ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 02 | February - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

"EFFECT OF PASSIVE STRETCHING AND FOAM ROLLER ON HAMSTRING FLEXIBILITY ON COLLEGE STUDENTS: A COMPARATIVE STUDY"

Bachelor of Physiotherapy

Yash Dholakiya Venus Institute Of Physiotherapy Gandhinagar - 382420

Dr. Arvind Kumar Principal And Professor Venus Institute Of Physiotherapy Gandhinagar - 382420

ABSTRACT

Background: Lateral epicondylitis, or tennis elbow, is a common overuse syndrome of the extensor tendons of the forearm causing pain in the elbow and forearm and lack of strength and function of the elbow and wrist. It has been suggested that eccentric exercise programs should be used as a first-line conservative treatment for LET in order to lengthen the musculotendinous unit while applying a load. Muscle Energy Technique (MET) is a gentle manual therapy intervention targeting the soft tissues primarily, although it also makes a major contribution toward the joint mobilization. Present study compares both these techniques for effective management of tennis elbow. **Methodology:** 30 College students with Hamstring tightness were selected via Inclusion and Exclusion criteria and divided into 2 groups via simple random sampling. One group received Foam rolling and another group received Passive stretching. Both groups assessed pre and post treatment via Active Knee Extension test. Total study duration was 2 weeks. **Results And Conclusions:** Results of present study confirms that both Foam rolling and passive stretching can be useful in improving hamstring flexibility in college students.

KEYWORDS

Foam Rolling, Passive Stretching, Hamstring Flexibility

INTRODUCTION

Young adulthood (Between ages of approximately 18-26) is a sequential and essential time of life. For normal human body functioning, good muscular flexibility play an important role. Limitation in flexibility causes severe musculoskeletal overuse injuries in a person and affects a person's level of function. Many musculoskeletal repeated overuse injuries due to decrease lower extremity flexibility that ranges from stress fractures and shin splints leads to patella femoral pain syndrome or anterior thigh pain or Runner's Knee and muscle strains.[1]

Hamstring muscles comprise the three major muscles of the posterior aspect of the thigh. These include the semimembranous as the medial most, long and short heads of the biceps femoris as the lateral most, and semitendinosus in between. These groups of muscles are clinically significant as they are highly susceptible to injury, especially in the athletes.[2]

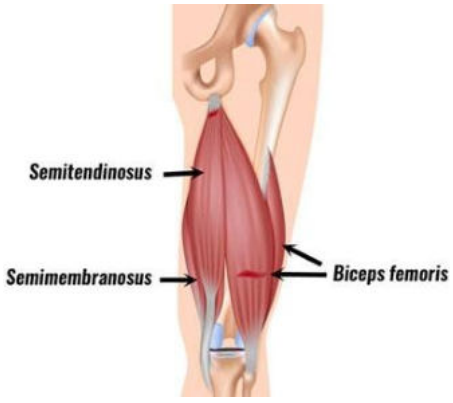

Figure 1: Hamstring muscle

The semimembranosus and long head of the biceps femoris have a common origin on the posterolateral aspect of the ischial tuberosity while semitendinosus has an origin on the anterolateral part of the ischial tuberosity. The short head of biceps has origin medial to the linea aspera on the distal aspect of the posterior part of the femur. Both the long and short head of biceps femoris go on to insert over the head of the fibula while semimembranosus inserts over the medial condyle of the tibia. Semitendinosus inserts onto the pes anserine region on the medial part of the tibia. [3]

All the hamstring muscles traverse two joints (hip and knee) from origin to insertion except the short head of biceps femoris, which only traverses knee joint from its origin to insertion. The main function of the hamstring muscles is flexion at the knee joint and extension at the hip joint. Biceps femoris also helps in the external rotation of the hip while semimembranosus and semitendinosus help in the internal rotation of the hip joint.[4]

Although there is no consensus in the literature, some studies suggest that a combination of abnormalities (strength, flexibility, warm up, fatigue) or morphological proximal attachment increase the risk of hamstring strain. Moreover, poor hamstring flexibility has been associated with pelvic, knee, and lower back pain, and it may affect sport performance. For these reasons, proper hamstring stretching is the key to flexibility improvement in these muscles, with it being part of many rehabilitation and training programs in the health or sport fields. [5]

Static stretching is a common technique used by strength and conditioning specialists and athletes to increase muscle length. This type of stretching takes the muscle to its end range and maintains this position for a specified duration.

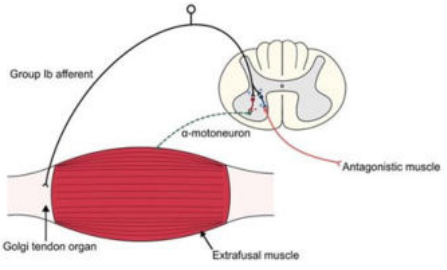

Figure 2: Static Stretching and GTO Activation

One of the advantages of static stretching may be the facilitation of the Golgi tendon organ (GTO). Static tension placed on the muscle tendon unit has been shown to activate the GTO, which may produce autogenic inhibition of the muscle that is stretched. Static stretching has been shown to be very effective at increasing hamstring length [6]

Another popular technique in rehabilitation and fitness to increase the ROM is foam rolling (FR), also known in the literature as self-roller release or myofascial rolling. This flexibility effect of FR can be local or distant. FR is a collective term for manual therapy techniques based on the application of mechanical force using a foam roller on soft body tissue. Recent studies have showed that a single FR application can increase the ROM of a joint immediately after the treatment [18–20] and for durations of up to 30 min post-treatment [7].

The foam roll is a solid foam cylinder available in different degrees of hardness and size. The exerted pressure of the foam roll stimulates the Golgi tendon unit and decreases muscle tension. Another possible effect is improved hydration of tissues. While working, soft tissue is squeezed like a sponge; consequently, it is soaked through with fluid, which improves motion between the different layers of fascia and increases blood flow and temperature.[8]

Present study is done to see and find comparability of foam rolling and passive stretching as both techniques shown effective individually.

Review Of Literature

1. Lech Dobija et al. (2023) did a study on **Immediate effect of passive hamstring stretching on flexibility and relationship with psychosocial factors in people with chronic low back pain**. One minute of passive stretching was performed in 90 people with CLBP. Active Knee Extension test, Fingertips-to Floor distance, Fear-Avoidance Beliefs Questionnaire (FABQ) and Hospital Anxiety and Depression Scale (HADS) were used as an outcome measure. Their result shown that Passive hamstring stretching induced an immediate, statistically significantly improvement in hamstring flexibility. [9]

2. Masahiro Iwata et al. (2019) did a study on **Dynamic Stretching Has Sustained Effects on Range of Motion and Passive Stiffness of the Hamstring Muscles** on 24 healthy subjects. DS consisted of ten 30-s sets of 15 repetitions of extension and relaxation of the hamstrings. Isokinetic dynamometer was used to assess range. They concluded that DS increases ROM and decreases passive stiffness in a sustained manner. [10]

3. Danielle M. DeBruyne et al. (2017) did a study on **Self-Mobilization Using a Foam Roller Versus a Roller Massager: Which Is More Effective for Increasing Hamstrings Flexibility?** The literature was searched for studies on the effects of using foam rollers or roller massagers to increase hamstrings flexibility in asymptomatic physically active adults. Four randomized controlled trials were included; 2 studies provided level 2 or 3 evidence regarding foam rollers and 2 studies provided level 2 or 3 evidence regarding roller massagers. Both roller-massager studies reported increases in hamstrings flexibility after treatment. Data from the foam-roller studies did not demonstrate a statistically significant increase in hamstrings flexibility, but 1 study did demonstrate a strong effect size. The reviewed moderate-quality studies support the use of roller massagers but provide limited evidence on the effectiveness of foam rolling to increase hamstrings flexibility in asymptomatic physically active adults.[11]

4. Sung-Hak Cho et al. (2016) did a study on **Immediate effect of stretching and ultrasound on hamstring flexibility and proprioception**. Study included 30 healthy university students with no history of pain in the Achilles tendon or hamstring within the recent 6 months. Each participant completed two experiments. In the first experiment (MS), they completed self-myofascial stretching using a foam roller for 7 days. In the second experiment (MSU), the same participants performed the self-myofascial stretching after the 15-minute application of ultrasound. This study involved a pre- and post-test on hamstring muscle flexibility and hip joint proprioception. They concluded that Self-myofascial stretching immediately increased hamstring muscle flexibility and improved hip joint proprioception, but the addition of pre-stretch ultra sound provided no further benefit. [12]

5. Junker et al. (2015) did a study on **The Foam Roll as A Tool to Improve Hamstring Flexibility.** They included 40 young male between 17-47 years and divided into 3 groups: foam roll group (FOAM, n = 13), a contract relax PNF stretching group (CRPNF, n = 14), or a control group (CG, n = 13). The FOAM group massaged their hamstring muscles with the foam roll 3 times per week for 4 weeks (12 training sessions). The CRPNF group was assigned to 12 sessions of contract- relax PNF stretching. The CG underwent no intervention. Hamstring flexibility (ROM) was measured by a stand-and-reach test before and after the intervention period. Their results concluded that The foam roll can be seen as an effective tool to increase hamstring flexibility within 4 weeks. The effects are comparable with the scientifically proven contract-relax PNF stretching method. [8]

6. E Sherer et al. (2013) did a study on **Effect of utilizing myofascial foam roll on hamstring flexibility**. Total study duration was 4 week and they included. Total 18 subjects were in the study and out of them 8 were in control group and 10 were in Foam roller group. Foam roller was used for 2 times a week for 4 weeks and participants used 3-5 minutes on foam roller. Their results concluded that Hamstring flexibility was higher in Foam roller group compared to control group. [13]

7. Azadeh H. et al. (2011) did a study on **Hamstring flexibility in young women following passive stretch and Muscle energy technique**. 30 young female between age group of 20-25 year were included and divided into 2 groups: static stretching (n=15) and Muscle energy technique (n=15). Hamstring flexibility was evaluated by Passive knee extension test.

Total 10 session was given. They concluded that there were similar result in improvement of Hamstring flexibility.[14]

Need Of Study

- Maintaining normal muscle length requires regular stretching to prevent muscle stiffness and benefit from the decreased risk of musculoskeletal injuries and enhanced physical performance. Despite the importance of regular stretching, much controversy exists as to which stretching technique and parameters are the most effective for increasing muscle flexibility. Several stretching techniques have been described in the literature, but there is no any literature which compared Passive stretching and Foam roller on Hamstring flexibility on College students, so there is need to do study.

Aim And Objective Of The Study

- **Aim**
- To compare the Foam rolling and Passive stretching on Hamstring Flexibility on College going students.

Objectives

- To find effect of foam rolling on hamstring tightness in college students
- To find effect of passive stretching on hamstring tightness in college students
- To compare effect of foam rolling and passive stretching on hamstring tightness in college students

Hypothesis

- **Null Hypothesis**
- **H_o1:** There is no significant effect of foam rolling on hamstring tightness in college students
- **H_o2:** There is no significant effect passive stretching on hamstring tightness in college students
- **H_o3:** There is no significant comparative effect of foam rolling and passive stretching on hamstring tightness in college students

Alternative Hypothesis

- **H_i1:** There is significant effect of foam rolling on hamstring tightness in college students
- **H_i2:** There is significant effect passive stretching on hamstring tightness in college students
- **H_i3:** There is significant comparative effect of foam rolling and passive stretching on hamstring tightness in college students

Methodology

Study Design, Setting And Sampling

- **Study Design:** A Comparative Study
- **Study Setting:** Various Colleges near Gandhinagar
- **Study Duration:** 2 weeks
- **Sampling Technique:** Simple Random Sampling
- **Population:** Students with Hamstring Tightness
- **Sample Size:** 30 subjects

Selection Criteria

Inclusion Criteria:

- Subjects willing to participate
- Both male and female
- Able to follow command
- Age group: 18-25 year
- Positive Active Knee Extension test (Popliteal Angle Less than 125^0)

Exclusion Criteria:

- Currently seeking medical care for lower extremity
- Previous medical history that included any surgery for lower extremity injuries
- Neuromuscular disorder
- Had current or previous complaint of lower extremity pain, spine pain
- Subjects who are on pain medications
- Any cardiac disease

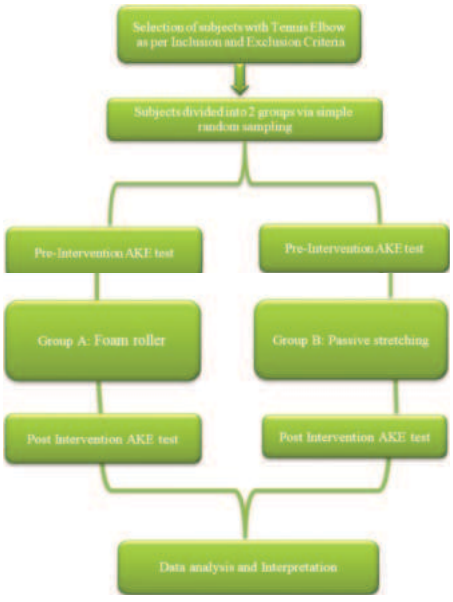

Figure 3: Flow Chart of the study procedure

Materials Required
- Assessment form
- Consent form
- Plinth
- Goniometer
- Foam roller

Methodology
Procedure:
1. Selection of the students done on the basis of Inclusion and Exclusion criteria
2. Subjects participated was signed Assessment form and Consent form
3. Pre- Active knee extension measurement was taken
4. Subjects were randomly allocated into 2 group:
5. Group 1. Was received Foam roller for Hamstring tightness
6. Group 2. Was received Passive stretching for Hamstring tightness
7. Post- Active knee extension measurement was taken
8. Result and Analysis
9. Conclusion

Group A: Foam Roller for Hamstring Tightness [15]
- The subjects assumed a long sitting position on a firm and even surface by placing the arms backward and transferring their body weight to their palms.
- The foam roller, applied bilaterally, was placed under the hamstrings and slowly moved back and forth from the ischial tuberosity to the popliteal fossa by applying pressure for 2 min and the applied pressure was the maximum tolerated by the patients (pushing till discomfort) with no pain.
- 6 days a week, throughout the 2 week study, subjects were perform three stretching repetitions, with one minute of rest between each repetition.

Figure 4: Foam Roller for Hamstring Tightness

- **Group B: Passive Stretching for Hamstring Tightness** [14]
- Subject was in supine position and then hip and knee will be flexed to 90^0, then knee was passively extended until resistance will be felt. The primary resistance point was determined by therapist as a soft tissue barrier or end point.
- Knee was maintained in this position for 10 seconds.

Figure 5: Passive Stretching for Hamstring Tightness

Outcome Measure:
Active Knee Extension Test [1]
- **Position Of Patient:** supine lying with test side hip should be flexed
- **Position Of Therapist:** the therapist stands next to the patient
- **Method:** the subject lies supine, head back and arms across the chest. The hip is passively flexed until the thigh is vertical. Maintain this thigh position throughout the test, with the opposite leg in a fully extended position. The foot of the leg being tested is kept relaxed, while the leg is actively straightened until the point when the thigh begins tested is kept relaxed, while the leg is actively straightened until the point when the thigh begins to move from the vertical position. The Popliteal angle at this point is recorded.

RESULT
Study variable was taken before starting sessions on both groups and at the end of the study, study variable was AKE.

Age Distribution:

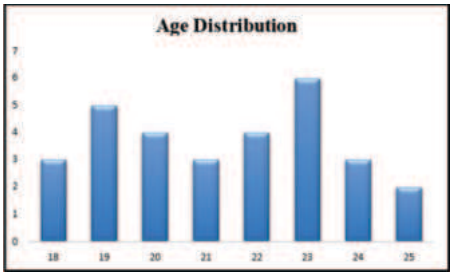

Figure 6: Age Distribution

Age group was between 18-25 years. Among a total of 30 Hamstring tightness subjects, 3 were between 18-25 years, 6 were between 26-30 years, 4 were between 31-35 years and 7 were between 36-40 years. The mean age of participants was 35±15 years.

Gender Distribution:

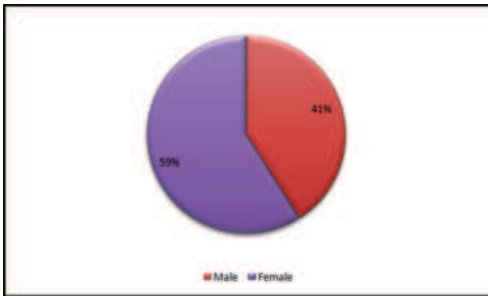

Figure 7: Gender Distribution

Among total 30 subjects with tennis elbow, 41% were female and 59% were male.

Data Analysis:
Statistical analysis was performed on the data obtained from 30 patients. Data was analyzed using SPSS Version 25.0. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired 't' test used for comparing data within each group and independent 't' test for comparing between the groups. Data was considered statistically significant with P<0.05 and highly significant at p<0.01.

Table 1: Paired "t" test values for AKE

Group	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A	30.1	1.2	25.06	P<0.05
Group B	33.07	1.09	30.22	P<0.05

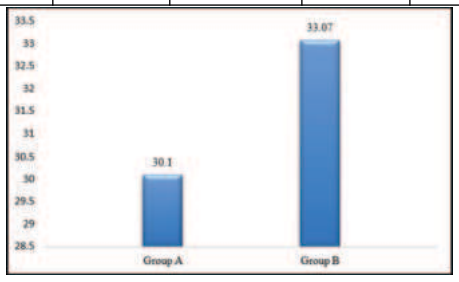

Figure 8: Mean Values of AKE

Table 2: Independent "t" test values

Outcome Measure	"t" Value	"p" Value
AKE	-1.31	P<0.05

Pre and post mean difference AKE show 30.1 in group A and 33.07 in group B. As p<0.05 there is significant difference within two groups.

Independent "t" test shows "t" value of -1.31 which clarifies that there is no significant difference in between group analysis.

DISCUSSION

Outcome of the study is to compare the Effect of foam roller versus passive stretching on hamstring tightness among various college students near Gandhinagar. Total 30 patients between age of 18-25 years were taken.

Present study shown there is near equal significant effect seen in Foam roller group than passive stretching group. Both groups shown statistically significant effect pre and post measurement but there is no significant improvement seen in between group analysis.

For normal human body functioning, good muscular flexibility plays an important role. Limitation in flexibility causes severe musculoskeletal overuse injuries in a person and affects a person's level of function. Many musculoskeletal repeated overuse injuries due to decrease lower extremity flexibility that ranges from stress fractures and shin splints leads to patellofemoral pain syndrome or anterior thigh pain or Runner's Knee and muscle strains. (Davis, Ashby et.al. 2005) Appropriate levels of flexibility and skeletal muscle strength are requisite for carrying out systematic movements, which in sequentially provide effective quality of life and best presentation in competitive sports. (Nobrega, Paula.et.al.2005) [1]

Ylinen et al. measured changes in extensibility using the SLR method although no data was provided evaluating changes in passive stiffness through the common range of motion which appears to be the mechanism of adaptation following an appropriately prescribed volume of passive hamstring stretching. The results of this study suggest that passive muscle stiffness, primarily of the hamstring muscles, is the mechanism by which extensibility was increased with the passive stretching program. The results of this study, while indicating changes in passive muscle stiffness, are not able to provide information on whether the adaptation is in the series or parallel components of muscle. This study did not measure, and cannot rule out, that changes in passive stiffness of other posterior chain muscles trained in this study (i.e., gluteals) also contributed to the training improvement. Changes in neural activation are associated with the changes observed in hamstring extensibility. [16]

It has been theorized that a slow static stretch facilitates the GTO, which may produce inhibition of the muscle that is stretched. Self-stretching and PNF-R require an active contraction of the opposing muscle (quadriceps), which, according to Moore and Hutton and Osternig et al, actually facilitates the hamstring muscles. Therefore, the mechanism by which PNF functions may not be related to the long-held theory of neural inhibition associated with prestretch contractions. The authors speculate that other mechanisms such as mechanical elongation or creep of the connective-tissue components of the muscle while in the presence of inhibition of the GTO during passive static stretching may be the overriding difference. [6]

Foam rolling also provides an effective means of improving hamstring flexibility. There are many mechanoreceptors in fascia; these are sensory endings that are responsive to compressive and tensile loading. It is claimed that the stimulation of Golgi receptors are essential in myofascial release with the foam roll. The stimulation of Golgi receptors inhibits the muscle spindle activity and decreases muscular tension. This phenomenon is known as autogenic inhibition. Fama and Bueti suggested that it is likely that the pressure of the foam roll causes stimulation of the Golgi receptors by ischemic compression. They demonstrated that there was a negative effect of a warm-up with foam rolling on jump performance, especially for the countermovement jump, when compared with a dynamic warm-up. Nevertheless, the stimulation of Golgi receptors only explains the immediate effects of foam rolling and not the observed effects as in this study. Ruffini's receptors and free nerve endings react on sustaining and alternating pressure. On the contrary, Pacini's receptors are only responsive to varying pressure and are essential for proprioception, a requirement for proper movement. In fascial training, a proprioceptive refinement is encouraged.[17]

CONCLUSION

The present study confirms that both foam rolling and passive stretching can be effective interventions for improving hamstring flexibility in college students. These findings are significant as they provide practical insights for physical education programs, athletic training, and general fitness routines.

Limitations

- Sample size is small
- Male and female were not evaluated separately.

Annexure A
Patient Information Form

DEMOGRAFIC DATA OF PARTICIPANT

- Name:
- Age: _____
- Height:_____
- Weight:_____
- History: _____
- Contact Number:_____

Annexure B
Consent Form
Date:_____

Study Title: "Effect Of Passive Stretching And Foam Roller On Hamstring Flexibility On College Students: A Comparative Study".

Subject's Name:_____
Age:_____

I Have Been Explained About The Research Project Entitled "Effect Of Passive Stretching and foam roller on hamstring flexibility

on college students: a comparative study"

I understand that my participation in the study is voluntary and that I will be free to withdraw at any time without giving any reason.

I understand that the data obtained through the study may be used for research paper publication and I also understand that my identity will not be revealed in any information released to publish.

I agree to take part in the above study.

Sign of Subject: Sign of Investigator:

Master Chart

Sr. No.	AKE test			
	Group A		Group B	
	Pre	Post	Pre	Post
1	124	167	118	158
2	131	165	122	160
3	124	160	119	146
4	126	171	117	145
5	120	143	114	152
6	128	164	120	146
7	124	149	117	158
8	123	152	124	164
9	122	144	120	162
10	130	165	116	144
11	120	145	127	162
12	125	148	122	146
13	118	143	131	165
14	126	160	122	145
15	124	148	130	166
16	118	143	128	162
17	127	167	120	156
18	120	155	130	164
19	122	148	126	163
20	120	160	124	162
21	121	147	120	144
22	126	148	126	166
23	118	146	118	148
24	115	140	110	140
25	114	144	116	147
26	114	143	122	160
27	123	160	127	165
28	113	142	120	145
29	120	146	126	160
30	116	142	123	146

REFERENCES

1. Swati SA, Singh AK, Singh S, Wadhwa K. CORRELATION OF LUMBAR FLEXIBILITY AND HAMSTRING FLEXIBILITY ON FUNCTIONAL MOVEMENT SCREEN TEST IN YOUNG ADULTS.
2. Davis KW. Imaging of the hamstrings. Semin Musculoskelet Radiol. 2008 Mar;12(1):28-41.
3. Petersen J, Hölmich P. Evidence based prevention of hamstring injuries in sport. Br J Sports Med. 2005 Jun;39(6):319-23.
4. Woods C, Hawkins RD, Maltby S, Hulse M, Thomas A, Hodson A., Football Association Medical Research Programme. The Football Association Medical Research Programme: an audit of injuries in professional football--analysis of hamstring injuries. Br J Sports Med. 2004 Feb;38(1):36-41.
5. Covert, C.A.; Alexander, M.P.; Petronis, J.J.; Davis, D.S. Comparison of ballistic and static stretching on hamstring muscle length using an equal stretching dose. J. Strength Cond. Res. 2010, 24, 3008–3014.
6. Davis DS, Ashby PE, McCale KL, McQuain JA, Wine JM. The effectiveness of 3stretching techniques on hamstring flexibility using consistent stretching parameters. The journal of strength & conditioning research. 2005 Feb 1;19(1):27-32.
7. Monteiro, E.R.; Cavanaugh, M.T.; Frost, D.M.; Novaes, J.D. Is self-massage an effective joint range-of-motion strategy? A pilot study. J. Bodyw. Mov. Ther. 2017, 21, 223–226.
8. Junker DH, Stöggl TL. The foam roll as a tool to improve hamstring flexibility. The Journal of Strength & Conditioning Research. 2015 Dec 1;29(12):3480-5.
9. Dobija L, Pereira B, Cohen-Aknine G, Roren A, Dupeyron A, Coudeyre E. Immediate effect of passive hamstring stretching on flexibility and relationship with psychosocial factors in people with chronic low back pain. Heliyon. 2023 Sep 1;9(9).
10. 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. Journal of sports science & medicine. 2019 Mar;18(1):13.
11. DeBruyne DM, Dewhurst MM, Fischer KM, Wojtanowski MS, Durall C. Self-mobilization using a foam roller versus a roller massager: which is more effective for increasing hamstrings flexibility?. Journal of sport rehabilitation. 2017 Jan 1;26(1):94-100.
12. Cho SH, Kim SH. Immediate effect of stretching and ultrasound on hamstring flexibility and proprioception. Journal of Physical Therapy Science. 2016;28(6):1806-8.
13. Sherer E. Effects of utilizing a myofascial foam roll on hamstring flexibility.
14. Shadmehr A, Hadian MR, Naiemi SS, Jalaie S. Hamstring flexibility in young women following passive stretch and muscle energy technique. Journal of back and musculoskeletal rehabilitation. 2009 Jan 1;22(3):143-8.
15. Miller JK, Rockey AM. Foam rollers show no increase in the flexibility of the hamstring muscle group. UW-L Journal of Undergraduate Research. 2006;9:1-4.
16. Gilbert KK, Brismee JM, Collins DL, et al. 2006 young investigator award winner: lumbosacral nerve root displacement and strain. Part 2. A comparison of 2 straight leg raise conditions in unembalmed cadavers. Spine 2007;32(14):1521–1525
17. Lukas, C. Faszienbehandlung mit der Blackroll [Treatment of fascia with the blackroll]. Norderstedt: BoD, Books on Demand, 2012.