Hong Kong Physiotherapy Journal (2017) 36, 57–62

Available online at www.sciencedirect.com

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journal homepage: www.hkpj-online.com

RESEARCH PAPER

Acute effects of different foam rolling volumes in the interset rest period on maximum repetition performance

Estêvão Rios Monteiro, BSc [a,*], Andrew Vigotsky, BSc [b], Jakob Škarabot, MSc [c], Amanda Fernandes Brown, MSc [a], Aline Gomes Ferreira de Melo Fiuza, BSc [a], Thiago Matassoli Gomes, MSc [a,d], Israel Halperin, MSc [e], Jefferson da Silva Novaes, PhD [a]

[a] *Department of Gymnastics, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil*
[b] *Leon Root M.D. Motion Analysis Laboratory, Department of Rehabilitation, Hospital for Special Surgery, New York, NY, USA*
[c] *Department of Biology of Physical Activity, University of Jyväskylä, Jyväskylä, Finland*
[d] *Estácio de Sá University, Exercise Physiology Laboratory — LAFIEX, Rio de Janeiro, Brazil*
[e] *School of Exercise and Health Sciences, Edith Cowan University, Western Australia, Australia*

KEYWORDS
fatigue;
massage;
self-manual therapy;
self-myofascial release

Abstract *Background:* Foam rolling (FR) is a ubiquitous intervention utilised for the purpose of acutely increasing the range of motion without subsequent decreases in performance. Thus, it is commonly used during the periworkout period—that is, prior to, during, or after an athlete's workout.
Objective: This study investigated how different FR durations applied to the quadriceps during the interset rest periods affects the numbers of repetitions in the knee extension exercise.
Methods: Twenty-five females completed four sets of knee extensions with 10 repetitions of maximum load to concentric failure on four occasions. Between each set, a 4-minute rest interval was implemented in which participants either passively rested or performed FR for different durations (60 seconds, 90 seconds, and 120 seconds). The 95% confidence intervals revealed a dose-dependent relationship in which longer durations of FR resulted in fewer completed repetitions.
Results: On average, the number of repetitions with PR was 13.8% greater than that in FR120, 8.6% greater than that in FR90, and 9.1% greater than that in FR60.

* Corresponding author. Department of Gymnastics, School of Physical Education and Sports, Federal University of Rio de Janeiro, 540 Carlos Chagas Filho Avenue, 21941-599, Rio de Janeiro, Brazil.
E-mail address: profestevaomonteiro@gmail.com (E.R. Monteiro).

http://dx.doi.org/10.1016/j.hkpj.2017.03.001

Conclusion: For the purposes of performance and likely adaptation, interset FR seems to be detrimental to a person's ability to continually produce force, and should not be applied to the agonist muscle group between sets of knee extensions.

Introduction

Foam rolling (FR) is a ubiquitous intervention utilised for the purpose of acutely increasing the range of motion without subsequent decreases in performance [1,2] Thus, it is commonly used during the periworkout period—that is, prior to, during, or after an athlete's workout. Although much of the previous research on FR interventions examined the effects of FR on range of motion or on explosive or nonfatiguing tasks [1,2], to our knowledge only two studies to date have investigated the effects of FR on an anaerobic, fatiguing task. The first study observed equivocal outcomes, in which the power output during Wingate testing decreased for females, but increased for males, following FR [3]. The second study utilised interset FR applied to the antagonist muscle group between sets of knee extensions, and found a dose–response decrease in repetition performance with large amounts of FR volume [4].

Resistance training is one of the most widely practiced types of physical activity and is used both for performance benefits as well as in clinical settings (e.g., rehabilitation after an injury) [5,6]. Anecdotally, it is not uncommon for athletes to foam roll agonist muscle groups during a warm-up, between warm-up sets, or between working sets, as it believed that greater ranges of motion can be achieved by doing so. At present, there is paucity of investigations on the effects of interset FR applied to an agonist muscle group on resistance training performance, such as the number of repetitions that participants can complete. Therefore, the purpose of this study was to investigate the effects of different volumes of FR applied to the quadriceps muscle during the interset rest period on repetition performance of a knee extension exercise.

Methods

Participants

Twenty-five recreationally active females (Table 1) were recruited for the study based on an *a priori* sample size calculation [7]. An *a priori* sample size calculation ($\eta_p^2 = 0.34$; $\beta = 0.95$; $\alpha = 0.05$) using G*Power [8] found that six participants would be adequate; however, in order to increase statistical power, 25 individuals were recruited. The participants performed the procedures in the luteal phase of the menstrual cycle [9]. Anthropometric data included body mass (Techline BAL – 150 digital scale, São Paulo, Brazil) and height (Stadiometer ES 2030 Sanny, São Paulo, Brazil).

Individuals were included if they had been involved in resistance training programme for at least 1 year prior to the experiment, 3–4 sessions per week, using loads equal to 8–12 repetitions maximum, and had experience with the knee extension machine exercise. Participants were free from any functional limitation or medical condition that could have compromised their health or confounded results of the study. During the 16-day period of data collection, participants were instructed not to engage in any strenuous lower body resistance training exercise. Prior to the study, all participants were provided verbal explanation of the study and read, and signed the informed consent form and Physical Activity Readiness Questionnaire [10]. All procedures were in accordance with Declaration of Helsinki. The local ethics committee approved the study (57023616.7.0000.5257/16).

Experimental design

The participants visited the laboratory on six occasions during a 16-day period with at least 48 hours' interval between each visit. They underwent a 10-repetition maximum (RM) test and retest procedure on the first and second visits. After the two 10-RM tests, they visited the laboratory on four occasions. Each session consisted of four sets of knee extension 10 RM load to concentric failure, interspersed by 4-minute rest intervals, with the goal of completing the maximum number of repetitions. During the interest rest periods, participants underwent one of the following interventions in each of the testing days in a randomised (aleatory entry in latin square format) crossover order: (1) passive rest (PR), (2) FR for 60 seconds (FR60), (3) FR for 90 seconds (FR90), and (4) FR for 120 seconds (FR120) (see Figure 1 for the experimental setup).

Table 1 Participant characteristics

Age (y)	27.8 ± 3.6
Height (cm)	168.4 ± 7.2
Body mass (kg)	69.1 ± 10.2
BMI (m^2/kg)	24.2 ± 2.1
RTE (mo)	23.0 ± 6.6
Knee Extension 10RM (test) (kg)	70.7 ± 11.1
Knee Extension 10RM (retest) (kg)	71.4 ± 11.2
ICC (test–retest)	0.981 (95% CI = 0.966–0.996)

BMI = body mass index; CI = confidence interval; ICC = intraclass correlation coefficient; RM = repetition maximum; RTE = resistance training experience.