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COMPARISON BETWEEN MYOFASCIAL RELEASE AND BENT LEG RAISE TECHNIQUE WITH PLYOMETRIC TRAINING ON HAMSTRING FLEXIBILITY AND FITNESS PARAMETERS IN BEGINNER RUNNERS- AN EXPERIMENTAL STUDY

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Purpose:
The purpose of this study was to examine the effect of self-Myofascial Release (MFR) and self-Bent Leg Raise (BLR) stretching on hamstring flexibility and fitness parameters before and after plyometric training sessions in beginner runners.

Study Design: An experimental study.

Objectives:
To evaluate the effects of self-MFR and self-BLR stretching combined with plyometric training on hamstring tightness, endurance, strength, and agility.

Methodology:
Sixty-four subjects aged 18-25 were included in this study. Athletes were selected based on inclusion criteria and were randomly divided into two groups. The experimental group received self-MFR for 6 weeks, with three sessions per week, along with plyometric training. The control group received self-BLR for 6 weeks, with three sessions per week. Outcome measures included the rate of perceived exertion scale, active knee extension test, agility T-test, and leg press test.

Results:
Data analysis using paired t-tests and unpaired t-tests revealed no significant differences between pre and post hamstring tightness, endurance, agility, and strength in both groups. However, the experimental group (self-MFR) showed more significant improvements compared to the control group (self-BLR).

Conclusion:
The study concluded that the self-Myofascial Release technique combined with plyometric training is more effective than the self-Bent Leg Raise technique combined with plyometric training in improving hamstring flexibility and fitness parameters in beginner runners.

Keywords:
Myofascial Release, Bent Leg Raise, Plyometric training, Hamstring tightness, Agility, Strength, Endurance.

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Introduction

A runner is defined as a person who runs a minimum distance of 20-30 km per week on a regular basis and has been running consistently for 1-3 years. Jogging and running are essential aerobic exercises for maintaining a healthy lifestyle. Ideal running biomechanics involves coordinated movements of all kinetic chain parameters, encompassing support (foot strike, mid-support, take-off) and recovery phases (follow-through, forward swing, foot descent).

Kinematics, the study of motion without considering forces, plays a critical role in running. In the sagittal plane, maximum hip extension occurs at toe-off, and maximum hip flexion occurs during mid to terminal swing. Knee flexion during the stance phase absorbs impact, followed by extension in the propulsive phase. The coronal plane involves hip adduction during stance and abduction during the swing. In the transverse plane, maximum internal pelvic rotation occurs in mid-swing to enhance stride length. Kinetically, hamstrings play a vital role, especially during the swing phase, by eccentrically contracting to control tibial movement and prevent knee hyperextension.

Running-related injuries often stem from training errors, accounting for 60% of such injuries. Tight hamstrings are a common issue, contributing to altered biomechanics and increased injury risk. Reduced hamstring flexibility, often seen in athletes with a history of injury, is a significant risk factor for recurrence. Flexibility, defined as the ability to move joints through an unrestricted range of motion, is crucial for injury prevention.

Hamstring injuries, common in sports requiring rapid acceleration, are often due to factors like muscle weakness, strength imbalances, fatigue, and improper warm-up. Non-contact injuries typically present as either sudden, incapacitating pain or slow, insidious onset.

Plyometric training enhances muscle power and performance through rapid stretching and shortening cycles, improving strength, joint stability, and running economy. Plyometric drills involve explosive activities like stopping, starting, and changing directions.

Static stretching, including self-myofascial release (MFR) and self-bent leg raise (BLR) techniques, is used to improve flexibility. MFR, often performed with foam rollers, increases flexibility, reduces arterial tightness, and decreases muscle soreness by releasing soft-tissue adhesions. The BLR technique aims to restore mobility and reduce muscle tightness.

This study aims to evaluate the effects of MFR and BLR combined with plyometric training on hamstring tightness in beginner runners over a 6-week period. The objectives include assessing the effects of SMFR and SBLR with plyometric training on hamstring flexibility and related fitness parameters—endurance, agility, and strength—in beginner runners, and comparing the effectiveness of SMFR versus SBLR combined with plyometric training. The need for this study arises from the fact that repetitive use of the hamstring muscle can lead to increased tightness, impacting stride length and overall performance. While plyometric training has been shown to improve running efficiency, few

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studies have explored the added benefits of hamstring stretching techniques. This research seeks to fill this gap by examining the combined effects of self-hamstring stretching and plyometric training on flexibility and performance.

Methodology

The study was conducted at Sports and Health Club, Sports Academy of Aurangabad in the state of Maharashtra in India. This experimental study employed a convenience sampling method and included a sample size of 64 participants, with 32 individuals in each group. Data collection spanned a duration of 1 year and focused on all male and female beginner runners. Materials used in the study comprised a written, informed, and signed consent form from each subject to permit their inclusion, along with a record or data collection sheet. The instruments and equipment utilized included a universal goniometer, a leg-press, a foam roller, and a stopwatch. Additionally, the Rate of Perceived Exertion Scale was employed for measurement purposes.

The inclusion criteria for the study were as follows: participants were required to be beginner runners, defined as individuals with no prior running training, who run a minimum distance of 3 km per session, at least 3 times per week, and have maintained this routine for at least 1 year. Additionally, participants needed to be aged between 18 and 26 years and must be athletes, both male and female, willing to participate in the study. They also had to have an active knee extension test angle of less than 125 degrees.

The exclusion criteria included any medical conditions that are contraindicated for strength training exercises according to the American College of Sports Medicine guidelines, runners with lower extremity injuries, any lower extremity reconstructive surgery in the past 2 years, athletes who have taken or are currently taking growth hormone or related performance endurance drugs, and those with medical or orthopedic problems that would compromise their participation in the study.

Procedure

The study aimed to evaluate the effect of hamstring stretching combined with plyometric training on hamstring flexibility. Following an explanation of the study, written informed consent was obtained from all participants. The research was conducted at MGM Sports and Health Club and the Sports Authority of India, Aurangabad. Baseline measurements for all outcome variables were recorded prior to the commencement of the study, including demographic data, hamstring flexibility range, Rate of Perceived Exertion scale, Agility T test, and Leg Press Test. Participants were then randomly allocated into two groups.

Outcome Measures:

1. **Rate of Perceived Exertion Scale:** This scale rates exercise intensity from 0 to 10.

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2. **Active Knee Extension Test:** The subject, in a supine position with hips flexed to 90 degrees and knees bent, was stabilized behind the knees. The athlete then actively extended each knee. Normal hamstring flexibility is indicated by a knee extension angle within 20 degrees of full extension, known as the popliteal angle. An angle less than 125 degrees signifies tight hamstrings.

3. **Agility T Test:** Cones were set up with a distance of five meters between three cones and a fourth cone placed 10 meters from the middle cone. The test involved running, side-stepping, and running backwards around the cones. The time taken to complete the course was recorded.

4. **Leg Press Test:** Athletes' weights were recorded, followed by a 10-minute warm-up. Participants performed leg presses with a weight close to their one-repetition maximum until they could no longer continue. The number of successful leg presses was counted, and if it exceeded eight, the weight was increased after a 10-minute rest, and the test was repeated. The maximum load calculator determined the athlete's 10 repetition maximum (10 RM).

Intervention Groups:

- **Group A (Experimental Group):** Received self-myofascial release (MFR) for 2-3 minutes before and after a 40-minute plyometric training session.
- **Group B (Control Group):** Performed self-bilateral leg stretching (BLR) for three repetitions before and after a 40-minute plyometric training session.

Plyometric Training Protocol:

- **Week 1:** Jumping Jacks (10), Vertical Jumps (5), Diagonal Jumps (4 spots, 5), Single Leg Side-to-Side Jumps (4 corners, 5), Split-Squat Jumps (5/5, alternate leg)
- **Week 2:** Jumping Jacks (15), Vertical Jumps (7), Diagonal Jumps (4 spots, 7), Single Leg Side-to-Side Jumps (4 corners, 7), Split-Squat Jumps (7/7, alternate leg)
- **Week 3:** Jumping Jacks (17), Vertical Jumps (10), Diagonal Jumps (4 spots, 10), Single Leg Side-to-Side Jumps (4 corners, 10), Split-Squat Jumps (10/10, alternate leg)
- **Week 4:** Jumping Jacks (20), Vertical Jumps (15), Diagonal Jumps (4 spots, 15), Single Leg Side-to-Side Jumps (4 corners, 15), Split-Squat Jumps (15/15, alternate leg)
- **Weeks 5-6:** Jumping Jacks (25), Vertical Jumps (20), Diagonal Jumps (4 spots, 20), Single Leg Side-to-Side Jumps (4 corners, 20), Split-Squat Jumps (20/20, alternate leg)

Self-MFR involved applying sustained pressure to myofascial tissue restrictions, with participants rolling their hamstrings on a foam roller while keeping their legs straight and quadriceps tightened.

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Each side was rolled for 1-2 minutes. Self-BLR involved placing one leg on a chair, flexing the other leg by 5-10 degrees, and bending diagonally over the flexed leg to stretch the hamstring, holding the stretch for 30 seconds and performing three repetitions.

RESULTS

Data was entered in Microsoft Excel and analysed using SASS version 24.0th. Normality of data was assessed for quantitative variable and data was found to be normally distributed. So Mean and SD were calculated for Quantitative variables and proportions were calculated for categorical variables. Also data was represented in form of visual impression like bar-diagram etc. For comparison of two groups mean unpaired t-test was applied. Patient t-test was used to check significant difference between pre and post treatment in each group. P- value of <0.05 was considered statistically significant.

Category	**Group A**	**Group B**
Gender		
Male	8 (25.0%)	10 (31.2%)
Female	24 (75.0%)	22 (68.8%)
Total	32 (100.0%)	32 (100.0%)
Age Group		
18-21	32 (100.0%)	23 (71.9%)
22-25	0 (0.0%)	9 (28.1%)
Total	32 (100.0%)	32 (100.0%)
Mean ± SD	18.78 ± 0.70	20.19 ± 1.92
t-value		2.88
P-value		P < 0.0001

The table presents the demographic characteristics of participants, including gender distribution and age group comparison between Group A and Group B. A statistically significant difference in age was found between the groups.

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Table 2: Comparison of Mean difference of Flexibility (degree) Right in pre and postof athletes in Groups:

Flexibility (degree) Right		Mean difference	t-value	p-value
Right	Pre Vs post treatment in Group A	38.90	17.01	P<0.0001 S
	Pre Vs post treatment in Group B	27.65	12.64	P<0.0001 S
Left	Pre Vs post treatment in Group A	31.56	14.39	P<0.0001 S
	Pre Vs post treatment in Group B	26.87	13.03	P<0.0001 S

Table 3: Comparison of Mean difference of Agility (sec) in pre and post in Groups:

Agility (sec)	Mean difference	t-value	p-value
Pre Vs post treatment Agility in Group A	6.69	8.77	P<0.0001 S
Pre Vs post treatment Agility in Group B	4.69	7.46	P<0.0001 S

Discussion

This study aimed to evaluate the effects of Self Myofascial Release (SMFR) combined with Plyometric

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Training and Self Bent Leg Raise (SBLR) combined with Plyometric Training on beginner runners with hamstring tightness. The primary outcome measures included hamstring flexibility, endurance, agility, and strength. Hamstring tightness was assessed using the Active Knee Extension Test, while endurance, agility, and strength were measured using the RPE scale, Agility T Test, and Leg Press Test.

A total of 64 athletes participated, comprising 18 males and 46 females aged 18 to 26 years. Group A, which received SMFR with Plyometric Training, consisted of 8 males and 24 females, while Group B, which received SBLR with Plyometric Training, included 10 males and 22 females. Randomization was used to allocate participants to each group. The study found that SMFR combined with plyometric training yielded slightly better results across all variables related to hamstring tightness compared to the SBLR method.

In Group A, the mean hamstring flexibility improved significantly from 95.31° to 134.21° on the right side and from 100.15° to 131.72° on the left side. Conversely, Group B showed improvements from 96.25° to 123.90° on the right side and from 101.40° to 128.28° on the left side. Both groups showed significant results ($p<0.0001$), but Group A demonstrated a slightly greater improvement. This suggests that SMFR is more effective in enhancing hamstring flexibility, corroborating previous studies that highlighted its benefits in increasing range of motion without compromising muscle performance.

The SBLR technique also proved beneficial but was less effective than SMFR. This technique influences muscle stretch tolerance through neurophysiological responses. Similar findings were reported by Toby Hall et al. (2005), who noted that the BLR technique improves range of motion and reduces pain, likely due to increased flexibility and placebo effects that activate analgesic centers. Cheraladhan E. Sambandan et al. (2011) also found BLR to be more effective than passive stretching for hamstring flexibility, aligning with our results.

Furthermore, the study assessed the Rate of Perceived Exertion (RPE), endurance, agility, and strength. Group A exhibited a greater mean improvement in RPE (2.72) compared to Group B (2.56), with significant results ($p<0.0001$) for both groups. Plyometric training, combined with SMFR, enhanced endurance more effectively than with SBLR, consistent with Rodrigo Ramirez-Campillio et al. (2013) findings. The improvements in agility and strength were similarly more pronounced in Group A. Studies by Michael G. Miller (2006) and Kevin Thomas (2009) support these results, indicating that plyometric training enhances power, agility, and muscle strength.

Limitations

This study had several limitations. Some coaches did not allow their athletes to participate due to ongoing national-level competitions. Additionally, the lack of long-term follow-up necessitates further longitudinal studies to evaluate the sustained effects of the interventions. Future research could also explore biomechanical aspects of muscles other than the hamstrings and extend the study to include endurance and strength training, as well as a focus on different muscle groups or running disciplines.

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