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EFFECT OF SCIATIC NERVE MOBILIZATION VERSUS DYNAMIC STRETCHING OF THE LOWER LIMB ON HAMSTRING FLEXIBILITY AND ATHLETIC PERFORMANCE

Original Research

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ABSTRACT

Background: Hamstring tightness is a prevalent concern among athletes, frequently impairing performance and predisposing individuals to musculoskeletal injuries. Optimal management requires interventions that enhance flexibility and reduce functional limitations. Conventional strategies such as static or dynamic stretching have demonstrated benefits, but increasing evidence suggests that neural mobilization techniques, particularly sciatic nerve gliding, may offer superior outcomes by addressing both muscular and neural restrictions. Understanding their comparative effectiveness is essential for guiding clinical and sports practice.

Objective: To evaluate the effects of sciatic nerve mobilization compared with dynamic stretching on hamstring flexibility and athletic performance in physically active males.

Methods: A randomized controlled trial was conducted on 20 male athletes aged 18–40 years who regularly engaged in exercise at least 2–3 times per week. Participants were recruited through convenience sampling and randomly assigned into two groups: the intervention group (n=10) received sciatic nerve gliding exercises, while the control group (n=10) performed dynamic lower limb stretching. The intervention was delivered twice weekly for three weeks, totaling six sessions. Outcome measures included the Straight Leg Raise (SLR) and Active Knee Extension Test (AKET) for hamstring flexibility, and 10-yard and 20-yard sprint tests for performance. Assessments were recorded pre- and post-intervention using a goniometer and stopwatch. Data were analyzed using SPSS version 27.0, with the Shapiro–Wilk test applied for normality, followed by Mann–Whitney U and Wilcoxon signed-rank tests for between- and within-group comparisons.

Results: The mean age of participants was 21.30 ± 1.81 years, with an average height of 1.74 ± 0.028 m and weight of 75.15 ± 4.56 kg. Sports distribution included football (35%), hockey (30%), cricket (20%), and others (15%). Significant improvements were observed in the intervention group, with greater gains in SLR right leg ($p=0.000$), AKET right leg ($p=0.023$), and AKET left leg ($p=0.022$) compared to the control. Both groups improved significantly in sprint performance ($p<0.05$), but the neural mobilization group showed superior flexibility outcomes.

Conclusion: Sciatic nerve mobilization was found to be more effective than dynamic stretching in improving hamstring flexibility and enhancing functional performance among young, physically active males. These findings support its application as a targeted intervention in sports rehabilitation and conditioning programs.

Keywords: Athletic performance; Dynamic stretching; Hamstring flexibility; Neural mobilization; Sciatic nerve; Sciatic nerve gliding; Sports rehabilitation.

INTRODUCTION

Athletic performance is dependent on the coordinated function of the neuromuscular and musculoskeletal systems, particularly in the lower extremities where explosive and repetitive activities such as sprinting, jumping, and decelerating are routine (1). The hamstring muscle group, composed of the semimembranosus, semitendinosus, and biceps femoris, spans both the hip and knee joints, contributing not only to hip extension and knee flexion but also to the stabilization of dynamic movements (2). These muscles originate from the ischial tuberosity and insert onto the tibia and fibula, enabling their critical biomechanical role in locomotor efficiency (3). However, the hamstrings are prone to injury, typically resulting from excessive eccentric loading, rapid lengthening under tension, or deficits in neuromuscular control (4). Limited flexibility in this muscle group can heighten passive stiffness, reduce range of motion, and predispose surrounding tissues and joints to increased stress, while also contributing to postural alterations such as anterior pelvic tilt and altered lumbopelvic mechanics, both of which compromise performance and elevate injury risk (5). Beyond purely muscular contributions, the sciatic nerve, which runs adjacent to the hamstrings, may also play a role in perceived tightness when its mobility is restricted (6). This neurodynamic factor has attracted growing attention, as traditional hamstring-focused interventions may not adequately address neural components of reduced flexibility. Epidemiological data confirm the clinical importance of this issue: hamstring injuries account for 12–16% of all injuries in professional football and up to 29% in track and field athletes, with recurrence rates reaching 34% (7). Male athletes are particularly vulnerable, experiencing injuries 1.5 to 2 times more often than females, largely due to lower baseline flexibility and engagement in high-intensity movements (8).

Physiotherapy strategies to restore hamstring flexibility typically include static stretching, proprioceptive neuromuscular facilitation, strengthening, and manual therapy (9). While effective to some extent, these interventions may not fully restore function when neural structures contribute to restriction (10). Sciatic nerve mobilization has therefore emerged as a valuable adjunct, employing controlled movements designed to promote neural excursion, reduce intraneural tension, and optimize neurodynamics (11). In parallel, dynamic stretching has gained favor as a preparation tool in sports, as it promotes muscle activation, proprioceptive readiness, and neuromuscular coordination, in contrast to static stretching which may temporarily dampen muscle activity (12,13). By preparing the muscle–tendon units for rapid loading cycles, dynamic stretching contributes to both performance enhancement and injury risk reduction. The importance of hamstring flexibility as a determinant of athletic performance and injury prevention is therefore well established (14,15). Recent evidence underscores the benefits of incorporating neural mobilization techniques. For example, a study found nerve gliding superior to static stretching for extensibility and passive stiffness (16), while another study observed Nordic exercises outperforming nerve gliding in certain contexts (17). Other studies confirmed the differential biomechanical behavior of neural versus muscular tissues (18) and demonstrated that nerve sliders can significantly improve hip flexion in individuals with tightness (19). Moreover, a study showed that both static stretching and neural sliders are effective in improving hamstring flexibility (20). Despite this accumulating evidence, limited research directly compares the effects of sciatic nerve mobilization and dynamic stretching. This gap in the literature warrants investigation, as identifying the more effective approach could streamline rehabilitation, optimize flexibility, and reduce treatment time in athletes with hamstring tightness. The present study is therefore designed to compare the relative effectiveness of sciatic nerve mobilization and dynamic stretching in improving hamstring flexibility, with the objective of determining the superior intervention for clinical and sports settings.

METHODS

This single-blinded randomized controlled trial was conducted following approval from the Institutional Ethical Committee, and written informed consent was obtained from all participants prior to their enrollment. The study was carried out at the Pakistan Sports Board Coaching Center, Lahore, over a period of six months. Participants were recruited using a non-probability convenience sampling technique, and random allocation into two groups was performed using the lottery method. A total of 24 male athletes, including footballers, rugby players, hockey players, and cricketers, were initially recruited based on a calculated sample size derived from standard formulas (mean values of 4.9 and 3.3, variance of 1.8, confidence level of 95%, power of 0.8, and two-tailed testing), which determined 12 subjects per group. Anticipating a 10% attrition rate, additional participants were recruited to account for potential dropouts. The inclusion criteria specified male athletes between the ages of 18 and 40 years who presented with hamstring tightness.

This was defined as the inability to achieve more than 160° of knee extension with the hip flexed at 90°, and less than 70° hip flexion during the Straight Leg Raise (SLR) test (11). Exclusion criteria included individuals with recent injuries (within the last six months) to the lumbar spine, those with prolonged inactivity exceeding three consecutive days, athletes with a history of low back pathology such as intervertebral disc bulge, fractures, trauma, or those unwilling to participate (12). Pre- and post-intervention assessments were conducted to evaluate hamstring flexibility and athletic performance. The Active Knee Extension (AKE) test, Straight Leg Raise (SLR) test, and 10- and 20-yard sprint tests were administered. For the SLR test, participants lay in a supine position while one leg was raised; a goniometer was aligned with the greater trochanter, pelvic midline, and femur to measure the hip flexion angle. Hamstring flexibility was graded as excellent (>110°), good (80–110°), or fair (60–79°), with the test showing 97% specificity and 66% sensitivity (15). In the AKE test, participants extended one knee while the other leg was maintained in vertical flexion, and the angle of extension was measured. The test demonstrated a reliability of 0.75–0.84 and validity of 0.87–0.94 (16). Athletic performance was assessed through 10- and 20-yard sprint tests, in which the time taken to complete the sprint was recorded using a stopwatch. These tests have demonstrated reliability of 0.89–0.93 and validity of 0.99.

Following baseline assessment, participants were randomly allocated into two groups while maintaining blinding of participants. Group 1 (n=10) received sciatic nerve gliding exercises performed in a supine position. Each session involved placing the cervical spine, thoracolumbar spine, and hip in flexion, followed by controlled knee extension to apply proximal and distal gliding tension on the sciatic nerve. Each set was held for 30 seconds, repeated six times per leg, for a total of 3 minutes per limb. Sessions were conducted twice weekly for three weeks, totaling six sessions (13). Group 2 (n=10) performed dynamic hamstring stretching, also in supine. The hip was placed in flexion, the knee in extension, and the ankle in neutral alignment. A downward force was applied at the ankle to stretch the hamstring for 30 seconds per repetition, repeated five times per leg, totaling 2.5 minutes per limb. The same treatment frequency and duration were maintained as in Group 1 (14). During the course of the study, four participants withdrew. Reasons for dropout included personal commitments (n=2), non-adherence to the intervention protocol (n=1), and a sports-related injury unrelated to the intervention (n=1). Consequently, data from 20 participants were included in the final analysis. Statistical analysis was conducted using SPSS version 27.0. Continuous variables were summarized as mean and standard deviation, while categorical variables were expressed as frequencies and percentages. Normality of data distribution was tested using the Shapiro–Wilk test, given the sample size of less than 50. As the data were not normally distributed, non-parametric methods were applied. Between-group comparisons were performed using the Mann–Whitney U test, while within-group comparisons were conducted with the Wilcoxon signed-rank test.

RESULTS

The study enrolled 24 male athletes, of whom 20 completed the trial following attrition. The mean age of participants was 21.30 ± 1.809 years, ranging from 18 to 24 years. The mean height was 1.74 ± 0.028 m (range 1.69–1.81 m), and the mean body weight was 75.15 ± 4.557 kg (range 64–89 kg). Within the experimental group, the mean age, height, and weight were 20.60 ± 2.12 years, 1.75 ± 0.036 m, and 76.40 ± 4.81 kg, respectively, while the control group recorded 22.00 ± 1.15 years, 1.73 ± 0.016 m, and 73.90 ± 4.15 kg, respectively. In terms of sports distribution, 4 participants (20%) were cricketers, 7 (35%) were footballers, 6 (30%) were hockey players, and 3 (15%) were engaged in other sports. Between-group analysis using the Mann–Whitney U test revealed that the sciatic nerve gliding group demonstrated significantly greater improvements in hamstring flexibility compared to the dynamic stretching group. Statistically significant differences were observed for the Straight Leg Raise (SLR) right leg ($p = .000$), Active Knee Extension Test (AKET) right leg ($p = .023$), and AKET left leg ($p = .022$). No significant differences were detected for the SLR left leg ($p = .380$), the 10-yard sprint test ($p = .621$), or the 20-yard sprint test ($p = .648$). Within-group analysis using the Wilcoxon signed-rank test demonstrated significant improvements across all measured outcomes in both groups. In the sciatic nerve gliding group, median values improved significantly for the 10-yard sprint, 20-yard sprint, SLR right and left legs, and AKET right and left legs (all $p < 0.05$). Similarly, in the dynamic stretching group, significant improvements were also recorded across all outcome measures, including both sprint tests, SLR, and AKET bilaterally (all $p < 0.05$). These findings indicate that both interventions effectively enhanced hamstring flexibility and athletic performance, although the sciatic nerve gliding group showed superior gains in measures of flexibility.

Table 1: Demographic Variables of Groups

Variable	Experimental group (n=10) Sciatic nerve gliding	Control group (n=10) Dynamic Stretching
Age	20.60±2.12	22.00±1.15
Height	1.75±.036	1.73±.016
Weight	76.40±4.81	73.90±4.15

Table 2: Mann-Whitney U test Between Groups Analysis

	GROUPS	MEAN RANK	MEDIAN	Z SCORE	P value
10m yard test	Interventional	11.15	1.16100	-.495	.621
	Control	9.85			
20m yard test	Interventional	11.10	3.1250	-.456	.648
	Control	9.90			
SLR right leg	Interventional	15.20	83.5000	-.3560	.000
	Control	5.80			
SLR left leg	Interventional	9.35	84.5000	-.879	.380
	Control	11.65			
AKET right leg	Interventional	13.50	123.0000	-2.276	.023
	Control	7.50			
AKET left leg	Interventional	13.50	115.0000	-2.296	.022
	Control	7.50			

Note: Mann-Whitney U test; SLR: Straight Leg Raise, AKET: Active knee extension test; P=0.05

Table 3: Wilcoxon Test within Groups Analysis for Sciatic Nerve Gliding Group

Group	Test	Treatment	Median	Wilcoxon	Mean rank	Z score	P value
Interventional group (neural gliding)	10m yard test	Pre treatment	4.2950	98.500	5.50	-2.803	<0.05
		Post treatment	1.0275				<0.05
	20m yard test	Pre treatment	4.6525	99.000	5.50	-2.805	<0.05
		Post treatment	3.0200				<0.05
	SLR right leg	Pre treatment	68.5000	58.000	.00	-2.816	<0.05

Group	Test	Treatment	Median	Wilcoxon	Mean rank	Z score	P value
		Post treatment	84.7500				<0.05
	SLR left leg	Pre treatment	59.5000	93.500	.00	-2.810	<0.05
		Post treatment	76.0000				<0.05
	AKET right leg	Pre treatment	33.7500	75.000	.00	-2.805	<0.05
		Post treatment	1.23.0000				<0.05
	AKET left leg	Pre treatment	38.7500	75.000	.00	-2.805	<0.05
		Post treatment	117.5000				<0.05

Note: Wilcoxon Signed Ranks Test: SLR: Straight Leg Raise, AKET: Active knee extension test; P=0.05

Table 4: Wilcoxon Test within Groups Analysis for the Dynamic stretching Group

Group	Test	Treatment	Median	Wilcoxon	Mean rank	Z score	P value
Control group (dynamic stretching)	10m yard test	Pre treatment	4.5150	98.500	5.50	-2.803	<0.05
		Post treatment	1.0275				<0.05
	20m yard test	Pre treatment	5.3575	99.000	5.50	-2.803	<0.05
		Post treatment	2.9450				<0.05
	SLR right leg	Pre treatment	57.2500	58.000	.00	-2.812	<0.05
		Post treatment	72.2500				<0.05
	SLR left leg	Pre treatment	54.0000	93.500	.00	-2.807	<0.05
		Post treatment	83.7500				<0.05
	AKET right leg	Pre treatment	43.7500	75.000	.00	-2.809	<0.05
		Post treatment	1.1.5000				<0.05
	AKET left leg	Pre treatment	42.5000	75.000	.00	-2.803	<0.05
		Post treatment	102.0000				<0.05

Note: Wilcoxon Signed Ranks Test: SLR: Straight Leg Raise, AKET: Active knee extension test; P=0.05

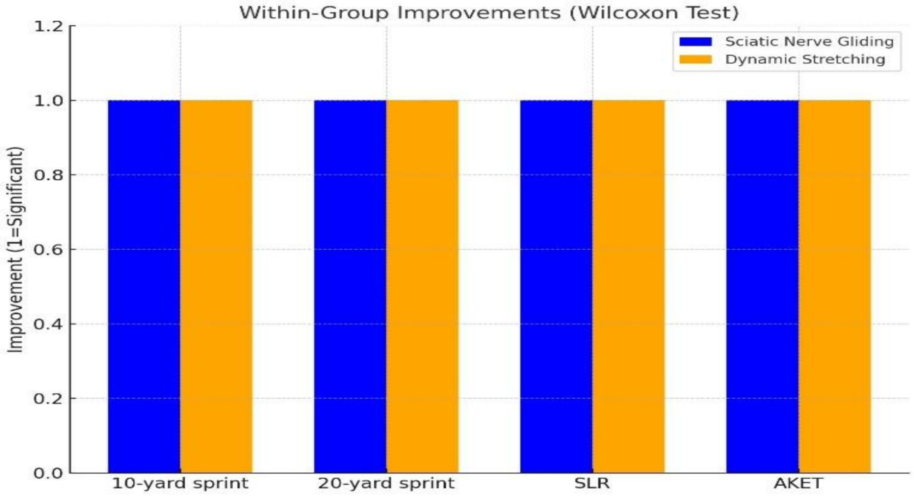

Figure 1 Within-Group Improvements (Wilcoxon Test)

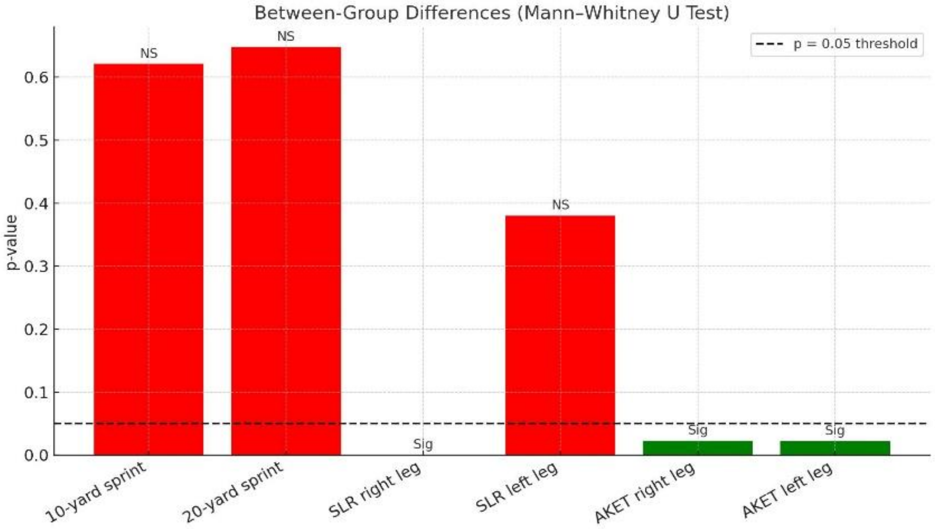

Figure 2 Between-Group Difference (Mann-Whitney U Test)

DISCUSSION

The present study evaluated the comparative effects of sciatic nerve mobilization and dynamic stretching on hamstring flexibility and athletic performance in young, physically active males. Both interventions produced significant improvements in flexibility and sprint performance; however, greater gains were observed in the sciatic nerve mobilization group. These findings indicate that neurodynamic techniques may hold superior value over traditional stretching methods when the aim is to optimize both flexibility and functional athletic capacity. The outcomes are consistent with earlier evidence showing that the addition of neural mobilization techniques enhances lower limb mobility and improves neurophysiological parameters in athletes with previous hamstring injuries (20,21). While those studies combined neural and static stretching, the current findings extend this evidence by demonstrating that sciatic nerve gliding alone was sufficient to produce marked improvements, even in healthy individuals. In contrast, other research reported that different forms of neural mobilization, such as sliding and tensioning, showed equivalent short-term effects but with reduced sustainability of gains beyond one hour (22). The present findings differ by showing longer-lasting improvements, likely attributed to the structured frequency of multiple treatment sessions and the inclusion of sport-specific performance outcomes.

Further support is provided by studies involving non-athletic populations, including sedentary individuals with or without diabetes, where sciatic nerve mobilization improved hamstring and calf flexibility (23). While those results emphasized flexibility outcomes alone, the current study demonstrated broader benefits by incorporating sprint-based performance measures, highlighting the functional transferability of neural mobilization techniques. Additional research comparing neurodynamic interventions with passive stretching in populations experiencing low back pain has shown superior outcomes for neural mobilization in reducing pain and improving muscle length (24). The present findings align with these results, though the emphasis here was on athletic function rather than pain relief. Other work comparing neural sliders and tensioners in healthy individuals reported both approaches to be equally effective (25). Although these studies suggest equivalence within neural techniques, the present findings demonstrate that neural gliding is superior to traditional dynamic stretching when performance outcomes are prioritized. The implications of these findings are clinically relevant. Enhanced hamstring flexibility and sprint performance reduce the risk of lower limb injuries and contribute to improved athletic readiness. The ability of sciatic nerve mobilization to target neurodynamic restrictions in addition to muscular stiffness may explain its superiority, as it addresses both muscular and neural contributors to limited mobility. This dual mechanism makes it a valuable addition to rehabilitation and performance enhancement programs.

The strengths of the study include its randomized controlled design, the use of validated outcome measures, and the inclusion of both flexibility and functional performance parameters, which provide a comprehensive evaluation of intervention effects. However, several limitations must be acknowledged. The small sample size reduces generalizability and statistical power. Attrition further limited the analyzed sample, and although accounted for in design, it may still have influenced results. Some participants reported mild discomfort and transient weakness during interventions, which could have impacted compliance. Variations in exercise execution and episodes of fatigue may have introduced inconsistencies in treatment adherence. Additionally, the short-term nature of the intervention precludes conclusions regarding the long-term retention of benefits. Future research should aim to recruit larger and more diverse populations, including female athletes and individuals from different sporting disciplines. Extending follow-up would clarify the durability of improvements and the potential preventive role of sciatic nerve mobilization in reducing hamstring injury recurrence. Incorporating advanced biomechanical and neurophysiological assessments may also provide deeper insights into the mechanisms underlying observed benefits. Structured supervision and close monitoring of exercise execution are recommended to enhance treatment fidelity and reduce fatigue-related noncompliance. In summary, the study demonstrated that sciatic nerve mobilization was more effective than dynamic stretching in improving hamstring flexibility and athletic performance among young active males. These findings highlight the clinical relevance of neurodynamic techniques in sports rehabilitation and performance enhancement, while also underscoring the need for further investigation to optimize their application across varied populations and contexts.

CONCLUSION

In conclusion, the study demonstrated that while both sciatic nerve mobilization and dynamic stretching were effective in improving hamstring flexibility and athletic performance, sciatic nerve mobilization produced superior overall outcomes. By addressing both muscular and neural components of mobility, it offered greater enhancements in functional performance, making it a valuable intervention for physically active individuals. These findings emphasize the practical importance of incorporating neural mobilization techniques into athletic training and rehabilitation programs to optimize performance, reduce injury risk, and promote long-term musculoskeletal health.

AUTHOR CONTRIBUTION

Author	**Contribution**
Muhammad Farooq	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Haris	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing

Author	**Contribution**
	Has given Final Approval of the version to be published
Tanveer Sikander	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Arfa Asif	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Filza Shoukat	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sadia Khalid	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Adnan Hashi*	Contributed to study concept and Data collection Has given Final Approval of the version to be published

REFERENCES

1. PONTAGA I, VILKS S, ABOLINS V. Assessment of static and dynamic balance performance in team sports athletes. Journal of Physical Education and Sport (JPES). 2024;24(1):123-32.

2. Afonso J, Rocha-Rodrigues S, Clemente FM, Aquino M, Nikolaidis PT, Sarmento H, et al. The hamstrings: anatomic and physiologic variations and their potential relationships with injury risk. Frontiers in physiology. 2021;12:694604.

3. Hashim A, Mustafa I, Shahid S, Butt SS, Ali A. Students' satisfaction in online education programs among undergraduate physiotherapy students of Lahore during covid-19. Rawal Medical Journal. 2020;45(3):507-9.

4. Imtiaz R, Sattar A, Qaiser A, Azfar H, Haq K, Bukhari SA, et al. Association of hamstring tightness with lower extremity injuries in athletes (analytical cross-sectional study). Pakistan Journal of Medical & Health Sciences. 2023;17(05):575-.

5. Amjad F, Hashim A, Bashir A, Sunbal S. GENDER DIFFERENCE IN FUNCTIONAL DISABILITY AMONG PATIENT WITH NON-SPECIFIC CHRONIC LOW BACK PAIN. Pakistan Journal of Rehabilitation. 2024;13(1):51-6.

6. Mullins K, Mac Colgáin D, Carton P. Incidence and severity of hamstring Injuries in female athletes who play field sports: a systematic review with meta-analysis of prospective studies. Journal of orthopaedic & sports physical therapy. 2022;52(11):740-A5.

7. Garcia AG, Andrade R, Afonso J, Runco JL, Maestro A, Espregueira-Mendes J. Hamstrings injuries in football. Journal of orthopaedics. 2022;31:72-7.

8. Yu S, Lin L, Liang H, Lin M, Deng W, Zhan X, et al. Gender difference in effects of proprioceptive neuromuscular facilitation stretching on flexibility and stiffness of hamstring muscle. Frontiers in physiology. 2022;13:918176.

9. Liyanage E, Malwanage K, Senarath D, Wijayasinghe H, Liyanage I, Chellapillai D, et al. Effects of Different Physical Therapy Interventions in Improving Flexibility in University Students with Hamstring Tightness-A Systematic Review and Network Meta-analysis. International Journal of Exercise Science. 2024;17(3):359.

10. Kazim SA, Nawaz A, Javed MT, Liaquat M, Noor S, Sheeraz M, et al. Association of Quality of Life and Pain Intensity in Patients of Trigger Points: Quality of Life and Pain Intensity. Pakistan Journal of Health Sciences. 2023:20-4.

11. Parveen S, Ansari S, Sharma S. Effects of the addition of neural mobilization to static stretching on nerve conduction and mobility in hamstring-injured soccer players. Sport Sciences for Health. 2024;20(1):193-201.

12. Cai P, Liu L, Li H. Dynamic and static stretching on hamstring flexibility and stiffness: A systematic review and meta-analysis. Heliyon. 2023;9(8).

13. Javaid N, Hashim A. Level of shoulder instability among adult female competitive swimmers. Rawal Medical Journal. 2022;47(4):986-.

14. Altundag E, Soylu C. Tailoring Athletic Performance: The Key Function of Hamstring Muscles. 2024.

15. Naeem Z, Amjad F, Hashim A, Chattha H, Athar I, Rafay I. Health-related quality of life in diabetic foot ulcer patients with unilateral above-knee amputation. Rawal Medical Journal. 2022;47(4):925-.

16. Satkunskiene D, Ra'ad MK, Muanjai P, Mickevicius M, Kamandulis S. Immediate effects of neurodynamic nerve gliding versus static stretching on hamstring neuromechanical properties. European Journal of Applied Physiology. 2020;120(9):2127-35.

17. Lim J-y, Lee I-w, Kim K-d. Immediate Effects of Neural Slider and Neural Tensioner on Forward Bending in Subjects with Hamstring Tightness. Journal of Musculoskeletal Science and Technology. 2021;5(1):6-13.

18. Jamil K, Robinson S, Abro SA, Hayat S, Zia K, Arzoo O, et al. Prevalence of Hamstring Tightness Among Healthcare Workers: Hamstring Tightness among Healthcare Workers. THE THERAPIST (Journal of Therapies & Rehabilitation Sciences). 2024:62-7.

19. Masood K, Riaz H, Ghous M, Iqbal M. Comparison between dynamic oscillatory stretch technique and static stretching in reduced hamstring flexibility in healthy population: A single blind randomized control trial. J Pak Med Assoc. 2020;70.

20. Williams K, Barraza JM, Cox ER. Effects of Neural Tension on Hamstring Flexibility in Collegiate Dancers: Neural Gliding vs. Dynamic Stretching 2021.

21. Hegishte AS, Kumar N. Effect of proprioceptive neuromuscular facilitation and dynamic stretching on flexibility, agility, and balance in hamstring tightness among collegiate level badminton players. International Journal of Research in Medical Sciences. 2023;11(5):1758-63.

22. Pesonen J, Shacklock M, Suomalainen J-S, Karttunen L, Mäki J, Airaksinen O, et al. Extending the straight leg raise test for improved clinical evaluation of sciatica: validity and diagnostic performance with reference to the magnetic resonance imaging. BMC musculoskeletal disorders. 2021;22:1-9.

23. Chaphekar A, Somarajan S, Naik M, Kothiya D, Nakrani J, Trivedi S, et al. Prevalence of Hamstrings Tightness Using Active Knee Extension Test among Diamond Assorters. Indian Journal of Public Health Research & Development. 2021;12(2):7-11.

24. D'souza CJ, Rajasekar S, Shetty RL. Comparing the immediate effects of different neural mobilization exercises on hamstring flexibility in recreational soccer players. Hong Kong Physiotherapy Journal. 2024;44(02):147-55.

25. Siddiqui H, Khan S, Saher T, Siddiqui Z. Effect of sciatic nerve mobilisation on muscle flexibility among diabetic and non-diabetic sedentary individuals: a comparative study. Comparative Exercise Physiology. 2021;17(3):229-34.