

Immediate Effects of Static Stretching and Post Isometric Relaxation on Hamstring Flexibility among Sedentary Young Adults: A Pilot Study

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Анотація. Підколінні сухожилля – це група м'язів у задній частині стегна, що перетинає кульшовий і колінний суглоби. Вони часто можуть зазнавати зниженої гнучкості, особливо серед молодих людей 18–25 років, що спричиняє напруження, яке викликає кілька станів, що впливають на організм людини. Розтягнення миттєво впливає на жорсткість м'язів, тому позитивний ефект можна отримати протягом кількох секунд або хвилин після сеансу. Незважаючи на високу поширеність цієї проблеми, бракує інформації про ефективний метод розтягнення, характерний для малорухливих людей цієї вікової групи. *Мета.* Порівняти миттєвий вплив двох методів розтягнення на гнучкість підколінного сухожилля серед студентів університету, які ведуть сидячий спосіб життя. *Методи.* Аналіз наукової літератури, вимірювання, методи розтягнення. *Результати.* Миттєві ефекти від одноразового заходу з кількома повтореннями постізометричної релаксації-розтягнення були більш очевидними щодо зменшення напруження підколінного сухожилля серед молодих людей, які ведуть сидячий спосіб життя, порівняно зі статичним розтягненням. Крім того, під час первинного оцінювання лише три суб'єкти з вибірки мали нормальну гнучкість підколінного сухожилля і були виключені з цього дослідження. Це показує, що поширеність напруження підколінного сухожилля є високою, існує необхідність визначити фактори ризику, характерні для молодих студентів університету, які ведуть сидячий спосіб життя, і вирішити їх за допомогою найбільш ефективної програми розтягнення з оптимальною тривалістю та частотою.

Ключові слова: гнучкість підколінного сухожилля, студенти, вправи на розтягнення, статичне розтягнення, постізометрична релаксація.

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IMMEDIATE EFFECTS OF STATIC STRETCHING AND POST ISOMETRIC RELAXATION ON HAMSTRING FLEXIBILITY AMONG SEDENTARY YOUNG ADULTS: A PILOT STUDY

Abstract. The hamstrings are a group of muscles in the posterior part of the thigh that crosses the hip and knee joints. They can often experience decreased flexibility, especially among young adults aged 18–25, causing strain that triggers several conditions affecting the human body. Stretching has an immediate effect on muscle stiffness, therefore a positive effect can be seen within seconds or minutes of the session. Despite the high prevalence of this issue, there is a lack of information on an effective stretching method specific to sedentary people of this age group. *Objective.* To compare the immediate effect of two stretching methods on hamstring flexibility among sedentary university students. *Methods.* Analysis of scientific literature, measurements, stretching methods. *Results.* The immediate effects of a single event with multiple repetitions of post-isometric relaxation-stretching were more evident in reducing hamstring strain among young sedentary adults as compared to static stretching. In addition, during the initial assessment, only three subjects in the sample had normal hamstring flexibility and were excluded from this study.

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Ліянаге Е., Джаясінгхе Ч., Красільщиків О. Безпосередній вплив статичного розтягування та постізометричного розслаблення на гнучкість підколінного сухожилля серед сидячих молодих дорослих: пілотне дослідження. *Теорія і методика фізичного виховання і спорту.* 2023; 1: 35–38
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Introduction

Background. 'Hamstrings' is a group of muscles in the posterior compartment of the thigh crossing both hip and knee joints. It is responsible for extension of the hip with flexion of the knee. Hamstring muscles, predominantly biceps femoris, are important in maintaining the trunk upright from a stooping posture against the influence of gravity [1].

Flexibility refers to the ability to rotate a single joint or series of joints smoothly and easily through an unrestricted, pain-free range of motion. Muscle length, joint integrity, and periarticular soft tissue extensibility are the factors which determine flexibility. Shortening or decreased flexibility of soft tissues may lead to activity limitations and participation restrictions [2]. Hamstring muscles are frequently subjected to reduced flexibility. Prevalence of hamstring tightness is very high among 18–25 years old college students in India [3]. This problem is common among university students in Lahore, Pakistan, too, where 23.33 % of males and 16.6 % of females between the ages of 17–25 years present with hamstring tightness. In this study, both sedentary individuals and individuals who engage in sports were included [4]. Majority of sedentary university students between the ages of 16–30 years have tightness in hamstring muscles [5].

Adverse Effects of Hamstring Tightness. Hamstring tightness is found to cause several conditions affecting the human body. Individuals with hamstring tightness are 8.7 times more prone to experience plantar fasciitis [6]. It induces prolonged forefoot loading and increases repetitive injury to plantar fascia [7]. Moreover, shorter hamstring muscles are common among patients with patellofemoral pain than among asymptomatic individuals, although it is not certain whether this is a cause or an effect of the condition [8]. Among the patients suffering from chronic low back pain, 28 % with moderate disability and

This indicates that the prevalence of hamstring strain is high, and there is a need to identify risk factors specific to young sedentary university students and address them with the most effective stretching program of optimal duration and frequency.

Keywords: hamstring flexibility, students, stretching exercises, static stretching, post-isometric relaxation.

19 % with severe disability have hamstring tightness [9]. Both intrinsic and imposed hamstring length can influence pelvic rotation (posterior pelvic tilt) during bilateral hip flexion of healthy young adults [10]. This posterior pelvic tilt can lead to reduced L1-S1 angle and lumbar spine lordosis in standing [11]. Moreover, low back pain has an association with reduced lumbar lordosis [12].

Static Stretching and Post-Isometric Relaxation for Hamstrings. Stretching is an important therapeutic manoeuvre which improves flexibility and range of motion by elongating the shortened structures. This technique imposes significant immediate effects on range of motion and muscle stiffness, [13] which means, positive effects can be obtained within few seconds or minutes after a stretching session. In static stretching (SS), soft tissues are elongated just beyond the point of tissue resistance and held in the lengthened position with sustained stretch force over a period of time. SS is a safer and more effective method in increasing flexibility and range of motion. A systematic review and meta-analysis by Medeiros et al. (2016) revealed that static stretching is effective in increasing hamstring flexibility in sedentary healthy adults between 18–40 years [14]. According to Babault et al. (2015), maximal concentric torque was significantly reduced in individuals with low and high hamstring flexibility immediately after a SS session (6×30 s) [15]. However, other interventions such as neurodynamic sliding [16], active isolated stretching and ballistic stretching [17], and modified dynamic stretching [18] were found to be more effective than SS of hamstrings, while proprioceptive neuromuscular facilitation [19] and eccentric training [20] showed almost similar effects.

Post-isometric relaxation (PIR) technique can be applied to tight muscles by placing the muscle in a stretched position and isometrically contracting it against minimal resistance. This is followed by

relaxation and gentle stretch as the muscle releases [21]. This technique was very effective in increasing hamstring flexibility of national-level football players in India [22]. Among 18–25 years-old healthy college students in India, PIR when performed thrice a week for three weeks was revealed to be a more effective technique in reducing hamstring tightness than reciprocal inhibition [23]. Naweed, J. et al (2020) report that PIR and active isolated stretch are equally effective in immediate, short-term, and long-term effects on hamstring flexibility of young, healthy college students between 18–25 years of age [24].

Justification. Many studies have been conducted so far comparing the effects of SS and PIR with other physiotherapy interventions, but the number of studies which include a comparison of the two interventions (SS and PIR) is few. Moreover, studies comparing the immediate effects of SS and PIR on hamstring flexibility are far less. SS and PIR are easy and safe manoeuvres to treat hamstring tightness. It is crucial to identify the most effective technique, which will be helpful in augmenting the improvement, and recognizing the immediate effects will help fast recovery. This pilot study will aid in finding the better stretching method of the two for reducing hamstring tightness with regard to the immediate effects among sedentary young adults. Further, there are ample studies among athletes and sports persons; however, there are limited studies and none in Sri Lanka to assess hamstring flexibility and to determine effectiveness of stretching exercises among sedentary young adults. Exercise efficiency and exercise performance wise, the sedentary young adults differ from those involved in competitive sports, hence, the prevalence of hamstring tightness and the effectiveness of stretching exercises among the two may differ as well. The present study aimed at finding the immediate effects of two types of stretching in a pilot study. Based on the findings, future studies to

determine the risk factors for hamstring tightness specific to sedentary University students and short-term, long-term effects of stretching exercises will be carried out.

Methodology. The pilot study was conducted among two batches of undergraduates studying the Physiotherapy Degree Programme. The age was between 20–30 years and those who consented to participate were included. A total of 35 undergraduates consented to participate and those satisfying the inclusion criteria were randomly allocated by 1:1 ratio to the SS and PIR group. The subjects needed to have hamstring tightness measured by active knee extension (AKE) to be included to the study. The subjects with a history of recent injury or surgery to the spine or lower limbs, those who involved in sports activity at competitive level and obese subjects were excluded. Finally, three subjects were excluded, because they had normal hamstring flexibility and 32 subjects were included (Males – 7, Females – 25). There were 04 males in the PIR group and 03 males in the SS group.

The subjects performed a warm-up by walking around in a room, they performed free shoulder and hand movements while walking. The subjects were in comfortable clothes, and they were positioned in supine with the contralateral extremity in extension. The ipsilateral hip and the knee were flexed to 90°, the subjects were asked to actively extend the ipsilateral knee with the foot relaxed. Knee extension stretched the hamstring muscles until myoclonus occurred. The subjects were then told to slightly flex the knee till the myoclonus stopped. At this point, the degree of knee flexion was recorded using a universal goniometer. Hamstring flexibility was measured on the dominant side for all the subjects.

Static Stretch. The starting position was long sitting position, with both knees straight, subjects were asked to raise the arms forward and bend at the pelvis attempting to touch the toes. The stretch was held for 30 seconds and repeated 4 times with a 30 second rest period.

Post Isometric Relaxation. The starting position was kneeling, the dominant limb was stretched straight ahead

Table 1. Baseline test results of the study participants

	Age (Mean ± SD)	BMI (Mean ± SD)	AKE angle (Mean ± SD)
SS	24.12 ± 0.71	21.98 ± 5.21	46.68 ± 5.31
PIR	23.93 ± 0.85	19.33 ± 2.16	49.03 ± 6.53

BMI = Body Mass Index, AKE = Active Knee Extension, SS = Static Stretch, PIR = Post Isometric Relaxation

Table 2. Results of Independent sample t-test comparing the two groups post stretching exercises

	F	Sig.	t	df	Sig. (2-tailed)
Equal Variance Assumed	0.919	0.24	2.643	30	0.013
Equal Variance not Assumed			2.643	27.52	0.013

with knee in extension, the subjects were asked to bend at the pelvis to feel a stretch at the hamstrings then they were instructed to press the heel on the ground for 10 seconds and relax. This was repeated 5 times with a rest period of 10 seconds. A greater range of trunk flexion was encouraged with each attempt.

The angle of AKE was measured soon after the stretching exercise. The cut-off for hamstring tightness was males > 23.4° and females > 33° these values were taken from a study that determined this cut off among University students [25].

Results. The details of the participants are presented in the Table 1.

The baseline data of the subjects of both groups for hamstring flexibility was matched using Independent sample t-test. There was no significant difference in the hamstring flexibility of the subjects of the two groups before stretching exercises.

According to the results in Table 2, there was a significant difference between the SS (M = 42.62, SD = 4.78) and PIR (M = 36.28, SD = 6.51) group; $t(30) = 2.64, p = 0.01$. The mean value of knee flexion measured with AKE for PIR group was lesser than the static stretching group. This indicates that the improvement was significantly higher in the PIR group.

Discussion. The subjects of the PIR group had a significantly higher score immediately after stretching exercise when compared to the static stretching group. There are limited studies among

sedentary young adults, most studies were conducted among young athletes. Some of the studies conducted among sedentary young adults show similar findings to the present study. Healthy, young students between 18–22 years of age with reduced hamstring flexibility were grouped and given SS and PIR separately. SS based intervention was performed for 4 weeks. This was repeated 4 times with 30s rest interval between each and given thrice a week for 4 weeks. It was found that PIR was more effective in improving knee ROM and decreasing hamstring tightness in less duration than SS [26]. PIR was more effective than ultrasound therapy with active static stretching and passive static stretching in improving hamstring flexibility among healthy individuals between 18–25 years, when the treatments were administered once a day daily for 2 weeks [27]. Furthermore, PIR was found to be more effective than SS in improving iliopsoas flexibility of healthy young adults (18–30 years) as well [28]. None of these studies had assessed the immediate effects of the stretching.

The sample of the present study comprised University Undergraduates, who are sedentary and do not involve in sporting activities. It aimed to determine the immediate effects as an initial step and further studies will be conducted to determine specific risk factors to hamstring tightness and short term and long-term effects of the stretching exercises for this population will be studied.

Conclusion. Immediate effects from single bout with few repetitions of Post

Isometric Relaxation stretching were more effective in reducing hamstring tightness among sedentary young adults compared to static stretching. The fact, that during initial assessment only 3 subjects out of 35 had normal hamstring flexibility (were excluded from this study) shows that the prevalence of hamstring tightness is high, and there is need to determine risk factors specific to sedentary young University students and address those with the most effective stretching programme to tackle the issue in both short- and long-term prospective.

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