

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Abstract

Background

The prevalence of LBP in basketball players ranges from 12.8% to 44%. The multifactorial nature of LBP in basketball players involves a combination of biomechanical, structural, and individual factors. Addressing risk factors such as muscle imbalances, spinal misalignments, and mechanical stress may be crucial in preventing and managing LBP in these athletes. The hamstrings play a crucial role in controlling anterior pelvic tilt during dynamic postures. Tight hamstrings limit the ability to perform activities that involve bending at the hips, leading to compensatory movements such as increased lumbar lordosis leading to low back pain.

Objectives

This randomized control study aimed to investigate the effects of dynamic soft tissue mobilization of the Hamstrings (DSTM) on alleviating low back pain (LBP) among collegiate-level basketball players. The study assessed the outcomes using the Active Knee Extension Test, Micheli Function Scale, and Pelvic Tilt measurements.

Methods

Sixty collegiate basketball players with a history of low back pain were randomly assigned to either the intervention group (n=30) or the control group (n=30). The intervention group participated in a three-week DSTM program, incorporating targeted hamstring release tailored to the basketball-specific movements, while the control group was given static stretching. Pre- and post-intervention assessments included the Active Knee Extension Test to measure hamstring flexibility, the Micheli Function Scale to assess functional outcomes related to low back pain, and Pelvic Tilt measurements to quantify changes in pelvic alignment. The mean age of the players being 21.35±2.8.

Results

After the three-week intervention period, the DSTM group demonstrated significant improvements in hamstring flexibility as indicated by increased Active Knee Extension Test scores compared to the control group ($p < 0.05$). Additionally, participants in the intervention group exhibited enhanced functional outcomes related to low back pain, as evidenced by lower Micheli Function Scale scores ($p < 0.01$). Pelvic Tilt measurements revealed a more neutral pelvic alignment in the DSTM group compared to the control group post-intervention ($p < 0.05$).

Conclusion

Conclusion: The findings of this study suggest that incorporating Dynamic soft tissue mobilization of the Hamstrings into the warm-up routine can be an effective strategy for reducing low back pain and improving functional outcomes in collegiate-level basketball players. The observed improvements in hamstring flexibility and pelvic alignment highlight the potential of DSTM as a valuable intervention in the management and prevention of low back pain in this athletic population. Future research should explore the long-term effects and applicability of DSTM in diverse athletic settings.

Keywords: DSTM, hamstrings tightness, LBP, basketball players

Introduction

Low back pain (LBP) represents a prevalent musculoskeletal complaint among athletes, particularly in sports demanding repetitive movements and high physical loads, such as basketball (Mortazavi et al., 2015) (Daniels et al., 2011). Hamstring tightness is frequently associated with compromised biomechanics and an increased susceptibility to LBP, indicating a critical link between lower limb flexibility and spinal health . Traditional interventions, such as static stretching, are commonly employed to address hamstring inflexibility (Rao, 2018). However, dynamic soft tissue mobilization (DSTM) offers an alternative approach that targets fascial restrictions and muscle extensibility more actively. This investigation assesses the comparative effectiveness of DSTM versus static stretching in mitigating LBP and improving hamstring flexibility and pelvic alignment in collegiate basketball players.

Basketball is a dynamic sport that demands agility, speed, and flexibility from its players. One common challenge faced by basketball athletes is low back pain, a condition that can significantly impact performance and overall well-being. This paper explores intricate link between tight hamstrings and the occurrence of low back pain in basketball players. Specifically, we will explore how the tightness of hamstrings contributes to this issue and discuss potential solutions to alleviate discomfort

The hamstring muscle group, spanning both the hip and knee joints, exerts considerable influence on pelvic posture and lumbar spine mechanics. Restricted hamstring flexibility can induce a posterior pelvic tilt and diminish lumbar lordosis, thereby increasing mechanical stress on spinal structures and contributing to LBP (Jandre Reis & Macedo, 2015). Collegiate basketball players, characterized by high-intensity movements and frequent jumping, are particularly susceptible to hamstring tightness and subsequent LBP due to the demands placed on their musculoskeletal system (Patel & Kinsella, 2017). Addressing hamstring extensibility is thus a pertinent strategy in the prevention and management of LBP in this athletic population (Rao, 2018) (Radziszewski, 2012).

Manual therapy techniques, including DSTM and static stretching, are widely employed in sports rehabilitation to enhance flexibility and reduce pain (Rao, 2018) (Al Dajah, 2014). DSTM, often involving instrument-assisted soft tissue mobilization (IASTM), focuses on breaking down fascial restrictions and improving tissue extensibility through dynamic movement during mobilization (Hopper et al., 2005) (2020). This approach aims to restore normal tissue texture and function (Rao, 2018). Static stretching, in contrast, involves holding a stretched position for an extended period, primarily targeting muscle lengthening (Kurtdere et al., 2020) (Imran Farooqui et al., 2016). Both methods seek to improve range of motion, but their underlying mechanisms and immediate effects may differ, particularly in dynamic athletic contexts (2020) (Hopper et al., 2005).

Research comparing DSTM (or IASTM) and static stretching for flexibility improvements indicates varying efficacy. Some studies demonstrate that IASTM and proprioceptive neuromuscular facilitation (PNF) can yield greater increases in hip flexion range than static stretching alone (Gunn et al., 2018). Similarly, DSTM has shown significant increases in hamstring flexibility compared to control or classic static mobilization (Hopper et al., 2005). Other investigations suggest that both IASTM and static stretching can effectively increase range of motion, with IASTM potentially offering greater benefits in specific contexts or for particular muscle groups (Myburgh et al., 2018). The impact on LBP, however, often depends on addressing underlying biomechanical dysfunctions, such as hamstring tightness and pelvic malalignment (Jandre Reis & Macedo, 2015) .

This randomized controlled study was undertaken to evaluate the influence of dynamic soft tissue mobilization (DSTM) of the hamstrings on LBP alleviation among collegiate-level basketball players. The investigation specifically focused on assessing changes in hamstring flexibility, functional pain outcomes, and pelvic alignment following the intervention.

Methodology:

This randomized control study involved sixty collegiate basketball players experiencing low back pain. Participants were allocated randomly into two groups: an intervention group (n=30) and a control group (n=30). The mean age of the athletes was 21.35 ± 2.8 years. The intervention group underwent a three-week DSTM program specifically designed to address hamstring release relevant to basketball movements. DSTM techniques typically involve applying sustained pressure with a tool or therapist's hands to the hamstring muscles while the athlete performs active or passive movements that elongate the muscle (Hopper et al., 2005). The goal was to improve tissue extensibility and reduce myofascial restrictions in the hamstrings (Rao, 2018). Concurrently, the control group engaged in a static stretching regimen for the same duration. Static stretching involved holding a stretched position for a specified duration, a common flexibility exercise (Kurtdere et al., 2020). This approach served as a comparative standard, representing a widely utilized, albeit potentially less dynamic, intervention for hamstring flexibility in athletic settings (Gunn et al., 2018).

Pre- and post-intervention evaluations included the Active Knee Extension Test (AKET) to quantify hamstring flexibility, the Micheli Function Scale for functional outcomes related to LBP, and Pelvic Tilt measurements to assess changes in pelvic alignment (Park & Jung, 2020). All assessments were conducted by blinded evaluators to maintain objectivity. Hamstring flexibility quantified using the Active Knee Extension (AKE) Test objectively measures the angle of knee extension achievable while the hip is flexed to 90 degrees, providing a direct metric of hamstring extensibility (2020) (Singh et al., 2016). LBP evaluated using the Micheli Function Scale is a self-reported questionnaire designed to assess the impact of LBP on daily activities and sports performance. Pelvic tilt measurements measured through pelvic inclinometer captured changes in pelvic alignment, a key biomechanical factor linked to lumbar spine load (Radziszewski, 2012). These comprehensive measures facilitated a robust evaluation of the DSTM intervention.

DSTM

Static Stretching

Results

Following the three-week intervention, both the DSTM and static stretching groups exhibited improvements across all measured parameters, underscoring the general benefit of targeted intervention for LBP and flexibility. In the DSTM group, right AKET scores increased from 118.3° ± 6.3° to 137.67° ± 7.9°, and left AKET scores improved from 118.3° ± 5.1° to 141° ± 7.5°, indicating substantial gains in hamstring flexibility. The Micheli Function Scale scores decreased significantly from 69.3 ± 7 to 17.3 ± 6.2, reflecting a marked reduction in LBP-related functional limitations. Pelvic tilt angle also improved from -1.87° ± 6.6° to 6.83° ± 1.4° in the DSTM group, suggesting a more neutral pelvic alignment. For the static stretching group, right AKET increased from 119° ± 5.7° to 121° ± 5.0°, and left AKET from 118° ± 5.4° to 121.8° ± 5.3°. Micheli scores decreased from 69.6 ± 7.0 to 65.8 ± 7.0, and pelvic tilt increased from -2.67° ± 6.4° to -1.07° ± 5.4°. Although both groups experienced positive changes, comparative analysis revealed that the DSTM group achieved significantly greater improvements in hamstring flexibility ($p < 0.05$), functional outcomes ($p < 0.01$), and pelvic alignment ($p < 0.05$) compared to the static stretching group.

Table1: Demographic Details

Variable(n=60)	**Mean(SD)**
Age (n=60)	21.35±2.85
Height (in cm)	163.88±9.11
Weight (in kg)	62.68±13.46

Table 2: Group 1 changes in variables

Variables	Pre (n=60)	Post(n=60)	t	p
AKET (Right)	118.33±6.3	137.67±7.9	-14.9	<0.05*
AKET(Left)	118.0±5.1	141.0±7.5	-14.69	<0.05*
MFS	69.53±7.0	17.33±6.2	31.83	<0.05*
Pelvic Tilt	-1.87±6.6	6.83±1.4	-7.5	<0.05*

Table 3: Group 2 changes in variables

Variables	Pre (n=60)	Post(n=60)	t	p
AKET (Right)	119.0±5.7	121.0±5.0	-3.2	<0.05*
AKET(Left)	118.17±5.4	121.83±5.3	-5.1	<0.05*
MFS	69.67±7.0	65.8±7.0	7.37	<0.05*
Pelvic Tilt	-2.67±6.4	-1.07±5.4	-2.4	<0.05*

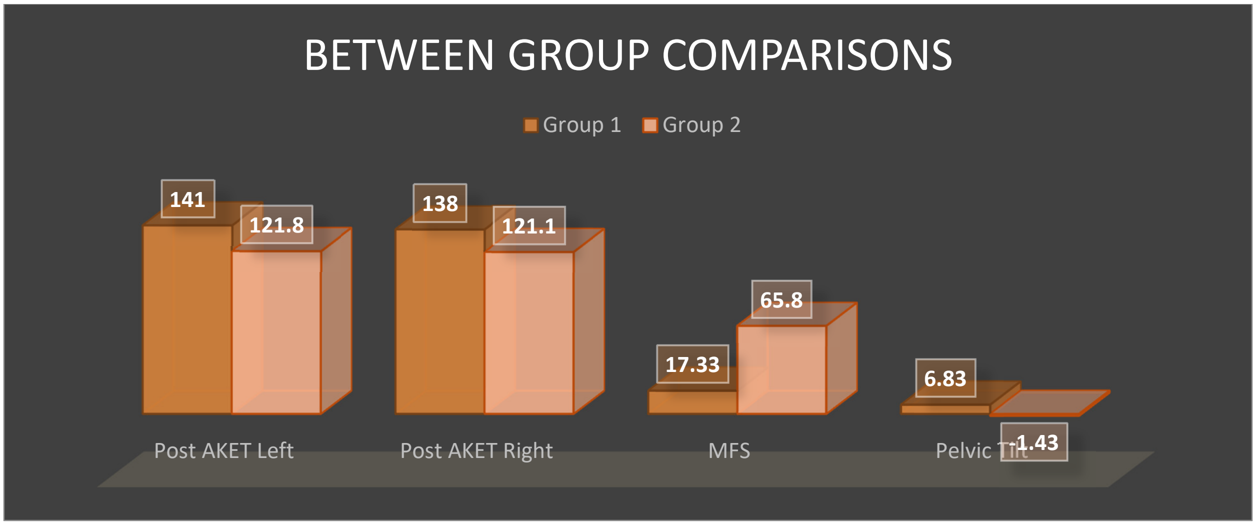

Figure1: Between group comparisons

Discussion

The present study's observations, indicating that DSTM of the hamstrings effectively reduces LBP and improves functional outcomes in collegiate basketball players, align with broader literature on soft tissue mobilization for musculoskeletal conditions (Chambers, 2013) (Celenay et al., 2019). The significant improvements in hamstring flexibility, as evidenced by Active Knee Extension Test scores, reinforce previous findings on the efficacy of dynamic soft tissue techniques over static stretching for increasing range of motion (Hopper et al., 2005) (Gunn et al., 2018). Furthermore, the observed positive changes in the Micheli Function Scale scores resonate with studies demonstrating pain reduction and functional improvement following targeted interventions for LBP (Seo et al., 2020) (Powers et al., 2008). The correction of pelvic tilt measurements provides objective biomechanical support for the clinical improvements, corroborating the interconnectedness of hamstring extensibility, pelvic posture, and lumbar spine health (Radziszewski, 2012) (Hennessey & Watson, 1993).

The superior outcomes observed in the DSTM group across AKET, Micheli Function Scale, and Pelvic Tilt measurements highlight the efficacy of DSTM. The substantial increase in AKET scores for the DSTM group suggests a more profound effect on hamstring extensibility (Hopper et al., 2005) (Singh et al., 2016). This enhanced flexibility likely contributed to the significant reduction in Micheli Function Scale scores, as improved hamstring length can alleviate the biomechanical strain on the lumbar spine that often exacerbates LBP (Jandre Reis & Macedo, 2015). The favourable shift in pelvic tilt angle in the DSTM group further supports this, indicating a restoration of more optimal lumbopelvic rhythm and reduced postural stress (Park & Jung, 2020). While static stretching provided some benefit, its less pronounced impact suggests a limitations in addressing the multifaceted nature of hamstring stiffness and its contribution to LBP compared to DSTM.

DSTM's effectiveness stems from its ability to directly influence soft tissue properties. This technique, often utilizing instruments, applies mechanical pressure while the muscle moves through its range of motion (Hopper et al., 2005) (2020). This dynamic application can disrupt adhesions, remodel collagen fibers, and enhance fluid dynamics within the fascia and muscle tissue, thereby increasing tissue extensibility and reducing mechanical impedance (Rao, 2018). The simultaneous movement also recruits mechanoreceptors, potentially modulating muscle tone and reducing neural tension, which can further contribute to improved flexibility and pain reduction (Curtis & Retchford, 2015) (Kim & Kim, 2020). The targeted release of hamstrings, directly addresses the underlying cause of LBP in these athletes, leading to comprehensive improvements in flexibility, pelvic alignment & pain.

The therapeutic effects of DSTM in this athletic cohort likely stem from several interconnected mechanisms. The direct mechanical pressure on hamstrings given in DSTM break down adhesions and increases tissue compliance within the hamstring musculature (Rao, 2018) (G.-W. Kim & Lee, 2020). This mechanical remodelling enhances muscle extensibility. Secondly, the integration of movement during mobilization, tailored to basketball-specific actions, likely facilitates neuromuscular re-education, optimizing motor control and movement patterns (Simatou et al., 2020) (J. Park & Lee, 2016). Improved hamstring flexibility directly influences pelvic kinematics, promoting a more neutral pelvic alignment and reducing the excessive lumbar lordosis often associated with tight hamstrings (Radziszewski, 2012). This normalization of pelvic position subsequently decreases aberrant mechanical stress on lumbar spinal structures, alleviating LBP. The process may also involve neurophysiological effects, such as a reduction in muscle hypertonicity and an increase in local blood flow, which collectively contribute to pain modulation and tissue healing (Fousekis et al., 2020) (Al Dajah, 2014).

The observed superior efficacy of DSTM over static stretching in this collegiate athlete cohort aligns with prior research suggesting DSTM (or IASTM) provides more rapid or substantial gains in range of motion (Gunn et al., 2018) (Singh et al., 2016). Static stretching, while beneficial for general flexibility, may not adequately address the deeper fascial restrictions or the dynamic movement patterns required in sports like basketball (DeBruyne et al., 2017). DSTM's ability to combine tissue mobilization with active movement appears to facilitate a more integrated and functional improvement in flexibility and biomechanics, directly influencing LBP (Moon et al., 2017). The results underscore that for athletes, an intervention that mirrors the dynamic demands of their sport may yield more effective and clinically meaningful outcomes.

These findings hold important implications for the clinical management and injury prevention strategies for collegiate basketball players. Implementing DSTM as a primary intervention for hamstring tightness associated with LBP could offer a more effective pathway to pain reduction and functional restoration than traditional static stretching (Mortazavi et al., 2015). Improved hamstring flexibility and neutral pelvic alignment not only mitigate LBP but also potentially reduce the risk of future hamstring injuries and other musculoskeletal complaints prevalent in athletes (van Dyk et al., 2018) (Sugiura et al., 2017). Optimizing these biomechanical factors can contribute to enhanced athletic performance by allowing for more efficient movement patterns and reduced pain-related limitations during training and competition (Cannon & James, 1984) (Radziszewski, 2012).

Despite the compelling outcomes, several limitations warrant consideration. The study utilized a relatively short intervention period of three weeks; therefore, the long-term sustainability of the observed improvements remains to be fully determined. The focus on collegiate basketball players, while providing a homogeneous sample, may restrict the direct generalizability of these findings to other athletic populations or the general public with LBP. Future investigations could benefit from assessing retention of flexibility and functional gains over extended periods. Additionally, while the study controlled for static stretching, a comparative analysis with other dynamic flexibility modalities or a combined intervention approach could provide further insights into the optimal treatment protocols.

Subsequent investigations could explore the long-term efficacy and cost-effectiveness of DSTM in preventing LBP recurrence and optimizing athletic performance over an entire competitive season. Researchers might also examine the applicability of DSTM across diverse athletic disciplines and age groups, beyond collegiate basketball. Additionally, comparative studies evaluating DSTM against other advanced manual therapy techniques or combined with core stabilization exercises could provide a more nuanced understanding of optimal intervention protocols for LBP in athletes (Chang et al., 2015). Further inquiry into the precise biomechanical and neurophysiological adaptations induced by DSTM would also enrich the scientific understanding of its therapeutic mechanisms.

Conclusion

This randomized control study demonstrates that dynamic soft tissue mobilization significantly improves hamstring flexibility, reduces low back pain, and promotes better pelvic alignment in collegiate basketball players compared to static stretching. While both interventions yielded positive changes, the DSTM group exhibited markedly superior outcomes across all measured parameters. The dynamic nature of DSTM, which addresses fascial restrictions and enhances tissue extensibility during active movement, appears to contribute to its heightened efficacy. These results suggest that DSTM represents a valuable and more effective intervention for managing LBP and optimizing biomechanics in athletic populations, thereby contributing to both injury prevention and performance enhancement in high-demand sports.

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