Parul University Journal of Health Sciences and Research
ISSN:2583-990X (E)
https://doi.org/10.62373/PUJHSR.2023.122

Effects of Sub-Occipital Muscles Inhibition and Self Stretch on Calf and Hamstring Muscle Tightness: One Time Comparative Study

Shruti Panchal *[1], Dharaben Patel [2], Ambica Mall [3], Threety Pruchhak [4].

[*1] Assistant professor, Parul Institute of Physiotherapy, Parul University, Vadodara, Gujarat, India.
[2,3,4] Parul Institute of Physiotherapy, Parul University, Vadodara, Gujarat, India.

Corresponding Author: Dr. Shruti Panchal, Assistant Professor, Parul Institute of Physiotherapy, Parul University, Vadodara, Gujarat, India.
E-Mail: shruti.panchal28213@paruluniversity.ac.in

ABSTRACT
Background: Muscle tightness is the most limiting factor for restricted ROM and decreased joint flexibility. Hamstring and calf muscles are more prone to getting tight, which causes musculoskeletal problems. This study focused on checking the effects of various therapeutic techniques, including the sub-occipital muscle inhibition technique and self-stretching technique, on hamstring and calf muscle flexibility in subjects with tight muscle groups.
Objectives: To determine the effects of sub-occipital muscle inhibition and self-stretch on calf and hamstring muscle tightness.
Methodology: A total number of 60 subjects aged between 20 and 45years were analyzed for the Active knee extension test, Passive dorsiflexion test, and Sit and reach test to assess the sub-occipital muscle inhibition and self-stretch on calf and hamstring muscle tightness.
Result: Showed significant improvement in AKE following suboccipital muscle inhibition (pre= 135.9; post = 162.63) and self-stretching (pre= 137.53; post=162.13) Had been obtained by comparing pre and post-intervention values of outcome measures AKE () (AKE, SRT and Ankle DF) by using paired t-test whereas between-group comparison of post, data mean and SD is done by impaired t-test.
Conclusion: From the results, it is concluded that the sub-occipital muscle inhibition technique is more effective in relieving tightness from the hamstring and calf group of muscles as compared to the self-stretching technique in AKE, SRT, and Ankle dorsiflexion.
Keywords: calf muscle tightness, Hamstring muscle tightness.

Background

Calf and hamstring tightness can impact the body's static and dynamic equilibrium and mobility [1]. Muscle tightness has long been used to define the physical length of a muscle, with tight muscles having a slight to substantial loss in length or a diminished ability to stretch from a neutral posture [2]. Short hamstrings have been connected to lumbar spine abnormalities, low back general dysfunction syndromes, contractures induced by central nervous system impairments, and sports-related injuries [3]. By rotating the pelvis posteriorly, the origin of the hamstring muscle is brought closer to its insertion [4]. Calf tightness reduces ankle dorsi flexion range of motion (ROM), which can impair walking and lead to falls in the elderly [5].

During a heel strike, the quadriceps femoris contracts eccentrically, while the gastrocnemius and soleus muscles contract concentrically during mid-stance and push-off [6]. Achilles tendinitis, gastrocnemius strain, and plantar fasciitis have all been linked to restrictions in normal ankle dorsi flexion range of motion (ROM) due to tight calf muscles in sports medicine [7]. Hamstring discomfort affects roughly 45% of young adults[8]. Hamstring tightness is fairly common among college students between the ages of 18&25[9].

The hamstrings, rectus femoris, and gastrocnemius are the calf's most frequently strained bi-articular muscles. In the following age categories, the borderline values for dorsiflexion are as follows: (3 to 4 years- 70), (5 to 13 years- 100), and (14 to 19 years- 50). Other causes of calf death are dehydration, lack of muscular stretching, extended physical exertion, and weak muscles, contributing to muscle tightness. claudication of the arteries and Calf muscle pain can be caused by constriction or blockages in the arteries that feed blood to the calf muscle. Because the calf muscles cannot support the foot when overly tight, a person is more prone to develop plantar fasciitis. Decreased hamstring extensibility may also lead to low back pain as the hamstrings pull the pelvis into posterior rotation and result in spinal compensations[10]. The eccentric contraction of the hamstrings that occurs during the late swing phase of running to decelerate knee extension has been reported to be associated with such injuries [11].

It has been reported that the flexibility of the hamstring increased as a result of an intervention targeting the sub-occipital muscles, and the sub-occipital muscle inhibition (SMI) technique is a method of relaxing the tension in the four muscles located between the occiput and axis, which regulates the upper cervical vertebra[12]. Body movement increases the strain on nerves and moves nerves associated with the surrounding tissue. Reduced hamstring flexibility can result from immobilization of the sciatic, tibial, and peroneal nerves, which can then lead to an outcome of a compromised straight leg raise (SLR) test[13].

Active Knee Extension (AKE), Straight leg raise, and Sit and Reach (SR) tests are the valid and reliable tools used to assess hamstring flexibility with ICC 0.87-0.94 and 0.93-0.97 for AKE and SLR, respectively [14,15]. Hamstring tightness was considered if the volunteer could not keep the hip flexed at 90° and the knee totally extended (180°)[16]. At the same time, Ankle dorsi flexion ROM can be used to evaluate the flexibility of calf muscles.

Different interventions for hamstring muscle tightness include Self-stretching techniques, manual stretching techniques, equipment-assessed stretching, and Wall-Supported Single-Leg Stretch are some of the different treatments for hamstring muscle tightness. Take two or three deep breaths while relaxing your leg against the wall. Forward Fold to Back Bending Upward-Reaching Mountain [17]. Among the stretching methods are ballistic stretching, static stretching, and variations of proprioceptive neuromuscular facilitation (PNF) techniques. Ballistic (bouncing) stretching is a rapid, jerky movement in which a body part is put into motion and momentum carries it through the ROM until the muscles are stretched to their physiological limit[18]. Different intervention for calf muscle tightness is Calf tension release with a blanket massage, toes on the wall stretch, standing forward bend calf stretch, calf stretching with a folding chair, and calf lengthening in a triangle pose [19].

Hamstring muscle tightness is defined as a Knee Extension Angle (KEA) greater than 20 degrees, where KEA is the degree of knee flexion from terminal knee extension[20]. The traditional sit-and-reach box restricts the ankles to a dorsi flexion position of 90°. Therefore, the midpoint between the horizontal (180°) and the neutral position (90°) was defined as 135°

plantar flexion[21]. For the sub-occipital muscle inhibition technique, the force was applied with the finger pads over the atlas in the direction of the ceiling with slight traction in a cranial direction for 2 minutes[22].

Flexibility is a significant requirement in young adults, and their profession demands a lot of bending, moving, and twisting of the musculoskeletal system. According to their professions, increased muscle tightness in the young age group is observed. Many studies have shown the effectiveness of self-stretching and sub-occipital muscle inhibition on the hamstring and calf muscle tightness. However, we carried out a comparative study on the effectiveness of the sub-occipital muscle inhibition or self-stretching technique for the hamstring and calf muscle group.

Methodology

Study design: One-time comparative study

Inclusion criteria: Willingness of the subjects to participate in the study (informed consent signature), all the subjects in age group 20-45 years, unilateral or bilateral hamstring and calf tightness - SLR test, passive dorsi flexion test, sit and reach test.

Exclusion criteria: history of any injury to lower limb, history of herniated disk or lumbar protrusions, history of acute back pain, history of pain paresthesia in lower limbs.

Outcome measures: passive dorsi flexion test, Active knee extension test (popliteal angel), Sit and reach test.

Procedure: After matching the inclusion and exclusion criteria, 60 subjects with calf and hamstring tightness were included. All subjects were randomly divided into two equal groups after obtaining consent of individual subjects where group A(n=30) received suboccipital muscle inhibition technique and group B (n=30) received self-stretching of hamstring and calf muscles; all outcomes were taken before and immediately after intervention For hamstring muscle self-stretching technique Subjects in prolonged sitting, stretching their hands forward towards the feet for 30 seconds with three repetitions [23].

Suboccipital muscle inhibition technique: Subjects were taken supine, lying with eyes closed, and the therapist sat on the subject's head side. The subject's head was suspended in the therapist's hand, with fingers palpating suboccipital muscles at the base of the skull. The therapist rested the pads of her fingers on the projection of the posterior arch of the atlas, followed by a sustained stretch, which was applied to suboccipital muscles, pulling the head

outwards towards the therapist. Stretch force was maintained for 2 minutes to enhance the relaxation of the muscles.

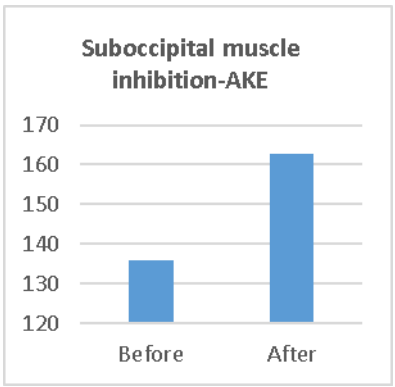
Result

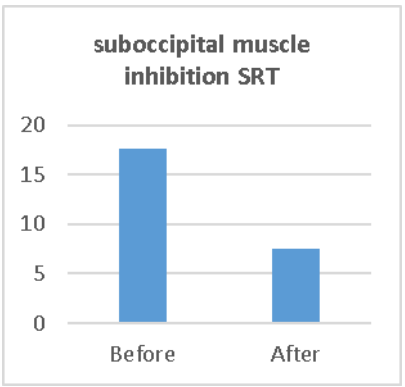
Results have been obtained by comparing pre and post-intervention values of outcome measures (AKE, SRT, and Ankle DF) by using paired t-test, whereas between-group comparison of post-data mean and SD is obtained from unpaired t-test.

Table 1: Sub-occipital muscle inhibition- AKE, SRT, ANKLE DF.

Parameters	Before (Mean± SD)	After (Mean± SD)	t-value	p-value
AKE	135.9±5.14	162.3±3.99	26.141	0.005
SRT	17.6±7.13	7.5±5.12	12.075	0.005
Ankle DF	4.33±1.19	14.4±1.05	34.089	0.005

When comparing AKE, SRT and ankle dorsiflexion ROM following suboccipital muscle inhibition technique, pre and immediately-after-intervention mean ± SD values obtain were 135.9 ± 5.14 and 162.3 ± 3.99 (for AKE), 17.6±7.13 and 7.5±5.12(for SRT) and 4.33±1.19 and 14.4±1.05 (for Ankle DF) with t- values 26.141, 12,075, 34,089 respectively suggesting significant improvement of hamstring and calf muscle flexibility with p value significant at <0.05.





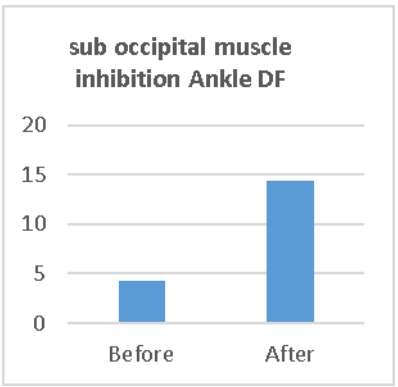
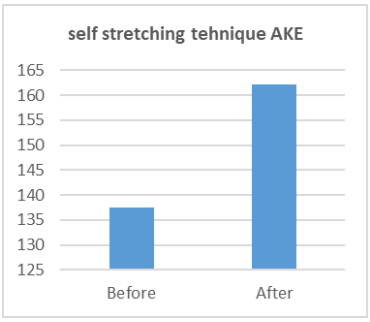
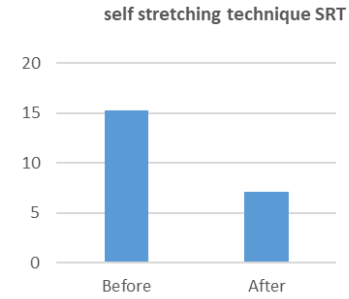


Table 2: Self-stretching technique: AKE, SRT, ANKLE DF.

Parameters	**Before (Mean± SD)**	**After (Mean± SD)**	**t-value**	**p-value**
AKE	137.5±7.71	162.1±7.23	18.201	0.005
SRT	15.2±4.47	7.13±5.57	9.340	0.005
Ankle DF	4.16±1.18	14.06±0.67	35.755	0.005

When comparing AKE, SRT, and ankle dorsiflexion ROM following self- stretching technique, pre and immediately-after-intervention mean ± SD values obtained were 137.5±7.71 and 162.1±7.23 (for AKE), 15.2±4.47 and 7.13±5.57for SRT) and 4.16±1.18 and 14.06±0.67 (for Ankle DF) with t- values 18.201,9.340,35.755 respectively suggesting significant improvement of hamstring and calf muscle flexibility with p-value significant at <0.05.





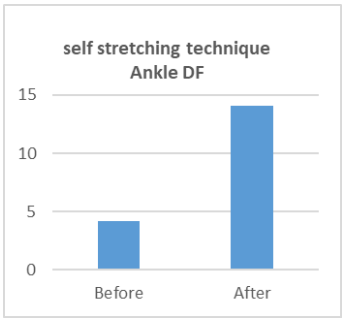
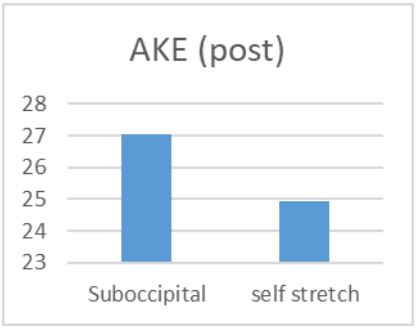
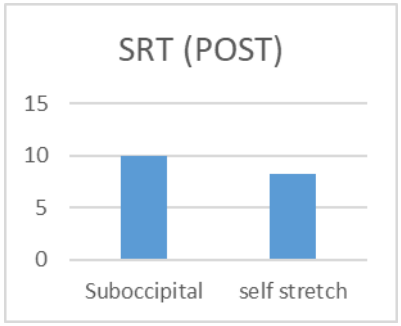


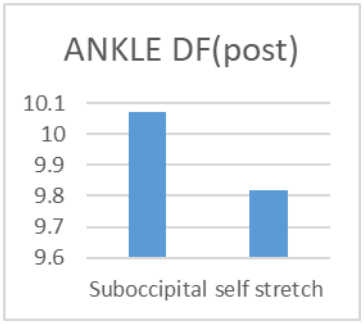
Table 3: AKE, SRT, ANKLE DF.

Parameters	**Sub-occipital (mean of mean±SD)**	**Self-stretching (mean of mean±SD)**	**t-value**	**Sig**
AKE	27.03 ±5.60	24.92 ± 7.40	1.259	.060
SRT	10.03 ± 4.58	8.21 ± 4.09	1.752	.431
SRT	10.07143±1.617434	9.821429 ± 1.516575	.412	.541

The obtained t-value and Sig. were 1.259 and 0.60, respectively, when comparing the sub-occipital muscle inhibition mean of the mean for AKE 27.03 and self-stretching mean for AKE 24.92 with SD of 1.18 and 0.67. The obtained t-value and Sig. were 1.752 and 0.431 when comparing the sub-occipital muscle inhibition mean of mean for SRT 10.035 and the self-stretching mean of mean for SRT 8.214 with SD of 4.58 and 4.09. With SD of 1.61 and 1.51, the obtained t-value and Sig. for sub-occipital muscle inhibition for Ankle DF 10.07 and self-stretching mean of mean for Ankle DF 9.82 were 0.412 and 0.541, respectively.







DISCUSSION

Muscle tightness is the most limiting factor for restricted ROM and decreased flexibility of the joint. Hamstring and calf muscles are more prone to getting tight, which causes musculoskeletal problems. This study focused on the effects of various therapeutic techniques, including sub-occipital muscle inhibition and self-stretching techniques, on hamstring and calf muscle flexibility in subjects with tight muscle groups.

Sub-occipital muscle inhibition technique is efficacious in improving hamstring and calf muscle flexibility. The results from this study showed a significant group difference favoring the sub-occipital muscle inhibition technique for improving AKE, SRT, and Ankle DF post-intervention for hamstring and calf flexibility.

The self-stretching technique is also very effective in improving hamstring and calf muscle flexibility by increasing AKE range up to (24.92 mean difference), which is a little less than sub-occipital muscle inhibition (27.03 mean difference), Sit and reach test length up (8.21mean difference) and Ankle DF (9.82 mean difference); these values are significant but slightly lower than Sub-occipital muscle inhibition (10.03 and 10.07 mean difference respectively).

Pramod K. Jagtap et al., 2015 studied the effect of the Suboccipital Muscle Inhibition Technique on hamstring tightness patients. It was concluded that the Suboccipital Muscle inhibition technique is efficacious in improving the flexibility of the hamstring muscle[24].

According to Schleip, if the tone of the sub-occipital muscle is decreased either passively, with a fascial treatment, or with active movements, the length of the hamstring muscles would be greater due to relaxation of the myofascial neural components. This can be associated with the hamstrings and sub-occipital muscle being part of a continuous link of the neural system that passes through the dura matter [25].

According to Laura C. Decoster, a single 30-minute stretching bout may be the most effective practice, and a period greater than 30 seconds is no more effective. However, studies have shown that stretching for shorter durations with increased repetitions can result in similar motion gains. Also, on stretching duration, some authors suggest that the total stretching time is more important than the number of repetitions. The length of a stretching protocol is also attractive to clinicians. Those studies investigating the effectiveness of stretching techniques over a longer period (weeks as opposed to a single session) achieved a greater range of motion; however, those studies employing only a single stretching session also made a statistically significant range of motion gains[26].

CONCLUSION

From the results, we can conclude that the sub-occipital muscle inhibition technique is more effective in relieving tightness from the hamstring and calf group of muscles as compared to the self-stretching technique in AKE, SRT, and Ankle dorsiflexion.

The self-stretching technique has also shown significant improvement in relieving the tightness in hamstring and calf muscles but comparatively less than sub-occipital muscle inhibition technique.

Source of funding: self

Conflict of interest: None

Author Contributions: **Shruti Panchal:** Study concept, Design and interpretation**, Dharaben Patel:** Collection of data literature review and Interpretation of the data**, Ambica Mall:** Collection of data literature review and Interpretation of the data**, Threety Pruchhak:** Collection of data literature review and Interpretation of the data.

References

[1]. Chaitali shah, The effect of hamstring and calf tightness on static, dynamic balance and mobility - a correlation study, indian journal of physiotherapy and occupational therapy - an international journal, January 2013, 7(4):17. https://doi.org/10.5958/j.0973-5674.7.4.115

[2]. Brittany L. Hansberger, Loutsch, Christy Hancock et al, Evaluating the relationship between clinical assessment of apparent hamstring tightness: a correlational analysis, Int J Sports Physiotherapy, 2019 Apr; 14(2), 253-263. https://doi.org/10.26603/ijspt20190253 PMid:30997277 PMCid:PMC6449015

[3]. Richard I. Caidosik, Effects of Static Stretching on the Maximal Length and Resistance to Passive Stretch of Short Hamstring Muscles, journal of Orthopaedic& Sports Physical Therapy, 6 December 1991;14(6):250-5. https://doi.org/10.2519/jospt.1991.14.6.250 PMid: 18796808

[4]. R Gajdosik, G Lusin, Hamstring muscle tightness. Reliability of an active-knee-extension test, 1983 Jul;63(7):1085-90. https://doi.org/10.1093/ptj/63.7.1085 PMid:6867117

[5]. Johnson et al, Effect of a static calf muscle-tendon unit stretching program on ankle dorsiflexion range of motion of older women, journal of Geriatric Physical Therapy, ournal of Geriatric Physical Therapy, august 2007;30(2):49-52. https://doi.org/10.1519/00139143-200708000-00003 PMid:18171487

[6]. Teddy W. Worrell, FACSM1 Troy I. Smith, lasonWinegardner, Effect of Hamstring Stretching on Hamstring Muscle Performance, Journal of Orthopaedic& Sports Physical Therapy, September 1994;20(3):154-9. https://doi.org/10.2519/jospt.1994.20.3.154 PMid:7951292

[7]. Lain W Muir, Bert M. Chesworth, Anthony A. Vandervoort, Effect of a Static Calf-Stretching Exercise on the Resistive Torque During Passive ankle dorsiflexion in healthy subjects, Journal of Orthopaedic& Sports Physical Therapy, fabruary 1999;29(2):106-115. https://doi.org/10.2519/jospt.1999.29.2.106 PMid:10322585

[8]. Sakshi K. Kariya, Waqar M. Naqvi, Om Wadhokar, Sub occipital muscle inhibition technique Verses cranial cervical flexion exercise for increasing hamstring flexibility in physiotherapy students, Journal of pharmaceutical research international, 11 November 2021;33(49A):8-13, https://doi.org/10.9734/jpri/2021/v33i49A33295

[9]. Bhagyashree K. Koli, Deepak B. Anap, Prevalance and severity of hamstring tightness among college student: a cross sectional study, international journal of clinical and biomedical research, 2018;4(2):65-68. https://doi.org/10.5455/ijcbr.2018.42.14

[10]. Amr Almaz Abdel-azlem et al, Effect of body position and type of stretching on hamstring flexibility, International journal of medical research & health sciences, 2013;2(3):399-406. https://doi.org/10.5958/j.2319-5886.2.3.070

[11]. Iwata M, Yamamoto A, Matsuo S, Hatano G, Miyazaki M, Fukaya T, Fujiwara M, Asai Y, Suzuki S. Dynamic Stretching Has Sustained Effects on Range of Motion and Passive Stiffness of the Hamstring Muscles. J Sports Sci Med. 2019 Feb 11;18(1):13-20. PMID: 30787647; PMCID: PMC6370952.

[12]. Cho SH, Kim SH, Park DJ. The comparison of the immediate effects of application of the suboccipital muscle inhibition and self-myofascial release techniques in the suboccipital region on short hamstring. J Phys Ther Sci. 2015 Jan;27(1):195-7. https://doi.org/10.5958/j.2319-5886.2.3.070 PMID: 25642072; PMCID: PMC4305561.

[13]. J park, JY cha, HJ kim, Immediate effects of a neurodynamic sciatic nerve sliding technique on hamstring flexibility and postural balance in healthy adults. Physical Therapy Rehabilitation Science. 2014;3:38-42 https://doi.org/10.14474/ptrs.2014.3.1.38

[14]. Nishchal Ratna Shakya, SajanManandhar, Prevalence of hamstring muscle tightness among undergraduate physiotherapy students of Nepal using Passive Knee Extension Angle Test, international journal of scientific and research publications, 2018;8(1):182-187.

[15]. Neto T, Jacobsohn L, Carita AI, Oliveira R. Reliability of the Active-Knee-Extension and Straight-Leg-Raise Tests in Subjects With Flexibility Deficits. J Sport Rehabil. 2015 Dec 3;24(4):2014-0220. https://doi.org/10.1123/jsr.2014-0220 PMID: 25364856.

[16]. Megan M Konor, Sam Morton et al, Reliability of three measures of ankle dorsiflexion range of motion, International journal of sports physical therapy, june 2012;7(3): 279-87.

[17]. Amber burke, Bill reif, A Different approach to relieving tight hamstrings. https://yogainternational.com/article/view/a-different-approach-to-relieving-tight-hamstrings/

[18]. SK Yadav, Study between the effectieness of bowen technique and dynamicsoft tissue mobilization in increasing hamstring flexibility, 2013 thesis dissertation submitted to RGUHS, Karnataka

[19]. Allison ray jeraci, 5 ways to release tight calves. https://yogainternational.com/article/view/5-ways-to-release-tight-calves/

[20]. NishchalRatna Shakya, SajanManandhar, Prevalence of hamstring muscle tightness among undergraduate physiotherapy students of Nepal using Passive Knee Extension Angle Test, international journal of scientific and research publications 2018;8(1):182-87.

[21]. Mookerjee, Swapan et al, Electromyographic Analysis of Muscle Activation During Sit-and-Reach Flexibility Tests,Journal of Strength and Conditioning Research, December 2014;28(12):3496-3501. https://doi.org/10.1519/JSC.0000000000000607 PMid:25187246

[22]. Michael beecher et al., The immediate effects of atlanto occipital joint manipulation and suboccipital muscle inhibition technique on active mouth opening and pressure pain sensitivity over latent myofascial trigger points in the masticatory muscle, Journal of orthopedic and sports physical therapy, May 2010;40(5):297-309. https://doi.org/10.2519/jospt.2010.3257 PMid:20436241

[23]. Brett Seras, How to do a towel calf stretch, August 18,2019. https://www.verywellfit.com/the-towel-calf-stretch-2696333

[24]. Rooju Vachhani, Himanshi Sharma, Effectiveness of Suboccipital Muscle Inhibition Technique versus Muscle Energy Technique on Hamstring Muscle Flexibility in College Going Students, International Journal of Research and Review, June 2021;8(6):160-174. https://doi.org/10.52403/ijrr.20210620

[25]. Prajapati UM, Shukla YU. Effect of suboccipital muscle inhibition technique on hamstring tightness in healthy adults - an interventional study. International Journal of Science & Healthcare Research. 2020; 5(4): 51-58.

[26]. Decoster LC, Scanlon RL, Horn KD, Cleland J. Standing and Supine Hamstring Stretching Are Equally Effective. J Athl Train. 2004 Dec;39(4):330-334. PMID: 15592605; PMCID: PMC535525.

Article information

Manuscript Submitted: 01-08-2023
Manuscript Revised: 02-09-2023

Manuscript Accepted: 23-01-2024
Manuscript published: 19-02-2024

Scan here to access this article online.