

Original Research Article

Effect of paschimottanasana versus foam roller on hamstring flexibility in physiotherapy college students: a comparative study

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ABSTRACT

Background: Reduced hamstring extensibility is frequently observed in young adults and may be influenced by prolonged sitting and low physical activity. Paschimottanasana and foam rolling are commonly used to address flexibility limitations, but their relative effects in physiotherapy students have not been directly compared often.

Methods: Sixty physiotherapy students aged 18-25 years with hamstring tightness on the YMCA Sit-and-Reach Test participated in this comparative interventional study. Purposive sampling was used, followed by chit-based allocation to Paschimottanasana (n=30) or foam roller self-myofascial release (n=30). Both groups trained three times weekly for four weeks. Flexibility was measured before and after the intervention. Paired t-tests assessed within-group change and an independent t-test compared post-intervention scores. Statistical significance was set at $p < 0.05$.

Results: Sit-and-Reach scores increased from 22.86 ± 2.08 cm to 25.16 ± 1.90 cm after Paschimottanasana ($t=5.51$, $p < 0.001$), and from 23.16 ± 1.74 cm to 24.16 ± 1.44 cm after foam rolling ($t=3.61$, $p=0.001$). The post-intervention comparison was also significant ($t=2.29$, $p=0.025$).

Conclusions: Both approaches improved hamstring flexibility, with a significantly larger improvement following Paschimottanasana. The posture may therefore provide a practical, low-cost flexibility option for healthy young adults.

Keywords: Foam roller, Hamstring flexibility, Paschimottanasana, Physiotherapy students, Sit-and-Reach test, Static stretching

INTRODUCTION

Hamstring tightness is a common musculoskeletal concern observed among young adults and college students.¹ The hamstring muscle group comprises the biceps femoris, semitendinosus, and semimembranosus, which extend across both the hip and knee joints. Due to their biarticular nature, these muscles contribute significantly to postural control, pelvic stability, gait, running, jumping, and other functional movements. Limited hamstring flexibility can influence normal lower-limb biomechanics and increase mechanical stress on the

lumbar region. It may also be associated with musculoskeletal conditions such as low back pain, hamstring injuries, patellofemoral pain, and postural abnormalities.¹

Physiotherapy students may have an increased risk of developing hamstring tightness because their daily routine often involves prolonged sitting during lectures, extended periods of studying, clinical training, and limited engagement in regular stretching or flexibility activities. Research conducted among university students has demonstrated a considerable occurrence of reduced

hamstring flexibility, with sedentary lifestyles and insufficient physical activity being recognized as important contributing factors.^{2,3} Decreased hamstring extensibility may further affect functional movement and physical performance by limiting normal movement patterns and flexibility.

Various therapeutic approaches have been investigated for enhancing hamstring flexibility, such as static and dynamic stretching, proprioceptive neuromuscular facilitation, yoga postures, myofascial release, and foam roller techniques.⁴ Paschimottanasana, a traditional yoga asana characterized by a sustained forward-flexion position, is one approach that may effectively stretch the muscles of the posterior kinetic chain.^{5,6} Maintaining this posture for a period of time may promote relaxation, improve tolerance to stretching, enhance local blood flow, and gradually increase the extensibility of the hamstrings.⁷ The effects may also involve neurophysiological mechanisms, as sustained muscle-tendon stretching can stimulate Golgi tendon organs and contribute to autogenic inhibition, while reducing resistance associated with muscle spindle activity, thereby allowing greater muscle lengthening.

Foam rolling is widely utilized as a method for enhancing muscle flexibility and mobility. It is a form of self-myofascial release in which an individual uses their body weight to apply controlled pressure to the muscles and surrounding fascial tissues over a cylindrical roller.^{8,9} This technique may influence soft-tissue mobility by reducing perceived muscle stiffness, improving local circulation, modifying fascial restrictions, and facilitating greater joint range of motion, while generally maintaining muscle performance. Its simplicity, low cost, portability, and ability to be performed without assistance have contributed to its widespread use among athletes, physiotherapy and rehabilitation populations, and individuals involved in regular physical activity.

Although both Paschimottanasana and foam rolling have been reported to improve hamstring flexibility, there is limited research directly evaluating and comparing their effectiveness in physiotherapy students.^{6,8} Establishing which intervention provides greater improvement in flexibility could help physiotherapists make informed, evidence-based decisions when selecting appropriate interventions. Such findings may also contribute to the development of effective strategies for maintaining flexibility and reducing the risk of musculoskeletal problems among young adults.

Therefore, the present study was undertaken to compare the effectiveness of Paschimottanasana and foam roller intervention in improving hamstring flexibility among physiotherapy college students.

METHODS

Study design

A comparative interventional study was conducted to evaluate and compare the effectiveness of Paschimottanasana and foam roller intervention on hamstring flexibility among physiotherapy college students.

Study setting

The study was carried out at the Outpatient Department (OPD) of P.E.S. Modern College of Physiotherapy, Shivajinagar, Pune, Maharashtra, India.

Study duration

The study was conducted over a period of six months i.e. 9th September 2025 to 9th March 2026.

Study population

The study population comprised undergraduate physiotherapy students aged 18–25 years presenting with hamstring tightness.

Sample size

A total of 60 participants fulfilling the eligibility criteria were recruited. Participants were equally allocated into two intervention groups: Group A (n=30): Paschimottanasana and Group B (n=30): Foam Roller.

Sampling technique

Participants were recruited using purposive sampling. Allocation into the two intervention groups was performed using the chit method, ensuring equal distribution of participants.

Inclusion criteria

Participants included if they were physiotherapy college students aged between 18 and 25 years, both male and female students, demonstrated hamstring tightness with a YMCA Sit-and-Reach Test score <24.9 cm, and willing to participate and provided written informed consent.

Exclusion criteria

Participants were excluded from the study if they had any musculoskeletal injury involving the spine or lower extremities, neurological disorders affecting lower-limb function, a history of spinal fracture or dislocation, or lower-limb trauma or surgery within the preceding six months. Participants with radiating pain associated with low back pain, open wounds, or skin infections were also excluded. Additionally, individuals who regularly

participated in yoga, sports, or other forms of structured physical training during the study period were excluded to minimize potential confounding effects on the study outcomes.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee of P.E.S. Modern College of Physiotherapy. Written informed consent was obtained from all participants after explaining the study procedures. Participant confidentiality was maintained throughout the study.

Outcome measure

Hamstring Flexibility: Measured using the YMCA Sit-and-Reach Test, a valid and reliable measure of hamstring flexibility. The test was performed before and after the four-week intervention. Participants completed three trials, and the highest score, recorded in centimeters, was used for analysis.

Intervention protocol

Group A-Paschimottanasan

Participants allocated to Group A performed Paschimottanasan under supervision.

Procedure

Participants sat on a yoga mat with both lower limbs fully extended and feet together. The spine was maintained in an erect position while both upper limbs were raised overhead during inspiration. During expiration, participants bent forward from the hip joints while attempting to reach the feet without flexing the knees. The end position was maintained for 30 seconds before returning to the starting position.

The end position was held for 30 seconds, after which participants slowly returned to the starting position. The intervention was performed for three sessions per week over a period of four weeks, with a 30-second hold maintained during each session.

Group B-foam roller

Participants allocated to Group B performed self-myofascial release using a standard 36-inch foam roller.

Procedure

Participants positioned the posterior aspect of both thighs over the foam roller while supporting body weight with the upper limbs. Slow rolling movements were performed from the popliteal fossa to the ischial tuberosity without hip rotation. Pressure was applied using body weight

while maintaining controlled movement throughout the intervention.

Dosage

Three sets, one minute per sets, thirty seconds rest between sets, three sessions per week, four weeks.

Study procedure

Following ethical approval, eligible participants were recruited according to the predefined inclusion and exclusion criteria. Baseline hamstring flexibility was measured using the YMCA Sit-and-Reach Test. Participants were randomly allocated into two intervention groups by the chit method. Group A received Paschimottanasan, while Group B received foam roller intervention according to the prescribed protocols. Both interventions were administered for four weeks. At the completion of the intervention period, hamstring flexibility was reassessed using the same outcome measure under identical testing conditions.

Statistical analysis

Collected data were entered into Microsoft Excel and analysed using descriptive and inferential statistics. Continuous variables were expressed as Mean $\pm$ Standard Deviation (SD). Within-group comparisons of pre- and post-intervention flexibility scores were analysed using the paired t-test. Post-intervention flexibility between the two intervention groups was compared using the independent (unpaired) t-test assuming equal variances. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 60 physiotherapy college students meeting the eligibility criteria participated in the study and successfully completed the four-week intervention. The participants were equally allocated into two groups: Group A (Paschimottanasan, n=30) and Group B (Foam Roller, n=30). No participant withdrew from the study, and complete data from all participants were included in the final statistical analysis.

Demographic characteristics

The study included participants aged 18-25 years, with the highest proportion belonging to the 25-year age group (15%). Female participants constituted the majority of the study population (90%), while male participants accounted for 10% (Table 1).

Effect of Paschimottanasan and foam roller on hamstring flexibility

The Paschimottanasan group demonstrated a statistically significant improvement in hamstring flexibility

following the four-week intervention. The mean Sit-and-Reach score increased from 22.86 ± 2.08 cm before intervention to 25.16 ± 1.90 cm after intervention ($t=5.51$, $p<0.001$).

Table 1: Demographic characteristics of the study participants (n=60).

Variables	Frequency (N)	Percentage (%)
Age (years)		
18	6	10
19	7	11
20	7	12
21	7	12
22	8	13
23	8	13
24	8	14
25	9	15
Gender		
Male	6	10
Female	54	90

Similarly, the Foam Roller group showed a significant improvement in hamstring flexibility, with the mean score increasing from 23.16 ± 1.74 cm to 24.16 ± 1.44 cm ($t=3.61$, $p=0.001$) (Table 2).

Table 2: Comparison of pre- and post-intervention hamstring flexibility within each group (n=30).

Groups	Pre-intervention, Mean $\pm$ SD (cm)	Post-intervention, Mean $\pm$ SD (cm)	t value	P value
Paschimottanasan	22.86 ± 2.08	25.16 ± 1.90	5.51	<0.001*
Foam Roller	23.16 ± 1.74	24.16 ± 1.44	3.61	0.001*

Table 3: Comparison of post-intervention hamstring flexibility between the two groups (n=30).

Groups	Post-intervention, Mean $\pm$ SD (cm)	t value	P value
Paschimottanasan	25.16 ± 1.90	2.29	0.025*
Foam roller	24.16 ± 1.44		

*Independent (unpaired) t-test; $p<0.05$ indicates statistical significance

DISCUSSION

The present study was conducted to compare the effectiveness of Paschimottanasan and Foam Roller intervention in improving hamstring flexibility among physiotherapy college students. The findings demonstrated that both interventions significantly improved hamstring flexibility after four weeks. However, participants who performed Paschimottanasan exhibited significantly greater improvement than those who received foam roller intervention.

These findings indicate that both interventions were effective in improving hamstring flexibility among physiotherapy college students.

Comparison between the two intervention groups

The independent t-test revealed a statistically significant difference between the two intervention groups following completion of the four-week intervention ($t=2.29$, $p=0.025$). Participants in the Paschimottanasan group demonstrated significantly greater improvement in hamstring flexibility than those in the Foam Roller group (Table 3).

Both Paschimottanasan and Foam Roller interventions significantly improved hamstring flexibility after four weeks of treatment. However, participants performing Paschimottanasan achieved greater improvement in flexibility than those receiving foam roller intervention. Based on the observed statistically significant between-group difference, the alternative hypothesis was accepted, indicating that Paschimottanasan is more effective than foam rolling in improving hamstring flexibility among physiotherapy college students.

Within-group analysis showed a significant increase in hamstring flexibility in both intervention groups. The Paschimottanasan group demonstrated an improvement in the mean Sit-and-Reach score from 22.86 ± 2.08 cm to 25.16 ± 1.90 cm ($p<0.001$), whereas the Foam Roller group improved from 23.16 ± 1.74 cm to 24.16 ± 1.44 cm ($p=0.001$). These findings indicate that both interventions are effective in enhancing hamstring flexibility in healthy young adults.

The greater improvement observed in the Paschimottanasan group may be attributed to the sustained static stretching provided by the posture.^{5,7} During Paschimottanasan, the hamstring muscles are maintained in a lengthened position, promoting viscoelastic deformation of the muscle-tendon unit and increasing stretch tolerance. Sustained stretching also stimulates the Golgi tendon organs, producing autogenic inhibition that reduces muscle tension and allows greater muscle elongation. Repeated stretching over four weeks may have contributed to long-term improvements in muscle extensibility.

Foam rolling also produced significant improvements in flexibility. The beneficial effects of foam rolling may be explained by self-myofascial release, which is believed to reduce fascial adhesions, increase local blood circulation, decrease tissue stiffness, and improve sliding between fascial layers.^{8,9} In addition, the mechanical pressure applied during foam rolling may alter pain perception and increase stretch tolerance through neurophysiological mechanisms. Although effective, the improvement produced by foam rolling in the present study was smaller than that observed with Paschimottanasana.

The between-group analysis demonstrated a statistically significant difference in post-intervention flexibility scores ($t=2.29$, $p=0.025$), indicating that Paschimottanasana was more effective than foam rolling. The greater mean improvement in the Paschimottanasana group suggests that a sustained static stretching technique may produce superior gains in hamstring flexibility compared with short-duration self-myofascial release in healthy physiotherapy students.

The findings of the present study are consistent with previous research reporting the effectiveness of yoga-based stretching exercises in improving hamstring flexibility. Several authors have demonstrated that regular static stretching significantly increases muscle extensibility and joint range of motion by improving the viscoelastic properties of the muscle-tendon unit and enhancing neuromuscular adaptation. Similarly, studies evaluating foam rolling have reported improvements in flexibility, although the magnitude of improvement varies depending on the duration, intensity, and frequency of the intervention.^{8,9,12,13}

The clinical significance of the present findings is noteworthy. Hamstring tightness is frequently observed among physiotherapy students because of prolonged sitting during academic activities and reduced participation in flexibility exercises. Improved hamstring flexibility may contribute to better posture, more efficient movement patterns, reduced mechanical stress on the lumbar spine, and a lower risk of musculoskeletal injuries. Since Paschimottanasana is simple, inexpensive, and does not require specialised equipment, it can be easily incorporated into daily exercise programmes, rehabilitation protocols, and preventive fitness programmes for young adults.

Overall, the findings of the present study indicate that both Paschimottanasana and foam rolling are effective interventions for improving hamstring flexibility. However, Paschimottanasana demonstrated significantly greater effectiveness and may therefore be considered the preferred intervention for improving hamstring flexibility among physiotherapy college students.

This study has few limitations. The study had a relatively small sample size of 60 physiotherapy college students, which may limit the generalizability of the findings. The

intervention period was limited to four weeks, and therefore the long-term effects of Paschimottanasana and Foam Roller exercises could not be determined. The study included only physiotherapy college students aged 18-25 years, so the findings may not be applicable to other age groups or populations.

CONCLUSION

The present study compared the effectiveness of Paschimottanasana and Foam Roller intervention in improving hamstring flexibility among physiotherapy college students. Both interventions produced statistically significant improvements in hamstring flexibility after four weeks of intervention. However, the improvement achieved with Paschimottanasana was significantly greater than that observed with foam roller intervention.

The findings suggest that Paschimottanasana is an effective, safe, economical, and easily accessible intervention for improving hamstring flexibility. It can be incorporated into routine flexibility training, rehabilitation programmes, and injury prevention strategies for physiotherapy students and other healthy young adults.

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