DOI: 10.55735/hjprs. v3i2.116

THE HEALER
Journal of Physiotherapy & Rehabilitation Sciences

Original Article

Effectiveness of Plantar Fascial Mobilization and Static Stretching on Hamstrings Flexibility among Overweight Individuals

Nabira Izhar[1*], Anam Bint Irfan[1], Syed Naeem Abbas[1], Khalid Abbas[1], Momin Mukhtar[1], Hafiz Abdul Rehman[1]

[1*]*Department of Physical Therapy, Shalamar Institute of Health Sciences, Lahore, Pakistan*

ABSTRACT

Background: Hamstrings tightness is commonly found among obese individuals and athletes. Many factors can result in hamstrings tightness such as overuse, bad posture and sports activities. It can result in major muscle imbalance which can predispose a person to muscle injuries. **Objective:** To evaluate the effectiveness of plantar fascial mobilization and static stretching on hamstrings flexibility in overweight individuals. **Methods:** This quasi-experimental study was conducted at the Physiotherapy department of Shalamar Hospital, Lahore for 6 months. About 50 participants were selected after meeting the eligibility criteria through non-probability purposive sampling. Participants were divided into two equal groups, Group A received static stretching of the hamstrings and Group B received plantar fascial mobilization for three consecutive days. Pre and post-treatment readings of the numeric pain rating scale and active knee extension were recorded in this study. Overweight individuals with having body mass index between 25 to 30 and age ranging from 18 to 35 years presented with hamstring tightness (at least 20 degrees of active knee extension were included in this study. Patients were excluded if they showed any red flags such as rheumatoid arthritis, fracture, tumor, osteoporosis, history of steroid use, lower limb injuries or surgery. The normality of data was assessed through the Shapiro-Wilk test. The difference between pre and post-treatment readings was calculated using paired sample t-test for this parametric data. Independent sample t-test was estimated for finding difference between groups. **Results:** Patients presented in both groups had an age between 18 and 50 with a mean age of 38.56±9.243. Data were analyzed through independent sample t-tests and paired sample t-tests. The results showed that plantar fascial mobilization along with static stretching was superior in improving hamstring flexibility (83.20±1.65) and reducing pain (1.96±1.48) than static stretching alone in improving hamstring flexibility (76.40±0.02) and in reducing pain (3.45±1.45). **Conclusion:** It concludes that both the treatment techniques, plantar facial mobilization and static stretching were effective in improving hamstring flexibility by increasing active knee extension and decreasing pain intensity however plantar fascial mobilization along with static stretching was superior to static stretching alone in improving the hamstring flexibility in overweight individuals.

Access the article online

***Corresponding Author:** Nabira Izhar, Shalamar Institute of Health Sciences, Lahore, Pakistan
Email: nabiraizhar@yahoo.com

Keywords: hamstrings flexibility; plantar fascial mobilization; static stretching

Citations: Izhar N, Irfan AB, Abbas SN, Mukhtar M, Rehman HA. Effectiveness of plantar fascial mobilization and static stretching on hamstrings flexibility among overweight individuals. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2023; 3(2):360-367.

DOI: 10.55735/hjprs. v3i2.116

INTRODUCTION

Hamstring tightness is commonly found among obese individuals and athletes. Many factors can result in hamstring tightness such as overuse, bad posture and sports activities. Hamstring tightness can result in major muscle imbalance which can predispose a person to muscle injuries.[1] In addition to this hamstring tightness can also result in many orthopedic conditions such as patellofemoral pain, plantar fasciitis[2] and low back pain[3]. The injury rate for hamstring muscles is between 22-34%, with a re-injury rate of 50% within one month.[4] Obesity leads to many medical issues.

It also limits physical capabilities in addition to many other medical problems such as decreased range of motion of various joints in the body. Overweight individuals are more prone to hamstring tightness. It also results in obstruction of inter-segmental movement and leads to mechanical interposition. This is the result of the increased amount of fat in the body which consequently decreases flexibility in obese individuals.[5] One of the most common reasons that limited flexibility is restricted fascia.[6] Fascia is a common form of connective tissue.

It is present all over the body and surrounds many different structures such as blood vessels, nerves and muscles.[7] Restriction of fascia can be the result of several factors such as inflammation, disease and injury. As restricted fascia results in decreased strength, flexibility, endurance and motor coordination it can have adverse effects on the musculoskeletal system and can lead to an increased amount of musculoskeletal pain.[8] Restricted fascia in overweight individuals is the result of inactivity, inflammation and injury. Restricted fascia becomes dehydrated and leads to the formation of fibrous adhesion to form. Such fibrous adhesion can result in severe pain, reduces the extensibility of soft tissues and also disturbs the mechanics of muscles which includes a decreased joint range of motion (ROM), muscle strength, endurance and motor coordination.[9] The stretching technique has been proven effective in increasing hamstring flexibility which ultimately results in injury prevention. The technique of static stretching includes holding the muscle in an elongated position for a specific period while a controlled amount of force is applied at the limitation.[10] Technique of self-mobilization can also be used to increase muscle flexibility. Self-mobilization includes the use of different devices such as tennis balls or foam roller. [11]

Myofascial release technique was developed by Barnes. It is a manual self-myofascial release technique that is used to reduce restrictive barriers and fascial restriction by breaking fibrous adhesions that is present between the layers of fascial tissue.[12,13] Although the studies have shown that both static stretching and myofascial mobilization techniques are effective for increasing ROM, there have not been any studies performed for a direct comparison of these two techniques among overweight individuals. There are many studies which are conducted on athletes but evidence of the use of tennis balls to mobilize fascia among overweight individuals is lacking.[14] The primary purpose of the study was to compare the effects of static stretching and plantar fascial mobilization via tennis ball on pain intensity and hamstrings flexibility in the overweight population.

METHODS

A quasi-experimental design was used in the study that was conducted in the outpatient department of physical therapy, Shalamar hospital, Lahore within the time duration of

DOI: 10.55735/hjprs. v3i2.116

six months. A total of 50 patients were and a non-probability purposive sampling technique was used to collect the data. The sample size was calculated by the online Epitool sample size calculator by taking pain as a variable, with the mean pain as 31.9+2.6, the power of study as 0.95 and the level of significance as 0.05. The sample size was 45 and after adding 10% of the attribution rate total size was 50, having 25 participants in each group. Overweight individuals having BMI >25 to 30 were included in this study and the age of patients who participated in this study ranged from 18 to 35 years. The patients presented with hamstring tightness (at least 20 degrees of active knee extension (AKE).

Patients were excluded from the study if they showed any red flags such as rheumatoid arthritis, fracture, tumor, osteoporosis, history of steroid use, resting blood pressure greater than 140/90 mmHg, lower limb injuries, wound in the sole and had been through a recent surgical procedure. Patients with BMI<25 were also excluded from the study. Participants were selected after the screening process according to the above-mentioned inclusion and exclusion criteria.

Informed consent was taken by each participant and was included in one of the two groups. Thorough case history, complete physical examination and knee assessment were done by the researcher. The participants completed a subjective numeric pain rating scale (NPRS). The ROM of the knee was measured with a universal goniometer. The researcher also performed an AKE test on each participant. Both groups were given the predefined treatment. Group B was treated with static hamstring stretching and in addition to this hamstring stretching, participants were requested to roll a golf ball to and fro beneath their right leg in a standing position, from the sole from behind the metatarsal heads to the heel. Both groups were selected according to the eligibility criteria treated with static hamstring stretching of three sets of 30secs for three consecutive days. The researcher measured knee flexion and perform an AKE test at the end of 3rd treatment session. All 50 participants received a total of three treatment sessions over three days.

Data were analyzed using SPSS for window software version 17. Statistical significance was set at $p \leq 0.05$. The normality of the data was assessed through the Shapiro-Wilk test. The difference between pre and post-treatment readings was calculated using paired sample t-test for this parametric data. Difference between groups, independent sample t-test was estimated.

RESULTS

Fifty patients who met the study criteria were included in this study. Demographic data were given as mean and standard deviation of height, weight and body mass index (BMI) in Table I. The results showed a marked reduction in Group B pain as compared to Group A. The value of active knee flexion and extension improved greatly in Group B in comparison with Group A. Hence static stretching with plantar fascial mobilization is more effective in improving hamstring flexibility as compared to static stretching as the p-value was showing significant results ($p<0.001$) as given in Table II and III.

DISCUSSION

The study was performed to find out the effects of static stretching and plantar fascial mobilization to improve hamstring flexibility, especially focusing on overweight individuals. This study included participants with BMI between 25 to 30. Both males and females were included in the study having hamstring

DOI: 10.55735/hjprs. v3i2.116

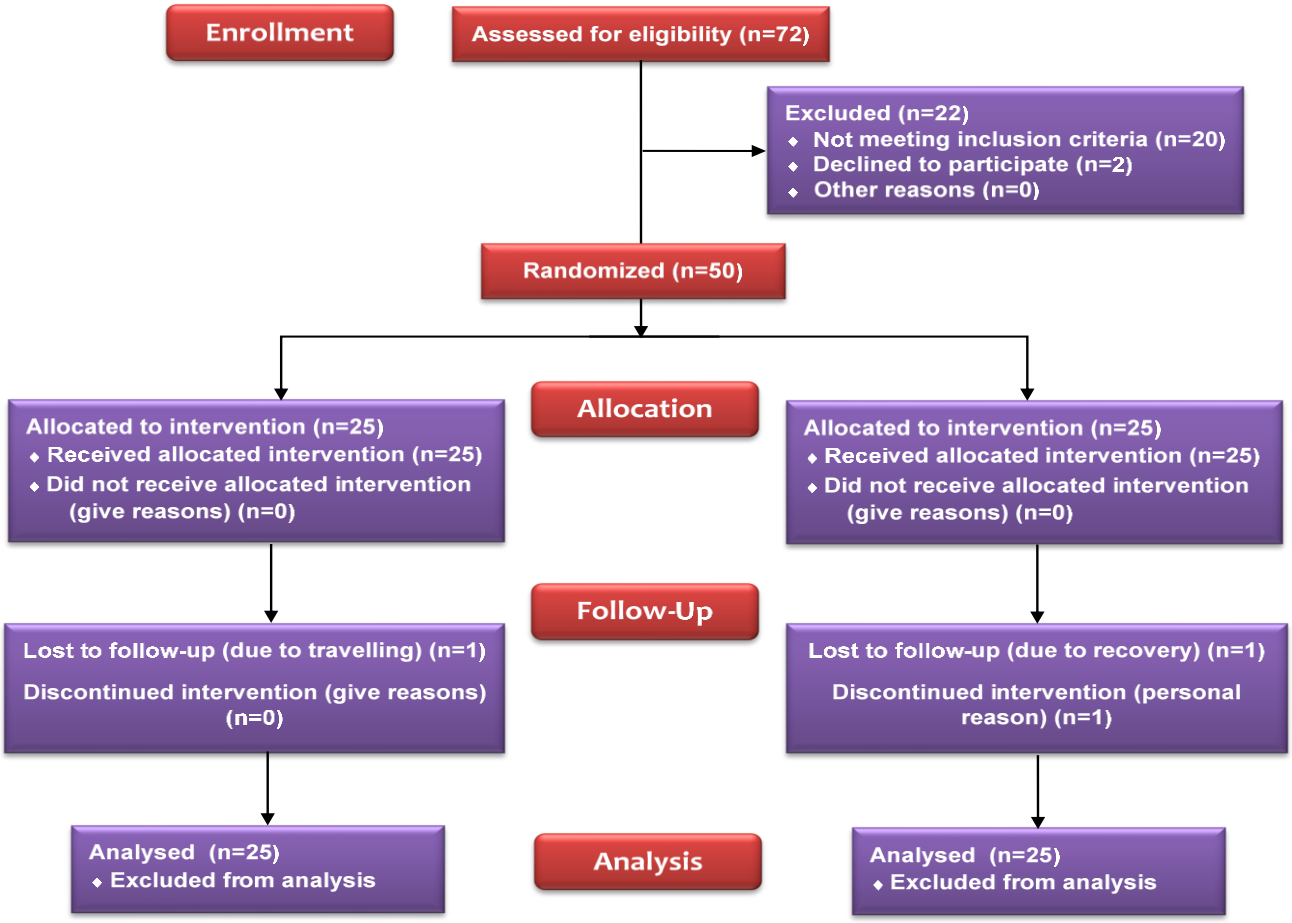

Figure I: CONSORT Flow Diagram

Table I: Mean and Standard Deviation of Height, Weight and BMI

		Mean	Standard deviation
Group A	Height (m)	01.60	0.17
	Weight (kg)	75.64	11.85
	BMI	27.60	1.58
Group B	Height (m)	01.63	0.11
	Weight (kg)	75.48	10.21
	BMI	27.80	1.68

DOI: 10.55735/hjprs. v3i2.116

Table II: Comparison of Numeric Pain Rating Scale and Active Knee Extension

Study Groups		Mean	Standard Deviation	p-value
Group A	Pre-NPRS	6.72	0.98	0.000
	Post-NPRS	3.48	1.45	
	Pre-AKE	45.12	11.67	0.000
	Post-AKE	76.40	11.23	
Group B	Pre-NPRS	6.52	0.22	0.000
	Post-NPRS	1.96	0.30	
	Pre-AKE	48.00	11.27	0.02
	Post-AKE	83.00	8.28	

Table III: Between-Group Comparison of Numeric Pain Rating scale and Active Knee Extension

	Study groups	Mean	Standard Deviation	p-value
NPRS	Group A	3.48	1.46	0.000
	Group B	1.96	1.48	
AKE	Group A	76.40	0.25	0.043
	Group B	83.20	1.65	

tightness. According to the study conducted by Hyong and Kang (2013), static hamstrings stretching exercises along the superficial backline not only affect the hamstrings and lumbar spine but may also have positive effects on balance and cervical range of motion. Although static stretching improves flexibility it can also have detrimental effects on neuromuscular performance.[15] Stretching can place strain on the origin and the insertion of the muscle and it may damage the sarcomere. In the present study, fascial mobilization was also used along with stretch to enhance neuromuscular performance by reducing pain. Behm DG. in 2021 found that prolonged static stretching without any warm-up session can produce a harmful effect as it reduces the performance of muscle, in this study predefined treatment was given before stretching the muscle which included the application of heating modality and slight ROM exercise.[16] In the current study this

DOI: 10.55735/hjprs. v3i2.116

technique of facial mobilization using a tennis ball was applied to the hamstring to improve flexibility along with static stretching. A study was conducted by Shetty K in which hamstring flexibility was improved using a tennis ball in athletes which showed plantar mobilization with a tennis ball helped to increase blood flow thus improving circulation in the plantar surface of the foot. It also improved muscle flexibility according to the posterior anatomy train which includes the lumbar spine, hamstring and ends in short toe flexors and plantar fascia.[14] but there was no study on overweight individuals. The current study uses the same technique of mobilizing plantar fascia with a tennis ball but it is carried out on overweight individuals.

A study by Kuruma H showed the effects of stretching technique and myofascial release on a range of motion and flexibility and concluded that myofascial release (MFR), increases the quadriceps and hamstrings flexibility that the plantar mobilization increased the sit and reach test for hamstrings' flexibility 4.3%. In addition, only 10s of rolling increases hamstrings' flexibility.[17] A recent study by Moran RN showed the effects of massage therapy on the acceleration of athletes. According to this study, the performance of athletes greatly improves after the fascial release of lower limb muscles.[18]

There is no study conducted on overweight individuals. In this study, the primary focus was to improve hamstrings flexibility, especially among overweight individuals. This experimental study showed improvement in hamstrings flexibility by increasing the active knee extension in both groups but group B which received plantar fascial mobilization with a tennis ball was found to be statistically more significant in increasing hamstring flexibility than group A receiving only static stretching of the hamstring. Hence it implies that applying plantar mobilization can result in an additional increase in flexibility. The present study also proved mobilization of the plantar fascia significantly changes the flexibility of hamstrings. Thus, such kind of technique can be helpful in addition to a more conventional technique for better results.

The limitation of the study was that this study was carried out only in overweight individuals having BMI between 25 to 30. Plantar fascial mobilization can also improve the flexibility of calf muscles as well but the present study only includes hamstring muscles. Further studies with larger sample sizes and different populations like obese patients are recommended. it is also suggested that these techniques should be used in different groups of lower limb muscles for future studies.

CONCLUSION

This study concluded that both the treatment techniques, plantar facial mobilization and static stretching were effective in improving hamstring flexibility by increasing active knee flexion and decreasing pain intensity, however plantar fascial mobilization along with static stretching was superior the static stretching alone in improving the hamstring flexibility in overweight individuals.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.
Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.
Competing interests: None
Funding: No funding source is involved.
Authors' contributions: All authors read and approved the final manuscript.
CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

DOI: 10.55735/hjprs. v3i2.116

REFERENCES

1. Hatano G, Suzuki S, Matsuo S, et al. Hamstring stiffness returns more rapidly after static stretching than range of motion, stretch tolerance, and isometric peak torque. Journal of sport rehabilitation 2019; 28(4): 325-31.
2. Lee JH, Jung HW, Jang WY. A prospective study of the muscle strength and reaction time of the quadriceps, hamstring, and gastrocnemius muscles in patients with plantar fasciitis. BMC Musculoskeletal Disorders 2020; 21(1): 1-7.
3. Houston MN, Hodson VE, Adams KK, Hoch JM. The effectiveness of whole-body-vibration training in improving hamstring flexibility in physically active adults. Journal of sport rehabilitation 2015; 24(1): 77-82.
4. Kendall BJ. The acute effects of static stretching compared to dynamic stretching with and without an active warm up on anaerobic performance. International journal of exercise science 2017; 10(1): 53.
5. Zhou J-P, Yu J-F, Feng Y-N, et al. Modulation in the elastic properties of gastrocnemius muscle heads in individuals with plantar fasciitis and its relationship with pain. Scientific Reports 2020; 10(1): 2770.
6. Škarabot J, Beardsley C, Štirn I. Comparing the effects of self-myofascial release with static stretching on ankle range-of-motion in adolescent athletes. International Journal of Sports Physical Therapy 2015; 10(2): 203.
7. Schroeder AN, Best TM. Is self myofascial release an effective preexercise and recovery strategy? A literature review. Current sports medicine reports 2015; 14(3): 200-8.
8. Sullivan KM, Silvey DB, Button DC, Behm DG. Roller-massager application to the hamstrings increases sit-and-reach range of motion within five to ten seconds without performance impairments. International Journal of Sports Physical Therapy 2013; 8(3): 228.
9. Bradbury-Squires DJ, Noftall JC, Sullivan KM, Behm DG, Power KE, Button DC. Roller-massager application to the quadriceps and knee-joint range of motion and neuromuscular efficiency during a lunge. Journal of athletic training 2015; 50(2): 133-40.
10. Ozmen T, Gunes GY, Dogan H, Ucar I, Willems M. The effect of kinesio taping versus stretching techniques on muscle soreness, and flexibility during recovery from nordic hamstring exercise. Journal of bodywork and movement therapies 2017; 21(1): 41-7.
11. Cheatham SW, Kolber MJ, Cain M, Lee M. The effects of self-myofascial release using a foam roll or roller massager on joint range of motion, muscle recovery, and performance: a systematic review. International journal of sports physical therapy 2015; 10(6): 827.
12. Do K, Yim J. Acute effect of self-myofascial release using a foam roller on the plantar fascia on hamstring and lumbar spine superficial back line flexibility. Physical therapy rehabilitation science 2018; 7(1): 35-40.
13. Grieve R, Goodwin F, Alfaki M, Bourton A-J, Jeffries C, Scott H. The immediate effect of bilateral self myofascial release on the plantar surface of the feet on hamstring and lumbar spine flexibility: A pilot randomised controlled trial. Journal of bodywork and movement therapies 2015; 19(3): 544-52.
14. Shetty K, Dsouza MR. Effectiveness of plantar fascia mobilization and passive stretching on hamstring muscle flexibility. International Journal of Health Sciences and Research 2018; 8(1): 134-7.
15. Hyong IH, Kang JH. The immediate effects of passive hamstring stretching exercises on the cervical spine range of motion and balance. Journal of Physical Therapy Science 2013; 25(1): 113-6.

DOI: 10.55735/hjprs. v3i2.116

16. Behm DG, Kay AD, Trajano GS, Blazevich AJ. Mechanisms underlying performance impairments following prolonged static stretching without a comprehensive warm-up. European journal of applied physiology 2021; 121: 67-94.
17. Kuruma H, Takei H, Nitta O, et al. Effects of myofascial release and stretching technique on range of motion and reaction time. Journal of Physical Therapy Science 2013; 25(2): 169-71.
18. Moran RN, Hauth JM, Rabena R. The effect of massage on acceleration and sprint performance in track & field athletes. Complementary therapies in clinical practice 2018; 30: 1-5.