



INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT



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ISSN: 2226-6348

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To Link this Article: <http://dx.doi.org/10.6007/IJARPED/v11-i3/13893>

DOI:10.6007/IJARPED/v11-i3/13893

Received: 15 July 2022, **Revised:** 18 August 2022, **Accepted:** 31 August 2022

Published Online: 12 September 2022

In-Text Citation: (Azemi et al., 2022)

To Cite this Article: Azemi, M. A. Bin, Muhamed, M. F. A. A., Azudin, M. Z. M., Ibrahim, T. M. S. bin T., & Jahizi, A. A. B. M. (2022). The Effect of Foam Rolling on Lower Limb Flexibility Among Cyclists. *International Journal of Academic Research in Progressive Education and Development*, 11(3), 944–951.

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Vol. 11(3) 2022, Pg. 944 - 951

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The Effect of Foam Rolling on Lower Limb Flexibility Among Cyclists

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Abstract

The purpose of this study was to study the influence of foam rolling on lower limb flexibility in a cycling team. A total of twenty subjects (N=20) were involved in this study and selected through the purposive sampling method. The research design that is used in this study is one group pretest-posttest. Sample Paired T-Test was used as this study included a pre-test and post-test using one group of subjects. During the pre-test, all subjects performed sit and reach flexibility test for three trials. After an intervention trial of 4 weeks, one week consisting of 6 days of intervention, subjects performed the same flexibility test for the post-test. Paired sample T-test has been used to analyze and measure the differences in flexibility between the pre-test and post-test with foam rolling treatment among cycling team athletes. The alpha is set at 0.05. The result showed the mean score for the difference between the pre-test and post-test (M=2.35, SD=1.556). The study found that the differences between pretest and posttest for flexibility is $t(19) = -6.751, p < 0.05$. Therefore, the null hypothesis is rejected. This finding suggests that foam roller positively affects lower limb flexibility among cycling team athletes.

Keywords: Cycling, Foam Roller, Lower Limb Flexibility, Sit and Reach Test

Introduction

Cycling is one physical exercise that directly targets the entire body's cardiorespiratory and metabolic function in a wide range of intensity levels and has several possible health benefits. Cycling can help health and has also been described as a significant potential means of promoting public health (Park et al., 2021). Besides, Hap et al (2021) state many benefits to using a bicycle as a daily routine to prevent various diseases. Nowadays, cycling is a sport that is widely known around the world. Therefore, many people participate in this sport regardless of age and type of cycling category. The most popular category is road bikes because they are

easy to use, do not have to find a specific place, and have low maintenance costs. According to Antequera et al (2022), many cyclists have particular issues with a shortened hamstring. The cyclist is constantly pedaling, with no range in that movement. The rest of their body's posture can shift, but their legs rotate very limitedly. Those muscles are mighty, but the muscle is also short and compact. If their shortened hamstrings prohibit them from putting their palms on the ground without bending their knees, cyclist performance on the road may be impaired. On the other hand, higher stiffness can be considered a possible threat because athletes with higher levels of muscle stiffness due to increased training loads have a higher chance of getting the injury (Morales et al., 2017). Self-myofascial release (SMR) is a technique in which an individual uses a tool to apply direct pressure to the targeted muscle. One type of SMR is foam rolling, often known as FR. Hendricks et al (2020). This method's ancestor is myofascial release (MR). MR is a foundational or essential method that is used in a wide range of manual therapies. A therapist uses this technique to treat and manage muscle issues by exerting pressure on a muscle and fascia. (Ajimsha & Shenoy, 2019).

There is a limited study about the effect of the foam roller on flexibility in either experienced subjects using a foam roller (FR) or the foam roller's application on the athletes' flexibility, especially cyclists who have only focused on resistance training experience and sports performance. This statement is supported by Beardsley and Stirn (2015); many researchers study self-myofascial release (SMR), doing their research based on duration and comparing SMR tools only. Due to that, there are still no studies on FR's effect on cyclists with flexibility problems in their lower limbs. Besides that, although most of the research has been done on FR, no meta-analysis has analyzed the literature and calculated the pooled effects of FR at this time (Wiewelhoeve et al., 2019). Clarity on when FR should be used and what protocols should be prescribed to be effective is required to inform evidence-based practice. The hypothesis for this study indicates no significant difference between the pre-test and post-test scores of lower limb flexibility after using a foam roller. As a result, this study will bridge a knowledge gap by expanding the current understanding of the effects of FR on lower limb flexibility in cycling team cyclists.

Research Objective

This study aimed to analyze how FR affected cyclists' lower limb flexibility. We predicted that a program involving FR would significantly increase lower limb flexibility compared to the cyclist's pre-and post-test results.

Methods

Participants

Twenty well-trained cyclists from the state of Perak (age: 17.8 ± 1.74 years; height: 1.66 ± 0.09 m; and total body mass: 57.9 ± 8.82 kg) consist of nine female and eleven male participants in the study. Using Gpower software (Version 3.1.9.2; Universitat Kiel, Kiel, Germany) and pilot research with a target effect size difference of 0.70, an alpha level of 0.05, and a power ($1 - \beta$) of 0.80, the sample size was estimated. A sample size of 10 participants was suggested as the absolute minimum by the a priori power analysis. The systematic sampling technique was used in this study. Participants in the study must fulfill specific requirements to participate, including having completed at least three months of training and having competed in a tournament during the ten months before the study. Athletes could not use self-myofascial release or any other manual treatment approach over the previous months.

Additionally, subjects had to be free of any recent musculoskeletal injuries. The International Journal of Exercise Science's (IJES) ethical standards and the Declaration of Helsinki were upheld throughout every step (Navalta et al., 2019). A permission form that the local university's ethics committee authorized was read and signed by all participants.

Protocol

A random crossover pretest-posttest design was used to determine how FR affected the subject's flexibility scores. According to Gopalan (2020), quasi-experimental research designs most commonly employ this research design. This design requires only one participant or subject group to undergo pre-, treatment-, and post-testing. To compare the pre-and post-test results, the obtained data were analyzed using a paired samples t-test.

Pre-test

Participants in the study were required to complete evaluation tests and sign a form for official permission statements. Age, height, total body mass, and gender anthropometric data were gathered at the initial visit. The pre-test was then administered to subjects in a random sequence. Before the trial, a 5-minute foam roller warm-up session was done, focusing on the lower body. The durability experiments were carried out immediately after stretching. For each cyclist, all tests were evaluated on the same day. Between these three trials, participants had the chance to rest for 1 minute. Participants were instructed to lean forward in an exhalation that prevents bounce or fast, powerful motion and never extends to discomfort. The data for all the participants will be collected. After finishing the test, all 20 participants will gather and be briefed about the program they must do, a 4-week foam rolling session.

Intervention

After their training session, athletes will use a foam roller GRID to complete the FR intervention session. The foam roller measures 33 cm long by 14 cm broad and features a rugged, hollow core covered in an ethylene-vinyl acetate covering 15 mm thick. The individuals were given instructions on myofascial release; one leg was used to assume a dorsal posture for the hamstrings while the other leg was crossed over (Figure 1), as previously reported by (Phillips et al., 2021). Each muscle group performed one set of 60 seconds under the analyst's guidance. There was a one-minute break between each leg. They were also reminded not to do or add their FR session outside the intervention session. All 20 athletes did this activity simultaneously and were monitored by the analyst.



Figure 1 Foam rolling techniques applied in the treatment of hamstrings demonstrated.

Post-test

A week after the end of the intervention session, the post-test was conducted in the exact location. The pre-test and post-test both use the same procedure. All participants in this study are given instructions for a cooling-down period once the tests are over. After doing the study, the analyst collects and analyses the data.

Result

Table 1

Demographic Data of the Sample

	N	Minimum	Maximum	Mean	Std. Deviation
Age	20	15	20	17.80	1.735
Height	20	1.45	1.79	1.6615	.09010
Weight	20	43.0	78.0	57.850	8.8155
Valid N (listwise)	20				

Table 1 shows the descriptive data of twenty subjects (N=20) of Perak Cycling Team athletes. The mean and standard deviation of age (M=17.80, SD=1.735), height (M=1.6615, SD= .09010) and weight (M=57.850, SD=8.8155) have been the study subject.

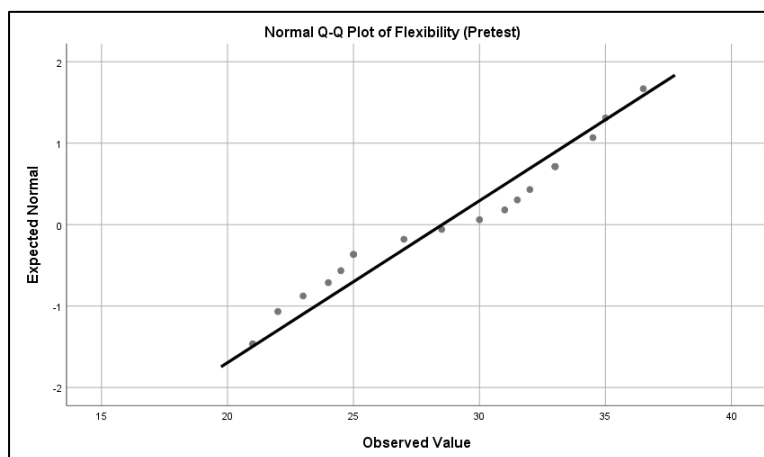


Figure 2 Graph of Normality (Pre-test)

Based on figure 2, the Q-Q plot of flexibility for the pre-test is shown as normal. The graph showed the normal probability plot of a sample from a normal distribution. When the few large and tiny values are disregarded, the graph's trend seems equally straight.

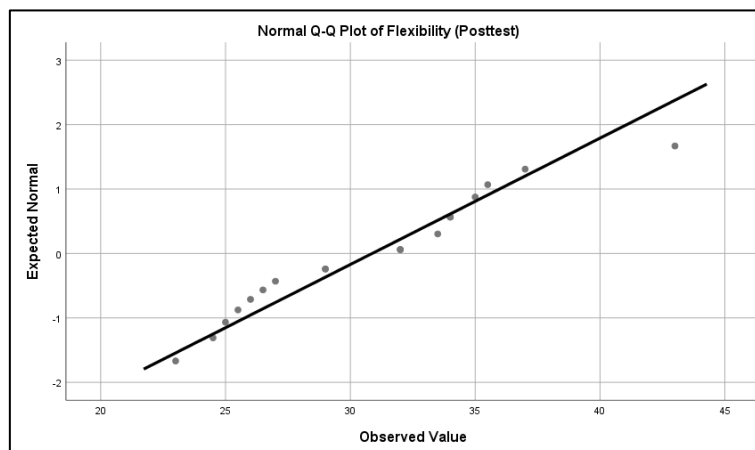


Figure 3 Graph of Normality (Post-test)

Based on figure 3, the Q-Q plot of flexibility for the post-test data is normally distributed. The graph showed the normal probability plot of a sample from a normal distribution. When the few large and tiny values are disregarded, the graph's trend seems to be equally straight.

Table 2
Mean and Standard Deviation of the test

	Mean	N	Std. Deviation	Std. Error Mean
Flexibility (Pretest)	28.525	20	5.0301	1.1248
Flexibility (Posttest)	30.875	20	5.0987	1.1401

Table 2 shows the mean value for both pre-test and post-test. Based on the value, it is shown that the mean score for the pre-test is (M=28.525, SD=5.0301), and the mean score for the post-test is (M=30.875, SD=5.0987).

Table 3
Paired Sample Test

	Mean	SD	t	df	Sig. (2-tailed)
Flexibility (Pretest)	- 2.35	1.556	- 6.751	19	.000
Flexibility (Posttest)					

From the result, it is shown that the mean score for the difference between pretest and posttest is (M=2.35, SD=1.556). The study found that the differences between pretest and posttest for flexibility is $t(19) = - 6.751, p < 0.05$. Therefore, the null hypothesis is rejected.

Discussion and Conclusion

When it comes to boosting an athlete's flexibility, there is emerging evidence using Flexibility Reduction. In this case, FR's usefulness is questionable. Variations in methodological design, FR intervention, exercise mode, and training status may have led to conflicting findings. Results show that FR improves flexibility acutely. Despite a little disparity, the score rose. It indicates foam rolling for self-myofascial release improves lower limb flexibility. Direct pressure from foam rolling leads targeted muscles to soften and stretch, increasing the lower limb range of motion. This study reveals a similar effect to other investigations, where pre-to-

post-test rolling improves the range of motion. The foam roller increases lower back and hamstring flexibility, according to (Sullivan et al., 2013). Self-myofascial release can assist stretch muscles and pressure the fascia by rolling, which helps smooth and extend the fascia and make the muscle more elastic. The rolling pressure on the muscles mimics myofascial release. Rolling did not affect muscle activation or quadriceps force output but the knee range of motion (Behara & Jacobson, 2017). Self-myofascial release increases mitochondrial biogenesis, muscle viscoelasticity, blood circulation, and angiogenesis. It will encourage the movement of the muscles, promoting increased mobility (Healey et al., 2014). In other studies, Sullivan et al. (2013) examined the effects of a foam roller on the hamstring range of motion and maximum voluntary isometric contraction. After utilizing the Foam Roller in a sit-and-reach test, the percentage increased somewhat. In this study, using a Foam Roller as a self-myofascial release tool increased the lower limb muscular range of motion.

Practical Application

As a result, from a practical perspective, coaches, trainers, athletes, and recreational exercisers can take the study's findings to provide suggestions for effective warm-up techniques. These results imply that FR can promote flexibility before sports or exercise performance without adversely affecting force output. These preliminary findings also should be further expanded through the conduction of larger-scale research with larger samples, for more sessions, and if possible, compared with a different control group using a different method. Flexibility is essential for all people around the world. Lack of bodily flexibility limits our range of motion and leads to injuries. American College of Sports Medicine (2013) recommends doing flexibility exercises two or three times a week to improve the range of motion and reduce bodily tension. A flexible regimen is crucial for constant physical activity throughout their growth process. Individuals and athletes may quickly increase their flexibility by utilizing a foam roller. Foam Roller workouts are efficient and low-tech for enhancing the range of motion. Numerous studies have demonstrated that self-myofascial release increases the flexibility of the lower extremity. They positively increased flexibility due to the user's capacity to exert pressure on the muscles through manual manipulation. This study indicated that a foam roller enhances flexibility, reduces the risk of injury, and promotes the user's recovery. FR is seen as one of the effective portable low-cost methods for helping the correction of existing muscular imbalance, alleviating discomfort, and inhibiting hyperactive musculature. Therefore, this foam roller is ideal for enhancing the athletic performance of all types of athletes.

Athletes are also subjected to particular intervention procedures like the foam roller. The athlete is introduced to the benefits of foam rolling by giving them new information on foam rolling. Proper guidelines and instructions for utilizing the foam roller are highly recommended. Therefore the coaches and trainers need to provide a sense of attentiveness to the athletes' practice of foam rolling. Athletes also claim that using a foam roller may enhance the flexibility of their lower limbs, allowing them to perform better in competition. In addition, this research will assist athletes and trainers in identifying the importance of foam rolling by providing new information on the most effective techniques.

In conclusion, foam rolling has a favorable influence on the flexibility of its users, as it enhances athletic performance, promotes recovery, and reduces injuries. Despite several contradictory research about the efficacy of foam rollers in promoting flexibility, the foam

roller's ability to increase lower limb flexibility persists. In addition, the favorable effects of foam rollers, as acknowledged by athletes and coaches, strongly recommend their use during training and competition. In addition, foam roller accountability and publicity are at the center of sports practitioners' education.

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