The Effects of Myofascial Release With Foam Rolling on Performance

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Abstract

Healey, KC, Hatfield, DL, Blanpied, P, Dorfman, LR, and Riebe, D. The effects of myofascial release with foam rolling on performance. *J Strength Cond Res* 28(1): 61–68, 2014—In the last decade, self-myofascial release has become an increasingly common modality to supplement traditional methods of massage, so a masseuse is not necessary. However, there are limited clinical data demonstrating the efficacy or mechanism of this treatment on athletic performance. The purpose of this study was to determine whether the use of myofascial rollers before athletic tests can enhance performance. Twenty-six (13 men and 13 women) healthy college-aged individuals (21.56 ± 2.04 years, 23.97 ± 3.98 body mass index, 20.57 ± 12.21 percent body fat) were recruited. The study design was a randomized crossover design in which subject performed a series of planking exercises or foam rolling exercises and then performed a series of athletic performance tests (vertical jump height and power, isometric force, and agility). Fatigue, soreness, and exertion were also measured. A 2 × 2 (trial × gender) analysis of variance with repeated measures and appropriate post hoc was used to analyze the data. There were no significant differences between foam rolling and planking for all 4 of the athletic tests. However, there was a significant difference between genders on all the athletic tests ($p \leq 0.001$). As expected, there were significant increases from pre to post exercise during both trials for fatigue, soreness, and exertion ($p \leq 0.01$). Postexercise fatigue after foam rolling was significantly less than after the subjects performed planking ($p \leq 0.05$). The reduced feeling of fatigue may allow participants to extend acute workout time and volume, which can lead to chronic performance enhancements. However, foam rolling had no effect on performance.

Key Words self-myofascial release, foam rolling, athletic performance

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Introduction

Regular exercise and performance can result in microtrauma, which is a small amount of damage to the muscle (7). The resulting inflammatory response may lead to fascia scar tissue over time, which in turn may lead to muscular dysfunctions (7,10,17). Common dysfunctions include physical traumas, overuse, and structural imbalances and lead to decreased performance and pain (7,10,17). For a number of centuries, massage has been used to prevent these dysfunctions and enhance muscle relaxation, reduce muscle tension and soreness, and to improve athletic performances (6,15,33).

In the last decade, self-myofascial release (SMR) has become an increasingly common modality to supplement traditional methods of treating the soft tissue (4,8,9). During SMR, patients use their body weight on a myofascial foam roller to exert pressure on the opposing soft tissues. By varying their body positions, patients can use the rollers to isolate specific areas of the body and treat restrictions in the soft tissue (8–10). Similar to massage, foam rolling before a workout has been said to help restore muscle length–tension relationships and allow for better warm-up (5,9).

Self-myofascial release has been introduced in laymen's literature as a method to treat restrictions in the fascia resulting from soft tissue injury (5,8,9). Anecdotally, there is a growing market for the purchase of foam rollers as a SMR tool, and they are common in commercial gyms and high school and collegiate strength and conditioning facilities. Foam rollers are commonly used both before and after a workout, but laymen's literature claims that SMR before a workout allows an athlete to increase his or her volume of training and decrease dysfunctions resulting from microtrauma without the cost of hiring a professional (5,9). However, there are limited clinical data demonstrating the efficacy or mechanism of this treatment on athletic performance (10). Despite this, coaches and trainers often spend valuable time with their athletes and clients training them to use foam rollers.

An alternative explanation for perceived benefits in performance could be a potential warm-up effect. Performing SMR on a foam roller necessitates supporting ones' partial body weight with the upper body, similar to planking exercises. Planking involves isometrically holding the body in a prone position and is typically used to strengthen the core muscles. Planking is similar to foam rolling because body position is maintained in similar ways, requiring similar isometric actions needed to support one's body weight.

Isometric exercises such as planking would have a warm-up effect through possible increased skin and muscle temperature, increased blood flow, and enhanced flexibility and mobility (14,35). Despite this alternative explanation, claims persist that SMR before a workout will enhance performance because of myofascial release, leading to increased mobility and neuromuscular efficiency (8,9). However, to date, there is no research investigating whether SMR enhances performance through massage-like treatment to the soft tissue or if there is simply a warm-up effect to performing the isometric hold.

In addition, some of the research that focuses on myofascial release through massage suggests that it acts as a mood enhancer and potentiates fatigue, thereby acting as an ergogenic aid (28,33,34). Given a lack of data on the effectiveness of SMR on soft tissue, it may be possible that anecdotal reports of foam rollings' positive effect on performance can be explained by mechanisms other than myofascial release. Therefore, the purpose of this study was to determine whether SMR using foam rollers enhances acute athletic performance when compared with planking, a similar isometric exercise.

Methods

Experimental Approach to the Problem

This was a randomized crossover design study in which each subject completing 1 day of familiarization and 2 days of experimental testing. One experimental day consisted of an SMR bout using foam rollers followed by a series of athletic performance tests. On the other experimental day, participants performed a planking exercises followed by the same series of athletic performance tests. The purpose was to examine the effects of foam rolling as an SMR technique on vertical jump power and height, isometric force production, speed, and agility compared with the control condition of planking exercise.

Subjects

Twenty-six healthy college-aged individuals (21.56 ± 2.04, 13 men, 13 women) volunteered for this study (see Table 1 for subject characteristics), which took place in during the Spring semester. Subjects were all recreationally active, defined as participating in regular physical activity at least 3–4 times per week for the past 6 months. A health history questionnaire was conducted to exclude those individuals with medical problems that could affect their ability to complete the study, such as recent or reoccurring muscle or bone injuries, or tendon or ligament injuries. Before participation, an explanation of the study was given, and the subjects were asked to read and sign an informed consent.

Table 1. Subject characteristics.*

	Women (n = 13)	Men (n = 13)
Age	21.75 ± 2.05	21.38 ± 2.10
Height, cm	164.76 ± 6.54	176.23 ± 6.00
Weight, kg	65.32 ± 13.23	74.1 ± 9.51
% Body fat	28.97 ± 8.60	11.4 ± 8.33
BMI	24.10 ± 5.12	23.83 ± 2.58

*n is subject number; BMI = body mass index.

The participants were also asked to (a) complete a physical activity and nutritional questionnaire, (b) complete a dietary log for 48 hours before experimental trials, (c) maintain a normal diet, (d) refrain from alcohol, nicotine, and caffeine consumption at least 48 hours before testing sessions, (e) refrain from use of pain reliever and analgesics for the duration of the study, and (f) not participate in any vigorous physical activity 48 hours before testing sessions. This study was approved by the University of Rhode Island Institutional Review Board.

Procedures

During the familiarization session, anthropometric measurements were taken, body mass index was calculated, and percent body fat was determined. Following this preliminary testing, subjects underwent 2 sessions of testing. The testing sessions were separated by 5 days, and each took place at the same time of day. Subjects were instructed to eat the same or similar meals 2 days before each testing session. This was done to help eliminate the chance of an increase in carbohydrate or caffeine intake. All testing sessions took place in the same location, which were supervised by the same investigators. Care was taken to ensure that all subjects received the same verbal encouragement and instructions for all exercises to negate potential differences in state of arousal. Subjects performed a standardized dynamic warm-up at the beginning of both testing sessions. This warm-up consisted of walking lunges (5 each leg), walking knee to chest (5 each leg), side squats (5 each leg), walking butt kicks (5 each leg), frankensteins (5 each leg), and penny pickers (5 each leg).

This was a balanced randomized crossover study; therefore, half of the subjects performed foam rolling on the first trial and the other half performed planking. The subjects performed the foam rolling for 30 seconds on each of the following muscles: quadriceps, hamstrings, calves, latissimus dorsi, and the rhomboids. After completing the foam rolling, the subjects then completed 4 athletic tests (vertical jump height and power, isometric force, and pro agility test) to determine overall performance.

The subjects performed light planking for the same periods of time that they performed the foam rolling. The planking was performed because it simulates the isometric body weight hold that foam rolling entails. This helped to eliminate the chance of post-activation potentiation, which is an increase in muscle twitch and low-frequency force after a "conditioning" contractile activity and can be looked at as a priming mechanism that serves to improve performance (31).

Anthropometric Measurements. Body weight was measured to the nearest 0.1 kg using a digital read scale associated with the Bod Pod calibrated before each measurement. Height was measured by use of a stadiometer (Seca, Hamburg, Germany) to the closest 0.5 cm. Body mass index was calculated as weight (in kilograms) divided by height (in meters) squared. Body composition was estimated through air displacement plethysmography (Bod Pod, version 2.14 Body Composition System; Life Measurement Instruments, Concord, CA, USA).

Muscle Soreness, Fatigue, and Perceived Exertion. All subjects read instructions on the use of 4 scales: the Soreness on Palpation Rating Scale, Overall Fatigue Scale, Overall Soreness Scale, and the Borg CR-10. After the warm-up and at the conclusion of each testing session, subjects rated their level of muscle soreness by selecting a number on the continuous scale. Ratings for soreness on palpation and overall soreness were as follows: 0, no soreness; 1, very light soreness; 2, moderate soreness; 3, light (weak) feelings of soreness; 5, heavy (strong) feelings of soreness; 7, very heavy feeling of soreness; and 10, maximal soreness. This type of scale is a valid and reliable measure that has been used in multiple studies regarding muscle soreness and pain (11,16,23). Fatigue ratings were obtained using a standard Likert scale from 0 to 10 with standard psychometric tags ranging from 0 to no fatigue, 1 to very light fatigue, 2 to moderate fatigue, 3 to light (weak) feelings of fatigue, 5 to heavy (strong) feelings of fatigue, 7 to very heavy feeling of fatigue, and 10 to maximal fatigue. The Borg CR-10 Scale with magnitude estimation was used to assess overall ratings of perceived exertion on a scale of 0–11 (3).

Foam Rolling. The foam roller that was used in the study was chosen because it was reported to not collapse under the participant's body weight. Curran et al. (10) investigated differences between 2 different foam rollers to compare the pressure and contact areas. One was the bio-foam roller (BFR), a uniform polystyrene foam cylinder, and the other was the multilevel rigid roller (MRR), a nonuniform cylinder consisting of a hollow polyvinyl chloride inner core (10). Curran reported that the MRR produced significantly more pressure on the soft tissue, and the mean contact area was greater in the BFR. Thus, order to better control for the pressure on the soft tissue, using a foam roller most similar to the one used by Curran et al. This study elected to use the Foam Roller Plus (FRP; Perform Better, Inc., Cranston, RI, USA). The FRP is an extremely dense cylindrical foam roller with a polyvinyl chloride core and neoprene cover and is similar to the MRR used in the Curran study.

The participants performed the foam rolling exercises over the lower extremities and back, which includes the quadriceps, hamstring, IT band, calves, latissimus dorsi, and rhomboid muscles. For each section of the body, the participants rolled the foam cylinder from the top of the selected area to the bottom and then returning to the starting position and performed this action for 30 seconds for each muscle group.

For the quadriceps, the participants laid face down with the foam roller under their thighs. Their forearms were on the ground in a planking position. With the participant supporting some of their own body weight, they rolled the foam distally and proximally from the bottom of the hip to the top of the knee.

To roll the hamstrings and the calves, the participants sat with the roller under their proximal thighs/calves. Their hands were placed on the ground with their fingers pointing toward their body. Then they rolled distally and proximally from the bottom of the greater trochanter to just proximal to the knee or from just distal to the knee to just proximal to the ankle while supporting some of their body weight with their hands.

The IT band was rolled by the participant lying on their side on the foam. With 1 leg crossed in front of the other and the bottom leg raised slightly off the floor. Participants rolled

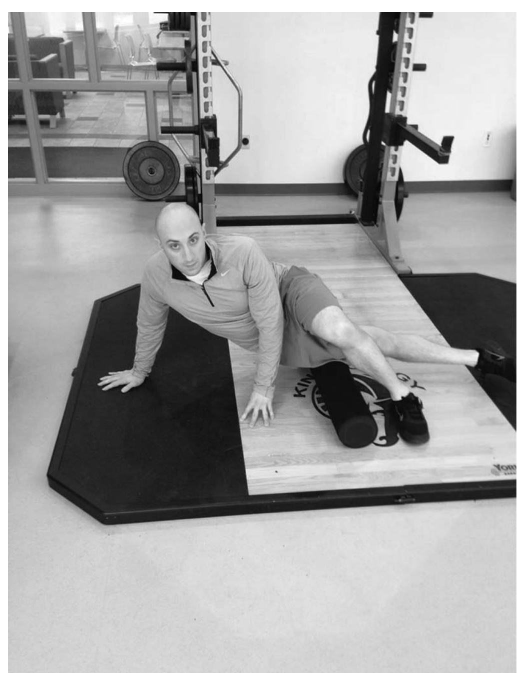

Figure 1. Example of self-myofascial release technique of the ilotibial band using a foam roller.

just distal to the greater trochanter distally to just proximal to the knee joint (Figure 1).

For the latissimus dorsi, the participants laid on their side with 1 arm outstretched overhead and the foam roller placed in the axillary area. Movement during this technique is minimal.

To roll the rhomboids, the participants laid supine on the floor with their arms crossed and the foam roller under the shoulders. The participants then held their hips off the ground while they rolled the foam caudally and cranially from their shoulder level to the middle of the back.

Control Condition. Planking exercise was used as the control condition because of the similarities in isometric holds between foam rolling and planking. This would effectively negate any potential warm-up effect that might occur from supporting oneself while performing the foam rolling exercises. Planking positions performed were similar to those used with the foam rolling and were held for 30 seconds, the same amount of time that was used to complete the foam rolling. For the IT band and the latissimus dorsi, the participants laid on their side with their forearm and their feet holding their body weight. For the control plank for the quadriceps, the participants were in a prone position holding their weight on their forearms and feet. For the hamstrings and calves, the participants held an upper body static hold with 1 leg off the ground. For the rhomboids, the participants were in a reverse bridge position that is the shoulders and feet on the ground and the hips lifted off the ground.

Measures. ***Isometric Force.*** Isometric squat force was assessed using force plate–associated software (Accupower; Advanced Mechanical Technologies, Inc., Watertown, MA, USA). The participants aligned themselves on a force place in a quarter squat positions under a Smith machine squat bar and pushed against the stationary bar maximally for 10 seconds. The knee angle for a quarter squats is approximately 135° (19), the participants' knee angle was measured with a goniometer, and the angles ranged from 100–135°. The same angle was used on both trials.

Vertical Jump Measurements. Vertical jump height was assessed with a Vertec (Perform Better). The vane stack was raised by a measured distance, so that the participants could not jump higher or lower than the set of vanes. Without a preparatory or stutter step, the participant performed a countermovement jump by quickly flexing the knees and hips, moving the trunk forward and downward, and swinging the arms backward. During the jump, the dominant arm reaches upward, whereas the nondominant arm moves downward relative to the body. At the highest point in the jump, the subject taps the highest possible vane with the fingers of the dominant hand. The score is vertical distance between the height of the highest vane tapped during the standing vertical reach and the vane tapped at the highest point of the jump. The best of 3 trials with 3-minute rest period was recorded to the nearest 0.5 inches (18).

Vertical jump power was also assessed using the force plate–associated software (Accupower; Advanced Mechanical Technologies, Inc.). The participants stood on a force place with their hands on their hips and performed 3 rapid vertical jumps. After the jumps, they were given a 3-minute rest period. The highest power of the 3 sets was recorded.

Agility. Agility was assessed using the pro agility test also known as the 5-10-5 yard shuttle run. There were 3 parallel cones each separated by 5 yards (4.6 m). The participants started by straddling the centermost of the 3 parallel lines. On an auditory signal, the participant sprinted 5 yards (4.6 m) to the line on the left and touched the cone with their hand and then changed direction and sprinted 10 yards (9.1 m) to the cone on the right, touched that cone, then again changed direction, and sprinted 5 yards (4.6 m) to the center cone. Hand contact was made with all indicated cones. The participants were given instruction and allowed to practice the drill. The best time of 2 trials was recorded to the nearest 0.01 second with a 5-minute rest period between the 2 trials (18).

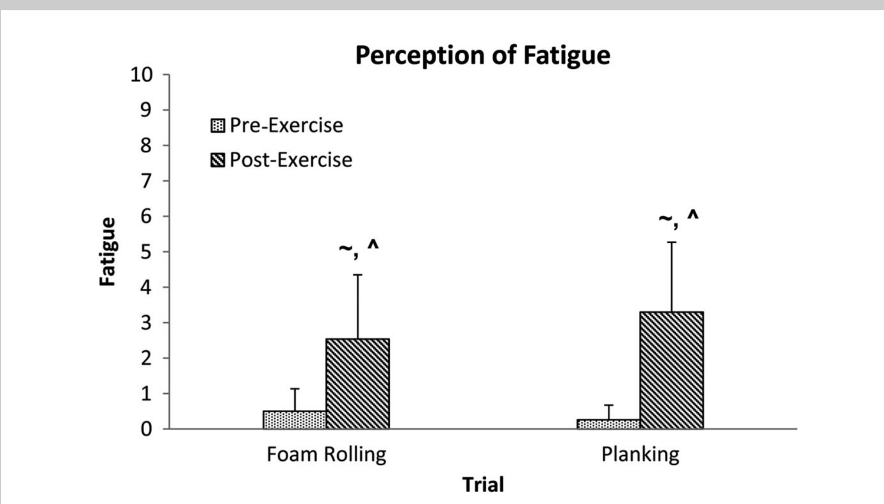

Figure 2. Mean levels of fatigue between trials. ~Significant difference ($p \leq 0.05$) compared with pre-exercise within the same trial. ^Significant difference ($p \leq 0.05$) compared with corresponding foam rolling trial.

Table 2. Results for athletic performance tests.*

	Foam rolling trial		Planking trial	
	Women	Men	Women	Men
Vertical jump height, cm	39.95 ± 7.77	58.32 ± 7.21†	37.81 ± 7.09	58.03 ± 7.4 1†
Vertical jump power, W	2276.92 ± 343.56	3793.77 ± 518.00†	2361.23 ± 411.41	3897.46 ± 836.45†
Isometric squat force, N	1631.39 ± 439.81	2637.69 ± 683.50†	1596.23 ± 456.61	2510.77 ± 842.55†
Pro agility drill speed, s	6.24 ± 0.65	5.37 ± 0.36†	6.39 ± 0.79	5.24 ± 0.27†

*cm = centimeters; W = Watts; N = Newtons; s = seconds.
†Significant difference ($p \leq 0.001$) compared with women in corresponding trial.

Dietary Regimens. The participants were required to maintain a dietary record 48 hours before each experimental trial to ensure consistency throughout the study. This diet consisted of their normal dietary habits and foods. Participants were instructed to follow the same dietary regimen before both experimental trials. This was done to help eliminate the chance of an increase in carbohydrate or caffeine intake.

Statistical Analyses

All results are reported as mean ± SD. A 2 × 2 (trial × gender) analysis of variance with repeated measures was used to analyze the data. In the case of a significant F score, a Bonferroni post hoc test was performed to determine where significant differences lay. Paired sample t-tests were used to determine significant differences between pre- and post-fatigue measures during each trial. Significance for all analyses was set a $p \leq 0.05$. Based on previous studies, it was determined that an n of 23 was adequate to defend the 0.05 alpha level of significance with a Cohen probability level of 0.8 (G-Power software, version 3.1.2; Franz Foul, Kiel University, Kiel, Germany).

Table 3. Results for fatigue, exertion, and soreness scales.*

	Foam rolling	Planking
Pre-CR-10	0.40 ± 0.59	0.82 ± 0.74†
Post-CR-10	2.21 ± 1.76‡	2.89 ± 1.61‡
Pre-soreness	0.23 ± 0.49	0.21 ± 0.40
Post-soreness	0.92 ± 1.33‡	1.40 ± 1.48‡
Pre-soreness on palpation	0.25 ± 0.43	0.44 ± 0.69
Post-soreness on palpation	1.63 ± 1.79‡	1.78 ± 1.61‡

*CR-10 is the Borg CR-10 Scale of perceived exertion.
†Significant difference ($p \leq 0.05$) compared with corresponding foam rolling trial.
‡Significant difference ($p \leq 0.05$) compared with pre-exercise within the same trial.

Results

There were no significant differences ($p \leq 0.001$) between foam rolling and planking for all 5 of the athletic tests. However, there was significant difference between genders on all the athletic tests. As expected, there were significant increases ($p \leq 0.01$) from pre to post during both trials for fatigue, soreness, and exertion. Fatigue after foam rolling was significantly ($p \leq 0.05$) less than after the subjects performed planking.

Athletic Tests

Men performed significantly better on the vertical jump for height, vertical jump for power, isometric force, and pro agility (Table 1) compared with women. There were no significant differences between trials (Table 2).

Scales

Measurements of fatigue, soreness, and exertion on a Likert scale revealed significant differences from pre to post during each exercise trial. There were not any significant gender differences for the measurements of fatigue, soreness, and exertion. However, fatigue was significantly greater after the planking trials when compared with the foam rolling trials (Figure 2). Table 3 shows all the results for the soreness and exertion scales.

Discussion

The results suggest that 30 seconds of foam rolling compared with planking on each of the lower limbs and back had no effect on performance. Men did show a better performance on all tests compared with the women. As expected, all the subjects reported increased fatigue, soreness, and exertion after each trial compared with the premeasures. However, the only main effect between trials was a significant increase in feeling of fatigue post planking trial.

The performance findings are in agreement with those of Goodwin et al. (15) who found that lower limb massage had no effect on 30-m sprints. As with this study, Goodwin recruited college-aged individuals. However, his volunteers were all male and participated in multiple sprint sports at the university level. The pace of the massage delivery was high with rapid and superficial strokes rather than the commonly used slow and deep strokes, which may have been a limitation to the study. The length of the massage was 15 minutes of contact and approximately 20 minutes including application of oils and turning time, which was longer than the 5 minutes of foam rolling in this study. The placebo was a sham ultrasound treatment given for the same amount of time as the massage. The warm-up was performed after the massage or placebo treatment, whereas in this study, the subjects performed the warm-up before the foam rolling and planking.

In addition, Wiktorsson-Moller et al. (35) reported that 6–15 minutes of massage alone decreased muscle strength in the hamstrings in subjects. The hamstrings and quadriceps strength was measured immediately after measurements of range of motion (ROM) and massage with Cybex-II isokinetic dynamometer equipped with an x-y pen recorder. However, this study did not accurately describe ROM measures, and it is possible that there was some bias on the investigators part if they manually measured ROM.

In contrast, Ask et al. (2) reported that maximal muscle power output during leg extension was significantly increased (by 11%) when the subjects received 10 minutes of standardized massage, which included effleurage, petrissage, and tapotement before the exercise rather than 10 minutes of passive rest. These studies may have differed from this study because of the length of massage given 10–15 minutes compared with 5 minutes of foam rolling. Also, the amount of pressure given in this study was self-selected and could have been more or less than the subjects received in the previous studies.

To date, this is the only investigation examining the effects of foam rolling on performance as opposed to massage. However, one study that directly measured ROM before and after a foam rolling protocol reported that foam rolling has no effect on hamstring flexibility in individuals with hamstring ROM restrictions (26). In that study, 23 college-aged individuals with reduced knee extension ROM were randomized to a control group (normal activity) or a foam rolling protocol performed 3 times per week. The authors reported no difference in active knee extension between the control group and the foam rolling group after 8 weeks. Taken in context, it seems as though SMR through foam rolling is ineffective at relieving tissue dysfunction and thus enhancing performance and joint ROM.

Although there were no differences between SMR and planking, men performed significantly better than women. This was an expected result because of the fact that women generally have approximately two-third the strength of men in all muscle groups (12,25). Maud and Shultz (24) reported that men compared with women had greater anaerobic power and anaerobic capacity. The mean vertical jump of subjects used in this study was comparable to similar college-aged populations. The mean vertical jump for the females in this study was 39.95 ± 7.77 cm and the mean for recreational college athletes is 38–39 cm (18). The men's mean vertical jump was 58.32 ± 7.21 cm and the mean for recreational college athletes is 61 cm (18). This means that the subjects used in this study were very active individuals, and they reported participation in recreational games such as basketball and soccer and unorganized activities such as running and biking at least 3 times per week.

As expected, measurements of fatigue, soreness, and exertion on a Likert scale revealed significant differences from pre to post during each exercise trial. Fatigue was significantly greater after the planking trials when compared with the foam rolling trials. Mori et al. examined the effects of massage on blood flow and muscle fatigue following isometric lumbar exercise. For this intervention, the subjects were instructed to lay prone on a table and to extend their trunks and hold that position for 90 seconds. The subjects then either rested for 5 minutes or received 5 minutes of massage on the lumbar region and then repeated the trunk extensions for 90 seconds. They reported that the subjects' feelings of local muscle fatigue significantly decreased after a second trial when subjects received massage (27). The authors theorize that this was because of an increase of muscle blood volume observed in the massage condition, which may help to enhance the removal of lactic acid (27). Ogai et al. reported similar results that perceived muscle fatigue starting from identical levels after the first exercise bout were reduced more effectively by massage in comparison to passive rest without massage. The subjects participated in 2 identical exercise trials on a cycle ergometer with a 35-minute rest period between bouts. Ten minutes of massage was applied from the 5th to the 15th minute of the rest period. The authors believed that the reduction in fatigue may have occurred from postexercise removal of lactate from the exercising muscles under the influence of massage (28).

All the previous studies examined the effects of massage on postexercise treatments, whereas this study examined the effects of pre-exercise treatments. Although there is not any current literature on the effects of massage pre-exercise, there is literature addressing how massage may affect perception. This may help to explain possible physiological reasons for a decreased perception of fatigue after foam rolling. The pressure that is exuded from massage may stimulate parasympathetic activity as shown by reduced saliva cortisol levels (33). Changes in hormonal levels (serotonin and cortisol) after massage mostly in specific conditions such as patients with low back pain, HIV-positive patients, and depressed adolescent mothers have been reported (13,21–23). Weinberg et al. (34) reported that massage has a significant positive mood enhancement with significant decreases in tension, confusion, fatigue, anxiety, anger, and depression. This agrees with the results of Hemmings et al. (20) that massage has pointed to having powerful effects of generating well-being, a sense of calm, a reduction in anxiety, and an improvement in mood and perceived relaxation and recovery. The data from this study suggests that foam rolling before a workout may have a similar positive effect in perception of fatigue.

Massage is commonly applied to athletes during periods of fatigue in training (1). Fatigue is associated with muscular fiber changes that reflect the increased effort required to maintain a given level of mechanical performance (29). The relaxation that massage therapy is able to produce has proved capable of reducing local fatigue (30) and the muscular excitability (6,32) by inducing relaxation (1). Thus, massage reduces the feeling of fatigue that may give the perception that participants can work out longer and harder. Although foam rolling did not affect performance, theoretically because there was no physiological effects on the musculature, the reduced perception of fatigue is a positive finding. Foam rolling may offer individuals a relaxing and mood-enhancing experience comparable to massage. Over time, these perceptions may provide a psychological environment conducive to enhancing performance.

Unexpectedly, the premeasures of the Borg CR-10 perceived exertion scale were significantly higher for the planking trial than the foam rolling trial. However, further statistical analysis revealed that once these reports were covaried, the premeasures had no effect on performance. The meaning of these results are unclear and could be because of the fact that subjects were not feeling well that day or did not get enough sleep the night before.

The laymen's literature claims that restrictions in the soft tissue can cause dysfunctions. However, this study did not assess whether restrictions were present. The subjects, while active individuals, were not competitive athletes and may not have had any soft tissue restrictions. Furthermore, the research protocol was a battery of tests, rather than competing or engaging in a typical workout setting. Thus, the intensity of this protocol may have been less than what is typically experienced, potentially influencing their perception of fatigue.

Anecdotal comments from subjects suggested that some enjoyed the foam rolling and some did not. The subjects' perception of how they liked or disliked using the foam rollers could have altered how well they performed and the self-selected pressure they used with SMR. However, to control for any perceptual bias only subjects who had no prior experience with foam rollers were recruited.

As stated previously, this study used self-selected pressure and approximately 5 minutes of massage compared with other studies giving at least 10 minutes of massage. The self-selected pressure on the rolling may have varied from subject to subject, unlike the constant pressure given from a masseur.

Practical Applications

The results of this study suggest that SMR through the use of foam rollers before a workout does not enhance athletic performance. Since workout time with athletes is often limited, strength and conditioning coaches should take this information into account when planning how to best use the time in a training session. However, perceived fatigue after foam rolling was significantly less compared with the control condition of planking. Foam Rolling may offer subjects a feeling of relaxation, which may have psychological benefits to some people.

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