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Comparison on the Effect of Foam Roller with and Without Passive Stretching on Calf Tightness in Badminton Players

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Abstract: ***Aim: The aim of the study is to compare the effect of foam roller with and without passive stretching on calf tightness in badminton players. Introduction: Badminton is an intense sport that requires fast and sudden movements. A professional player is expected to perform a large number of jumps, lunges and rapid directional changes. Repeated impact from running, lunging and jumping takes the player on the knees and ankle over the time. Jumping and landing over the toes first can automatically injure the calf muscle; this could be due to tightness of calf muscle. The objective of the study is the efficacy of foam roller over passive calf stretching in badminton players. Methodology: In this comparative study, 50 subjects were taken according to the inclusion and exclusion criteria. The subjects were divided into two groups i.e. Group A (foam roller with passive stretching) and Group B (foam roller alone). Bubble inclinometer was used to measure the ranges of ankle dorsiflexion. Result: The findings of the present study indicated that foam roller with passive stretching had great increase in ankle dorsiflexion ROM than foam roller alone. Conclusion: Although both techniques are effective in alleviating range of motion but foam roller when used along with passive stretching is an effective method for increasing the flexibility of calf muscles in badminton players compared to foam roller alone. Thus, giving an effective method for increasing the flexibility of calf muscle for instantly reliving muscle soreness post training and even during competition and thereby enhancing the badminton player's performance on court. Also preventing the badminton player from injury caused by lack of flexibility of calf muscle.***

Keywords: Foam Roller Stretching, Flexibility, Calf, Badminton

1. Introduction

Badminton is a racquet sport, involving a unique movement technique over a relatively small court area (Hughes, 1995). Great agility, quickness and reaction are essential to be successful. Playing badminton requires the use of the following major muscles: gastrocnemius, soleus, anterior tibialis, hamstrings, quadriceps, hip abductors and adductors, latissmus dorsi, teres major, pectoralis, deltoid, rectus abdominis, wrist flexors and extensors.

Badminton is an intense sport that requires fast and sudden movements. A professional player is expected to perform a large number of jumps, lunges and rapid directional changes which implies considerable strain on the calf muscle and the Achilles tendon: strains and ruptures are common (Henricson, Larsson, Olsson and Westlin, 1983). Because of the involvement of racquet, upper limb injuries such as Tennis Elbow and Rotator Cuff injury are also quiet common (Sajeed, 2016). Badminton is considered to be the sport with highest incidence of Achilles tendon rupture (Henricson, Larsson, Olsson and Westlin, 1983). Stiff and contracted muscles may increase the risk of such injuries and stretching and elevated heels have been recommended to decrease the risk (Henricson, Larsson, Olsson and Westlin, 1983).

Physical activity comprises all modes of movement caused by muscle activity resulting in increased energy expenditure. Physical fitness consists of the three components muscle strength, endurance and motor ability.

Flexibility is an important physiological component in badminton as it allows an adequate range of motion, to avoid sport injuries (Grady, Saxena, 1991). Flexibility of muscle is "the ability of a muscle to lengthen, allowing one joint to move through a range of motion" leading to more efficiency and effectiveness in movement which assist in preventing or minimizing injuries, & muscle soreness (Skarabot, Beardsley, Stirin, 2015). In order to increase flexibility, stretching is important and therefore, the range of motion of the involved joint area and muscle efficiency is also increased (Grady, Saxena, 1991). Flexibility is the property of individual muscles and joint. Many factors contribute to flexibility such as joint structure, muscle length, age and activity level (Kelly, Beardsley, 2016). Stretching enhances the performance and decreases the risk of injury during exercise, as well as improves range of motion (McCarthy et. al, 1997).

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 (Daniel, et. al, 2015). Foam rollers are commonly used as an adjunct to a stretching program or in some cases may serve as a replacement of regular static stretching. Foam roller is used to improve athletic performance and flexibility, it reduces work related soreness, slash recovery time and knock out muscle pain (Markham Heid, 2017). Professor Blaine Long says, foam rolling can decrease a muscle's "viscosity", which would make the muscle less resistant to motion and therefore more flexible.

Muscle tightness is caused by a decrease in the ability of the muscle to deform, resulting in a decrease in the range of motion at the joint on which it acts (Akinpelu, et. al, 2005). Maintaining normal muscle length requires regular stretching to prevent muscle stiffness and benefit from the decreased risk of musculoskeletal injuries (Scott et. al, 2005). The Calf muscles are important contributors to control movement and are involved in wide range of

activities from running and jumping allowing movement of foot and ankle.Calf muscle tightness is considered to be a critical causal factor in lower leg injuries in runners, including plantar fascitis and shin splints (Youdas, et. al, 2003). Muscle soreness and structural damage to muscles and connective tissue may result in altered muscle function and joint mechanics which substantially reduce performance or optimal training intensity for badminton players (Pearcey, et. al, 2015). An effective method to get instant increase in flexibility of calf is required along with relief of muscle soreness. Our study will throw light on the most effective way of increasing calf flexibility through passive stretching with or without foam roller.

2. Methodology

A total of 50 subjects were included in the study after screening them, based on the inclusion and exclusion criteria. The inclusion criteria included: badminton players of 15-25 years of age; both male and female were included for the study. The exclusion criteria comprised of any recent fracture of lower limb; any surgical procedure done.

Each of the subjects were explained about the purpose of the study and was made to sign the consent form. The subjects then were assigned in the two groups as they came for the study. Group A subjects (Passive calf stretching and foam rolling) and Group B subjects (only foam rolling).

The Calf flexibility of each subject was examined using bubble inclinometer.

Technique-
The subject layed supine on the bed with the therapist at the foot end. The bubble inclinometer was placed on the sole of the foot and set to Zero.

Then the dorsiflexion of ankle was measured and the pre intervention range was noted.

Figure: Represents measurement of Right Ankle Dorsiflexion ROM

Group A
Then the subjects of Group A were given passive stretching by making the subject to lie down supine. The therapist grasped the heel of the subject with palm pressed on sole of foot with one hand, while the other hand is placed on the knees to keep them straight. A hold of 30 seconds was maintained and the procedure is repeated for 3 times with 15 seconds rest between each set.

Figure: Represents Passive Calf Stretching

A cylindrical foam roller with 96 flexible bumps was used. Dimensions 33cm*14cm.

Foam rolling was performed in a seated position with the legs extended and the feet relaxed. One leg was crossed over the other to allow more pressure to be directed over the plantarflexor being treated. The subjects were instructed to use their arms to propel their body back and forward, from popliteal fossa to achilles tendon, in fluid motions. They were also instructed to exert as much pressure on the foam roller as possible. The procedure is repeated for 3 times with rest of 15 seconds (Skarabot, Beardsley and Stirin, 2015)

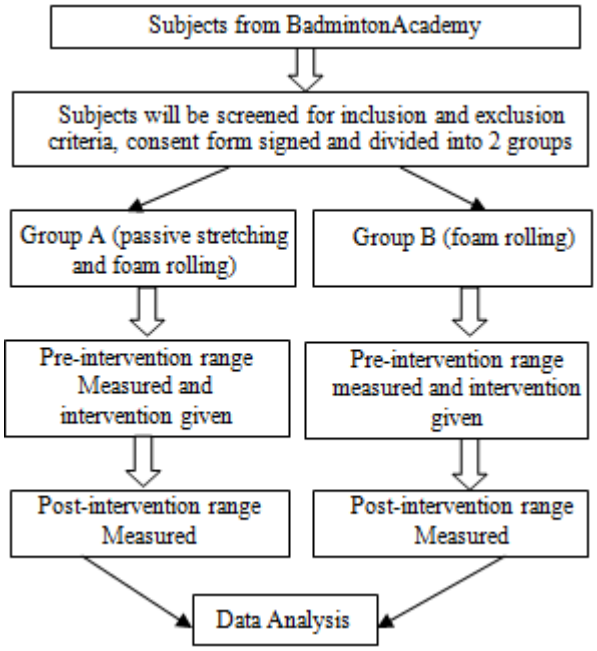
Figure: Application of Foam Roller

Group B

The subjects of this group were given Passive calf stretching by making them lie down in supine position. The therapist will grasp the heel of the subject with palm pressed on sole of foot with one hand, while the other hand is placed on the knees to keep them straight. A hold of 30 seconds is maintained and the procedure is repeated for 3 times with 15 seconds rest between sets.

After the following procedure was completed the post intervention range was measured and noted using bubble inclinometer by the technique as mentioned above.

Protocol



Data Analysis

Data analysis was performed using Microsoft Excel 2016 for window software importing master sheet containing subject data.

The formula used for calculating arithmetic mean is:

$$\bar{x}_{arithm} = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{x_1 + x_2 + \cdots + x_n}{n}$$

Formula used for calculating standard deviation:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

3. Result

Table 1.1: Represents Mean and Standard Deviation of Male and Female Age of Group A

Demographic Details(Group-A)	Mean±SD
Female Age	20.09±1.44
Male Age	20.35±2.09

Table 1.2: Represents Mean and Standard Deviation of Male and Female Age of Group B

Demographic Details (Group-B)	Mean±SD
Female Age	19.4±0.96
Male Age	21.4±2.47

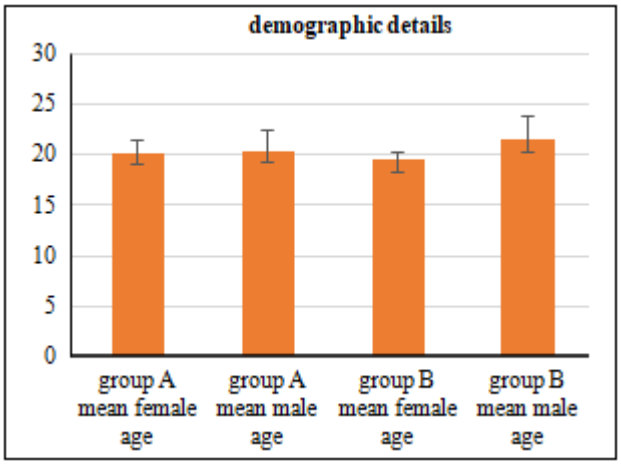


Figure 1: Depicts Mean and Standard Deviation of Male and Female Age of Both Group A and Group B

As shown below in Table 1.3 the Pre Right Mean and Standard deviation for Group A was 8.48+2.1236 degrees and Post Right Mean and Standard deviation was 19.8+1.9364 degrees.
The Pre Left Mean and Standard deviation for Group A was 9.48+2.1039 degrees and Post Left Mean and Standard deviation was 20.6+1.8929 degrees.

Table 1.3: Mean and Standard Deviation Values for Foam Roller and Passive Stretching Group (A)

Group A	Pre Right (Mean+SD)	Post Right (Mean+SD)	Pre Left (Mean+SD)	Post Left (Mean+SD)
Foam Roller With Passive Stretching	8.48+2.1236	19.8+1.9364	9.48+2.1039	20.6+1.8929

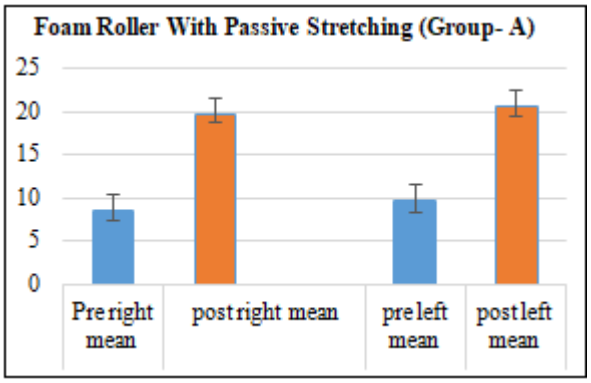


Figure 2: Depicts Pre and Post Mean and Standard Deviation of Group A

As shown below in Table 1.4 the Pre Right Mean and Standard deviation for Group B was 8.8+2.1015 degrees and Post Right Mean and Standard deviation was 15.6+2.00 degrees. The Pre Left Mean and Standard deviation for Group B was 10.16+2.1346 degrees and Post Left Mean and Standard deviation was 16.8+2.1794 degrees.

Table 1.4: Mean and Standard Deviation Values for Foam Roller Group (B)

Group B	Pre Right (Mean+SD)	Post Right (Mean+SD)	Pre Left (Mean+SD)	Post Left (Mean+SD)
Foam Roller	8.8+2.1015	15.6+2.00	10.16+2.1346	16.8+2.1794

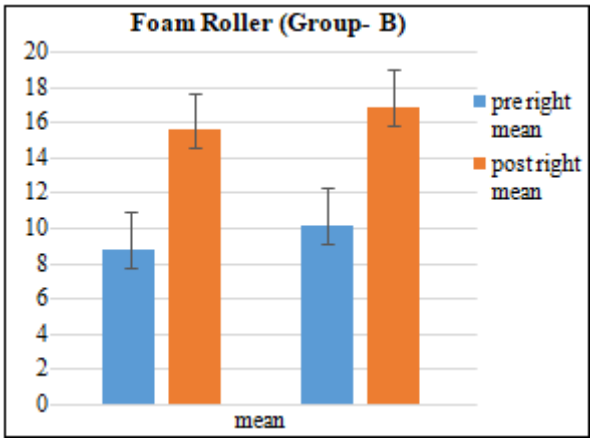


Figure 3: Depicts Pre and Post Mean and Standard Deviation of Group B

As shown below in table 1.5 the difference between Pre and Post Right Mean of Group A was 11.32 and difference between Pre and Post Left Mean was 11.12. The difference between Pre and Post Right Mean of Group B was 6.8 and difference between Pre and Post Left Mean was 6.64

Table 1.5 clearly shows that group A has more effect than group B.

Table 1.5: Mean Differences between the Two Groups

Group	Difference of Pre and Post Right Mean	Difference of Pre and Post Left Mean
Foam Roller With Passive Stretching (Group A)	11.32	11.12
Foam Roller (Group B)	6.8	6.64

4. Discussion

The present study was conducted to study the comparative effect of foam rolling with and without passive calf stretching on calf tightness in badminton players. 50 subjects were taken on the basis of inclusion and exclusion criteria. Subjects were divided into two groups i.e. group A

(foam roller with passive stretching) and group B (foam roller alone).

The purpose of this study was to evaluate the effective method to enhance flexibility of calf muscle and thereby increase ankle dorsiflexion ROM. This was achieved by examining the changes in pre and post ranges of ankle dorsiflexion in badminton players. The main findings is increase in ankle dorsiflexion range by the use of foam roller with passive stretching. The result does support the alternative hypothesis that there is a significant increase in calf flexibility with the use of foam roller and passive calf stretching.

In a rehabilitation setting, where ankle dorsiflexion ROM may be limited, small changes could be beneficial and so have a greater clinical relevance. It was found that foam rolling and passive stretching lead to greater increase in flexibility and that has an acute additive effect in comparison with foam rolling alone. According to Pearcey, et. al, 2015 foam rolling can substantially enhance recovery after delayed onset muscle soreness and muscle tenderness and this form of self-induced massage could benefit athlete seeking a recovery modality that is relatively affordable, easy to perform, and time efficient. In the present study it was found that foam roller alone did not produce a significant increase in ankle dorsiflexion ROM as compared to that of foam roller with passive stretching.

Stretching enhances the performance and decreases the risk of injury during exercise, as well as to improve Range of Motion (McCarthy et al., 1997). Active and passive stretching expands the range of motion by working in muscle tendons, capsules and ligaments. Many researchers described the benefit of stretching and how it improves athletic performance but there is a distinct lack of literature on how long (period of time) it takes to get actual lengthening of a muscle.

Grady, et. al. 1991, stated that a combination of stretching and warm up produced greater effect than warm up alone. This supports our current study that the combination of foam roller and passive stretching produced greater increase in ankle dorsiflexion ROM than foam roller alone. The mean difference of post foam roller and passive stretching (Group A) was 11.12 degree which is greater than the mean difference of post foam roller alone i.e. 6.64 degree.

5. Limitations of the Study

- Small sample size was there
- There was no homogeneity in the distribution
- Readings were not taken after 24 hours to check the effectiveness.

6. Future Scope of the Study

- Can be performed in other age group also
- Readings can be taken after 24 hours to check the effect of the technique.

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