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The use of myofascial release in the agility and power of healthy subjects: randomized controlled clinical study

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ABSTRACT

Background: The fascia involves all tissues and organs of the body, an important element in the organization of the transmission of forcebetween body segments, and any dysfunction or alteration can generate hypomobility, altering the biomechanics of movement and restricting muscle strength. Among the myofascial release techniques, there is self-myofascial release, a technique that makes use of a foam roller, which the subject is the one who actively slides from side to side over the foam roller. **Objective:** To evaluate the influence of high myofascial release through the foam roller on the power and agility of the hamstring and gastrocnemius muscles. **Methods:** This is a randomized controlled clinical study. Thirty healthy participants were invited, who underwent a training period for four weeks, with a frequency of three days a week, divided into three distinct groups: active stretching group (SG) composed of 10 subjects, who performed active stretching of the hamstring and gastrocnemius muscles; foam roller group (FR) composed of 10 subjects who performed self-myofascial release through the foam roller; and control group (CG) formed by 10 individuals who received no intervention. The participants initially underwent an anthropometric assessment (weight, height and body mass index), performed the Illinois Test for agility, which presents an interesting alternative for the evaluation and control of this motor ability, and the Vertical Jump Test that has been highlighted in the literature as the main method of measuring explosive strength of lower limbs. **Results:** Thirty-five participants were recruited, of which thirty met the inclusion criteria. In the development of the study, there were four dropouts, totaling a final sample of twenty-six subjects. After 4 weeks of intervention, no significant data related to vertical jump, which assessed muscle power, was observed, however, through the Illinois test, there was gains related to the agility of subjects in the FR when compared to the others. **Conclusion:** It can be concluded with the data from the present study, that the use of foam roller, as a strategy for self-myofascial release, proved to be efficient for the agility of the participants, however it did not present data as significant when related to muscle power.

Keywords: Myofascial release; Foam roller; Agility; Power.

BACKGROUND

The fascia is formed by dense irregular connective tissue, this tissue surrounds and connects all the muscles and organs of the body. It is an important element in our posture and movement organization[(1)]. According to Myers[(2)] and Stecco et al.[(3)] the fascia is directly involved both in the organization of movement and in the transmission of force between body segments. Some situations such as stress, physical stimuli, immobilization, muscle spasms, trigger points and other pathological conditions can generate an inflammatory process that, in addition to pain, can cause hypomobility, greater tissue stiffness generated by dehydration and eventually the development of fibrosis, compromising the physiological functioning of the fascia and altering the biomechanics of movement and restricting muscle strength, also influencing the body's local and global metabolism, immunity, wound closure and storage of various substances such as water and lipids[(4-6)]. Several manual therapy techniques can be used to treat disorders that affect the muscular fascia, with myofascial release being one of the therapies commonly chosen to treat such conditions[(7)]. The purpose of myofascial release is to release tissue retractions through a stretch that alters the viscosity of the tissue[(8)] due to a slight increase in temperature and energy level due to friction, stretching and pressure exerted on the target tissue[(9)] treating soft tissue adhesions, decreasing edema and inflammation, acting on pain relief and reduced sensitivity in addition to improving muscle recovery[(10)].

There are different forms of myofascial release, one of which is indirect or passive, in which the therapist is the one who performs the graduated stretch of the tissue, and this is guided both by those who perform the technique and by the feedback of those who receive it [(7)]. Other release techniques are actively performed by the subject, and to perform such techniques, accessories can be used, one of them is the foam roller [(11)]. The subject rolls from side to side on the foam roller, applying constant pressure on the soft tissues resulting from their body weight, stretching the tissue and generating friction[(12)]. The technique provides physiological responses that are favorable to improve performance, such as increased blood flow to the muscles, neuromuscular facilitation and range of motion. The technique has been used in sports and rehabilitation for warming up, optimization of muscle function and increased range of motion[(13, 14)]. The increased range of motion generates a gain in agility and power, benefits that are often desired. Physical capabilities that can be maintained and enhanced with the aim of promoting health. The Illinois agility test presents an interesting alternative for the evaluation and control of subjects' agility and motor skills.

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The test requires acceleration, deceleration and balance control, in addition to being relatively simple to perform, which minimizes the learning effect. The vertical jump has been highlighted in the literature as the main method of measuring explosive strength of lower limbs, in addition to being an easy and accurate way to quantify the average muscle power[15]. Thus, the aim of the present study was to evaluate the influence of high myofascial release through the foam roller on the power and agility of the hamstring and gastrocnemius muscles.

METHODS

The present work is a randomized controlled clinical study that was developed in the Guairacá Integrated Clinics, in the located at Rua Senador Pinheiro Machado, nº.571, Centro, in the city of Guarapuava (PR), according to the authorization of the person responsible for the clinic. The research was approved by the ethics and research committee of State University of the Midwest (UNICENTRO), in the city of Guarapuava (PR), with protocol number 2.732.336/2018 and resolution 466/2012 of the National Health Council/NHC. The sample of the present study was composed of 30 healthy subjects, of both genders, aged 18 to 35 years old, who were divided into 3 groups: Active Stretching Group (SG) composed of 10 subjects who performed active stretches for the ischiotibial and gastrocnemius muscles; Foam Roller Group (FR) composed of 10 subjects who performed self-myofascial release through the foam roller on the ischiotibial and gastrocnemius muscles; and a Control Group (CG) formed by 10 subjects who did not receive any intervention. All research subjects were approached personally and the invitation to participate in the study was carried out verbally, they received information about the purpose and procedure of the present study in accordance with the 466/2012 of the National Health Council that regulates research with human beings. Subjects who agreed to participate signed the Free and Informed Consent Form. As inclusion criteria are subjects: who did not present any osteomioarticular pathology in the lower limbs that made training impossible; aged between 18 and 35 years old, both female and male; who were regularly or irregularly active in the International Physical Activity Questionnaire (IPAQ); who signed the term. As exclusion criteria are subjects: who presented osteomioarticular pathology in the lower limbs that prevented the training; who were not aged between 18 to 35 years; who did not fit the IPAQ criteria; who did not sign the term. After signing the term, the division was made, randomly, through a draw with opaque and sealed envelopes, in the three groups of 10 members, all oriented as to the procedures that were submitted. The subjects were initially submitted to anthropometric assessment (weight, height and body mass index). Soon afterwards, they were submitted to a pre-intervention evaluation using a test to analyze the Illinois agility test (Figure 1). The test involves the use of 4 main markers (cones) to mark an area 10 meters long and 5 meters wide. In the center of this area, 4 markers are positioned at a distance of 3.3 meters. The test begins with the subject positioned behind the starting line, so that after the audible whistle command the subject must complete the course in the shortest possible time. The arrival at the final line characterizes its completion, and the time required to complete the course is adopted as the test result.

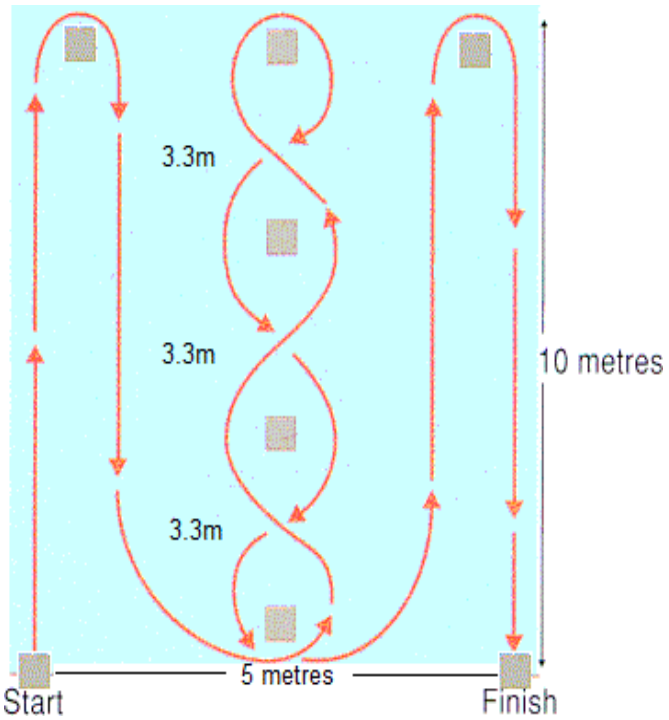

Figure 1: Demonstration of Illinois agility test.
Source: Bryanmac (https://www.brianmac.co.uk/illinois.htm)

Then, they were subjected to a pre-intervention evaluation through a test to analyze the power of the lower limbs called Vertical Jump Test, which corresponds to a vertical impulse without the aid of the upper limbs. The subject stood up, heels on the ground, feet parallel, body lateral to the wall with the upper limbs vertically. The distal ends of the digital pulps of the dominant hand projected on the measuring tape were considered as a reference point. After determining the reference point, the subject moved slightly away from the wall, in the lateral direction, in order to perform the series of three jumps, maintaining, however, the upper limbs vertically elevated. Obeying the command voice the subject performs the jump aiming to touch the digital pulps of the dominant hand, which should be marked with a pen, at the highest point of the measuring tape. During the

movement, the opposite arm must remain constantly in the starting position, that is, elevated (Figure 2).

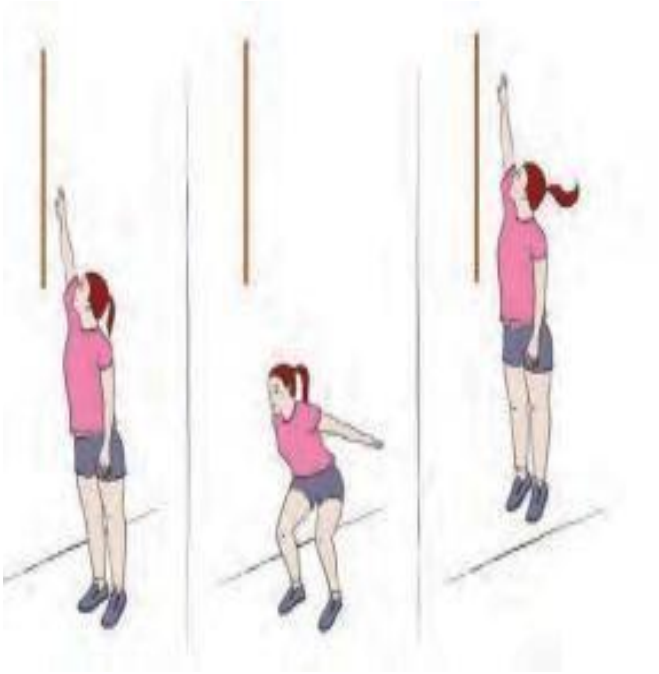

Figure 2: Demonstration of execution of the counter movement protocol in vertical jump dynamics.
Source: Ebah (http://www.ebah.com.br/content/ABSGAg_JsAH)

As for the procedures, subjects from the SG and FR were submitted to an activity program three times a week, for four weeks, totaling 12 training sessions. The CG did not undergo any intervention during the four weeks of the study. The SG performed active stretches for the ischiotibial and gastrocnemius muscles (Figure 3), five repetitions lasting 60 seconds each.

Figure 3: Active stretching of the hamstring and gastrocnemius muscles.
Source: Sport Life (https://sportlife.com.br)

The FR performed self-myofascial release through the use of the foam roller on the hamstring and gastrocnemius muscles (Figure 4), performing a slide from side to side on the roller, five repetitions were performed with a duration of 60 seconds each. The researcher was present in all evaluations and interventions.
After the four weeks of training, post-intervention evaluations were performed, in which all subjects in the three groups were subjected to the same tests performed in the pre-intervention evaluation (Figure 5). The data were analyzed using a signal processing program, and descriptive and inferential statistics were performed using the SPSS 20.0 for Windows. The Kolmogorov-Smirnov normality test was used to ascertain the sample pattern. As the data were presented in a parametric way, for the intra-group analysis the ANOVA test was used for repeated measures, with a significance level of 95% ($p \leq 0.05$).

Figure 4: Image of the self-myofascial release technique on the hamstring and gastrocnemius muscles with foam roller.
Source: Foam Roller Brazil (http://www.foamrollerbrasil.com.br).

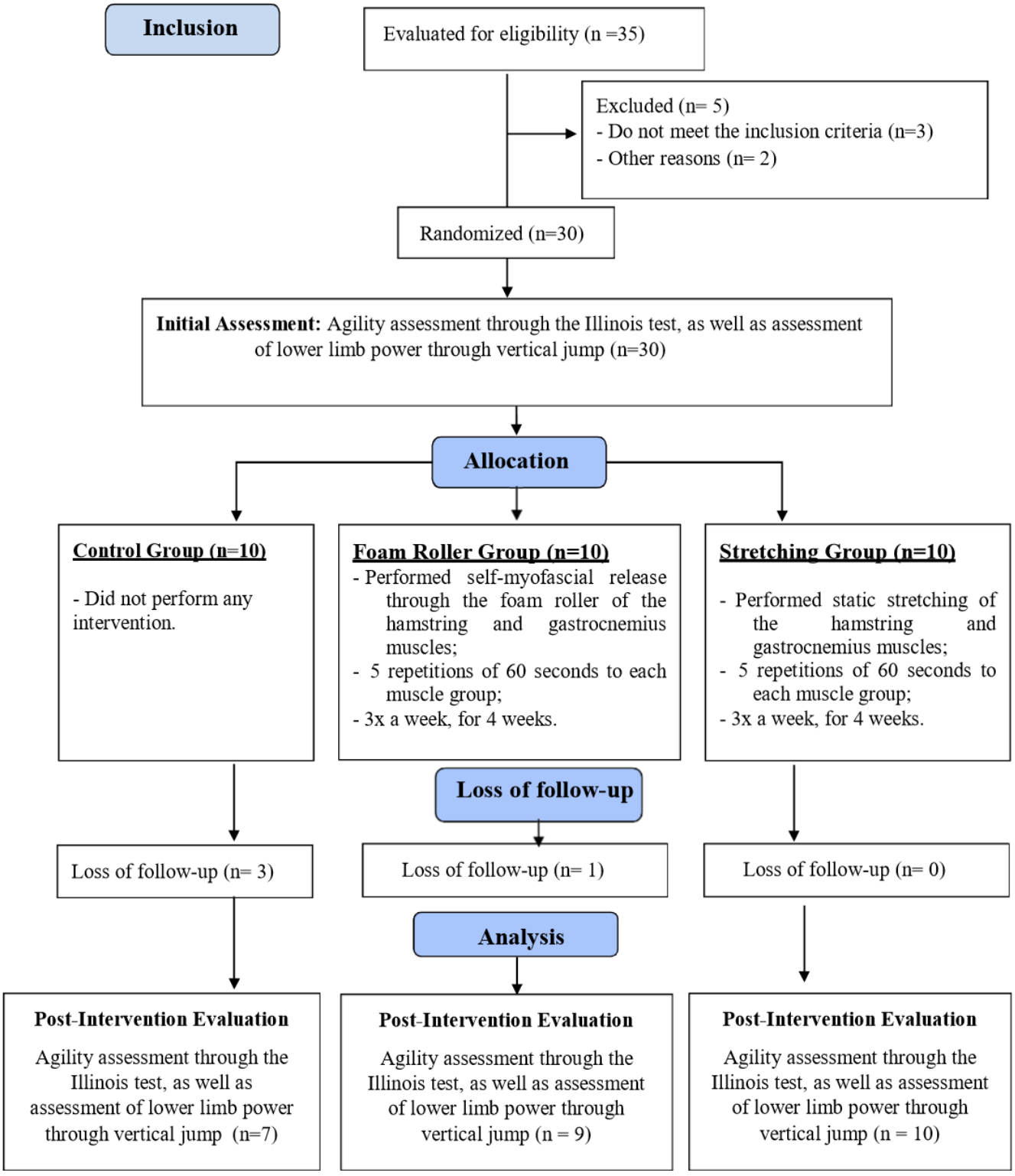

Figure 5: Flowchart according to CONSORT

RESULTS

Thirty subjects met the eligibility criteria of the thirty-five analyzed. Among the 30 selected subjects, there were 4 dropouts throughout the study, totaling twenty-six subjects at the end of the treatment (7 males and 20 females), however the data were analyzed by intention to treat. Anthropometric characteristics are reported in Table 1. The recruited sample proved to be parametric, with no significant differences between the three groups with respect to anthropometric data.

Table 1. Anthropometric characteristics of the subjects allocated to the control group, stretching group and foam roller group.

	Groups			
Variables	**Control Group**	**Stretching Group**	**Foam roller Group**	**Statistic (p≤0.05)**
Subjects	7	11	9	
Male / Female	2/5	1/10	4/5	
Dominant Limb (R/L)	7/0	9/2	9/0	
Age (years)	23.28 (5.21)	22.09 (1.22)	24.44 (1.74)	0.217
Weight (Kg)	75.60 (20.51)	60.90 (8.71)	71.91 (15.25)	0.160
Height (m)	1.65 (0.11)	1.63 (0.08)	1.73 (0.10)	0.111
BMI (Kg/m^2)	22.96 (11.01)	22.75 (2.97)	23.84 (3.05)	0.275

Note: * Teste T-Student não pareado (p≤0,05) foi realizado para comparar as variáveis antropométricas entre os grupos.

Figures 6 and 7 show the values of the height obtained in the vertical jump test and the Illinois agility test, respectively, of the subjects allocated to the CG, SC and FR before, immediately after and after 4 weeks of the procedure. Regarding the vertical jump test, there were no significant differences between groups. However, in relation to the Illinois agility test, a significant decrease in the test time can be observed in the FR, both in the moment immediately after (p = 0.033) and after 4 weeks of procedure (p = 0.007), showing the influence of the self-myofascial release technique on the agility of healthy subjects.

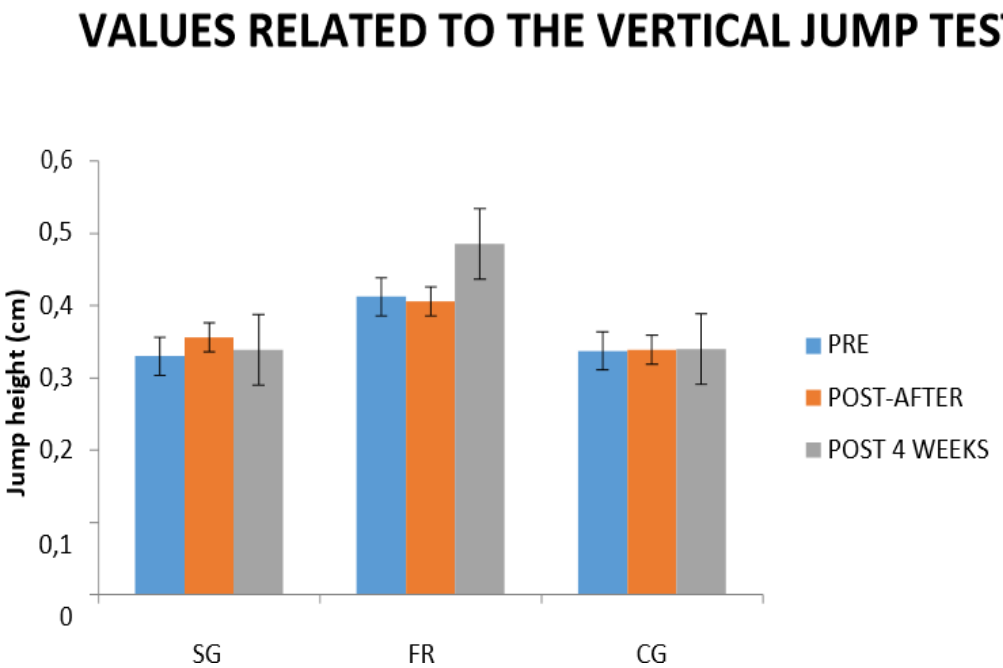

Figure 6. Mean (standard deviation) of the height obtained in the vertical jump test of subjects in the Control group, Stretching group and Foam roller group.
Note: *p≤0.05 (intra-group analysis - ANOVA test for repeated measures). #p≤0.05 (inter-group analysis - ANOVA One Way Test).

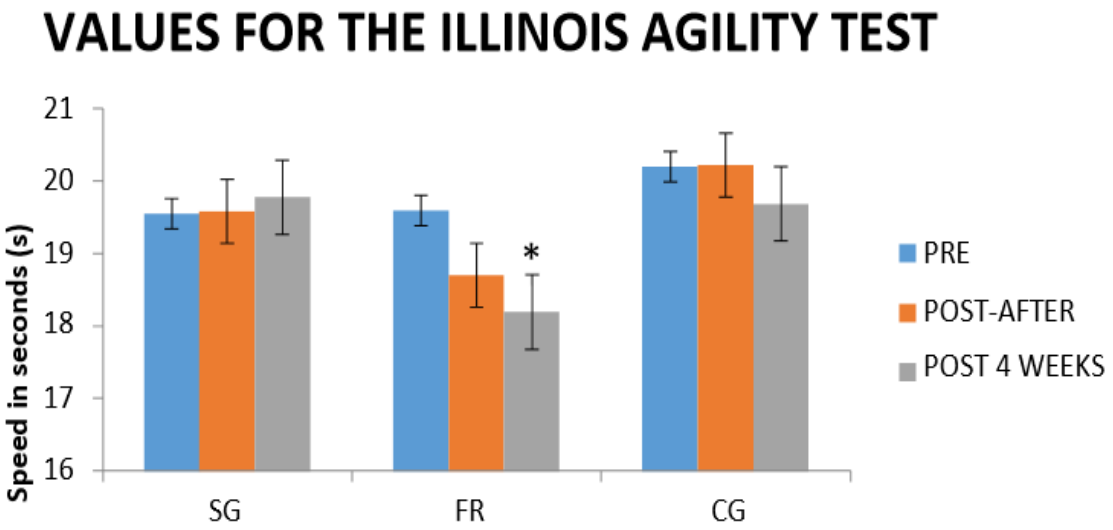

Figure 7. Mean (standard deviation) of the time obtained in the Illinois agility test of subjects in the Control Group, Stretching Group and Foam Roller Group.
Note: *p≤0.05 (intra-group analysis - ANOVA test for repeated measures). #p≤0.05 (inter-group analysis - ANOVA One Way Test).

DISCUSSION

The fascia is made up of a connective and elastic tissue that lines anatomical structures responsible for movement. The stiffening or changes in this structure can influence mobility. In view of the above, self-release appears as an auxiliary method for the return to normality of this tissue and reduction of changes that its abnormal state can cause[16]. Thus, the present study aimed to verify the influence of self-myofascial release on agility and potency in healthy subjects. Regarding the vertical jump test, which evaluates the power of the lower limbs, the proposed study did not observe a significant difference in the power of the jump after four weeks of self-release, compared to the control group. However, it showed significant results in subjects' agility, immediately after and after four weeks, submitted to the Illinois agility test. Peacock[17] states that the use of myofascial release through the foam roller acts as a strategy to aid strength and physical conditioning acting on muscle warm-up. In this way, it developed a study including eleven healthy and active men, evaluated in muscular power through vertical jump, agility through the agility and speed test. The subjects were divided so that one portion performed only dynamic stretching and another dynamic stretching associated with self-myofascial release with foam roller. In conclusion, both showed improvements and gains for warming up, however the use of myofascial release brings an additional gain to the subjects' physical performance. A study by Sousa et al.[16] sought to verify self-myofascial release and its influence on the flexibility and strength of young gymnasts. The participants were separated into two groups, randomly chosen, each group containing 8 gymnasts and evaluated using the vertical jump test, as well as the flexibility of the hamstrings through a Cardiomed® device. The intervention group was instructed to perform self-myofascial release, while the control group performed a series of static stretching. The study showed significant results, in which it was observed that the myofascial self-liberation group obtained greater gains in terms of flexibility, strength and power when compared to the control group.

Kargarfard et al.[18] evaluated the vertical jump power of 30 bodybuilders in two groups: G1 submitted to massage after exercise training and G2 control group, in which no post training intervention was performed, were evaluated 24, 48 and 72 hours after the protocol. The results obtained show a decrease in the vertical jump of the subjects evaluated in both groups, with the control group showing a greater decrease than the massage group. The data presented by the author do not corroborate those found in the present study, as the sample population is different from the one presented, as well as the technique. Furthermore, the data presented by this study do not show differences in power assessed through the vertical jump.

The present study did not find relevant data regarding muscle power. Nunes et al.[19] states that power is the maximum muscle contraction speed, while release acts on range of motion and neuromuscular response. Conducted a study with young male subjects in order to seek the influence of the technique on muscle power. The evidenced data corroborate with the present study, since it also did not find relevant data of these connections. As for agility, the present study observed a significant reduction in the time taken to perform the Illinois test in the foam roller group, suggesting that the self-release of the fascia contributes to the improvement of agility, while the stretching group increased and the control group decreased the time of the test in a non-significant way.

Madoni et al.[20] states that the frictional movement of the fascia on the roller contributes to the tissue to become more flexible, that is, it acts directly on its thixotropic property. This component is able to explain the positive influence of heating with the use of foam roller on agility. In addition, fluidity gain, fibrosis breakdown and reduced adherence are attributed to the benefits of self-release[21]. Some mechanical changes can also be observed due to self-release, such as changes in muscle filaments and hydration, along with increased tolerance to stretching, influenced by friction to tissues during release[21, 22]. Such actions contribute to the gain in extensibility of the fascia and soft tissues, resulting in increased range of motion and flexibility, a component directly related to improvement in muscle agility and power[20]. Healey et al.[23] evaluated 26 healthy school-age subjects, randomized into two groups: one undergoing plank exercise and the other releasing quadriceps, hamstrings, gastrocnemius, iliotibial and anterior tibial tract with foam roller, seeking to determine whether the use of foam roller before of athletic tests provides improved performance. Agility was assessed using the Shuttle run test, showing no significant improvement after the release protocol when compared to the plank group. They observed that fatigue is significantly lower in the foam roller group. These data disagree with the present study, which showed significant changes in agility, resulting from self-release with foam roller.

Jo et al.[24] evaluated the influence of self-release on the fatigue of 25 subjects who, after performing an exhausting protocol for fatigue, underwent foam roller release in group 1 and rest in sitting position in group 2. Subjects were evaluated for power and speed, in which the control group showed a greater decline in these aspects after the protocol. In a study by Picanco et al.[25] it was assessed agility in soccer players using the Illinois agility test, finding a correlation between agility and speed associated with muscle power. It defines agility, as the ability to move quickly, with a change in speed and direction, so it is understood that changes in speed, flexibility and coordination have an influence on agility. In agreement with this aspect, it can then be correlated that mobilization of the fascia can lead to improved strength, reduced pain, gain in range of motion and flexibility[26], and thus contribute to improving agility.

In relation to the studies mentioned above, there was an agreement between the authors with the proposed study, which demonstrated significant improvements in athletic valences such as speed and agility in different tests, demonstrating the relevance of myofascial release in musculoskeletal performance. We can cite as a limitation of the study the loss of the sample, withdrawal by the participant during the research is a factor beyond the control of the researcher. Another variable that can influence the results obtained is the non-limitation of training and physical activity performed by the physically active sample participants.

CONCLUSION

The present study sought to visualize the use of foam roller, in healthy subjects, in order to verify its influence on agility and muscle power of lower limbs. Relevant and positive data were found regarding the connection of self-release with agility, however, it is not possible to verify considerable data when relating the proposed techniques to muscle power. The data obtained from the study contribute scientifically, since, little research seeks to directly verify the effects of release related to muscle agility and power.

AUTHORS' CONTRIBUTION: MMK subject the study and the corresponding text, as well as data collection; WMP elaborated the study design; NLCP e MEC performed data collection; LPR e AJLD performed the statistical analysis; PHP e LABF performed a critical intellectual review of the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST: nothing to declare.

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