ACSM Southwest Chapter

Acute Effects of a Short Dynamic Warm-Up on Vertical Jump Performance and Perceived Readiness in Recreationally Active College Students

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ABSTRACT

Dynamic warm-up routines are commonly used before exercise and sport participation, yet the short-term effects of different warm-up durations on performance and perceived readiness remain unclear in recreationally active college students. PURPOSE: The purpose of this fictional study was to examine the acute effects of a brief dynamic warm-up on countermovement jump height, reactive strength index modified, and perceived readiness to perform. METHODS: Twenty-four recreationally active college students completed two experimental conditions in a randomized crossover design: 1) quiet seated rest and 2) a 10-minute dynamic warm-up consisting of lower-body mobility, activation, and progressive jumping drills. Following each condition, participants completed three maximal countermovement jumps on a force platform. Jump height, peak power, and reactive strength index modified were calculated. Participants also rated perceived readiness to perform using a 0-10 visual analog scale. RESULTS: Jump height was greater following the dynamic warm-up compared with seated rest (32.8 +/- 6.4 cm vs. 30.9 +/- 6.1 cm, $p = 0.01$). Peak power increased following the dynamic warm-up (4,128 +/- 702 W) compared with seated rest (3,982 +/- 688 W, $p = 0.03$). Perceived readiness was also higher following the dynamic warm-up (7.8 +/- 1.1) compared with seated rest (6.4 +/- 1.5, $p < 0.001$). Reactive strength index modified was not significantly different between conditions ($p = 0.08$). CONCLUSION: A 10-minute dynamic warm-up acutely improved vertical jump height, peak power, and perceived readiness in recreationally active college students. These fictional findings suggest that even brief dynamic warm-up routines may enhance explosive performance and psychological readiness before physical activity.

Introduction

Warm-up routines are commonly performed before exercise, sport practice, and physical performance testing. The general purpose of a warm-up is to prepare the body for more intense activity by increasing muscle temperature, enhancing neuromuscular activation, improving joint range of motion, and increasing psychological readiness (1,2,4). In applied exercise science settings, dynamic warm-ups are often preferred over passive rest or prolonged static stretching because they more closely resemble the movement patterns used during subsequent activity (3,4).

Vertical jumping is a commonly used assessment of lower-body power and neuromuscular function (8,10). Because jumping requires rapid force production, coordination, and efficient use of the stretch-shortening cycle, performance may be influenced by the type of preparation completed immediately beforehand (5,6). For example, a warm-up that includes progressive lower-body movements, submaximal jumps, and explosive drills may improve acute jump performance by increasing motor unit recruitment and movement-specific readiness (2,4). In addition to physical performance, perceived readiness may be an important practical outcome. Recreationally active students often rely on subjective feelings of energy, alertness, and preparedness when deciding how hard to train or compete. If a short warm-up improves both objective performance and perceived readiness, it may represent a simple and practical strategy for exercise science students, coaches, and recreational exercisers.

The purpose of this research project was to determine whether a 10-minute dynamic warm-up can improve countermovement jump performance and perceived readiness compared with seated rest in recreationally active college students? We hypothesized that countermovement jump height, peak power, and perceived readiness would be greater after the dynamic warm-up condition compared with the seated rest condition. It was also hypothesized that reactive strength index modified would improve following the dynamic warm-up, although this outcome was expected to show a smaller effect than jump height or perceived readiness.

Methods

Participants

Twenty-four recreationally active college students participated in this fictional study. Participants were classified as recreationally active if they reported completing at least 150 minutes of moderate-to-vigorous physical activity per week and had no lower-extremity injury within the previous six months (11). Participants were excluded if they reported cardiovascular, neurological, or musculoskeletal conditions that limited maximal jumping. Participants provided written informed consent prior to testing. Participants were 21.3 +/- 2.1 years old, 173.6 +/- 8.9 cm tall, and 72.4 +/- 12.7 kg. Reported weekly physical activity averaged 238 +/- 84 min/week.

Study Design

A randomized crossover design was used. Each participant completed two testing sessions separated by at least 48 hours. The two experimental conditions were: 1) seated rest and 2) dynamic warm-up. Condition order was randomized and counterbalanced. Participants were instructed to avoid strenuous lower-body exercise, caffeine, and alcohol for 24 hours before each visit. Testing was conducted at the same time of day for each participant to reduce potential effects of daily variation in performance.

Experimental Conditions

During the seated rest condition, participants sat quietly for 10 minutes before completing the jump testing protocol. During the dynamic warm-up condition, participants completed a 10-minute standardized warm-up. The warm-up included two minutes of light jogging, followed by dynamic lower-body mobility exercises, bodyweight squats, walking lunges, high knees, skips, and three sets of progressive submaximal jumps (2,4).

Countermovement Jump Testing

Following each condition, participants completed three maximal countermovement jumps on a force platform (8,10). Participants were instructed to stand still for two seconds, perform a rapid downward movement, and then jump as high as possible. Hands were kept on the hips during all trials to reduce the influence of arm swing. One minute of rest was provided between jumps.

Perceived Readiness and Statistical Analysis

Immediately before jump testing, participants rated perceived readiness to perform using a 0-10 visual analog scale. Paired-samples t-tests were used to compare jump height, peak power, reactive strength index modified, and perceived readiness between conditions. Statistical significance was set at $p < 0.05$. All values are presented as mean +/- standard deviation.

Results

Jump performance and perceived readiness outcomes are presented in Table 1. Countermovement jump height significantly increased after the dynamic warm-up compared with seated rest ($p = 0.01$). Peak power was also significantly greater following the dynamic warm-up condition ($p = 0.03$). Perceived readiness was higher after the dynamic warm-up compared with seated rest ($p < 0.001$). Reactive strength index modified was higher following the dynamic warm-up, but this difference did not reach statistical significance ($p = 0.08$).

Average increase in jump height from seated rest to dynamic warm-up was 1.9 cm, a 6.1% improvement. Nineteen of the 24 participants demonstrated higher jump height following the dynamic warm-up condition. Perceived readiness increased in 21 participants, remained unchanged in two participants, and decreased in one participant (Figure 1).

Variable	**Seated Rest**	**Dynamic Warm-Up**	**p-value**
Jump height, cm	30.9 +/- 6.1	32.8 +/- 6.4	0.01*
Peak power, W	3,982 +/- 688	4,128 +/- 702	0.03*
RSI modified, m/s	0.38 +/- 0.09	0.40 +/- 0.10	0.08
Perceived readiness, 0-10	6.4 +/- 1.5	7.8 +/- 1.1	<0.001*

Table 2. Jump performance and perceived readiness by condition. Values are mean +/- SD. *$p < 0.05$.

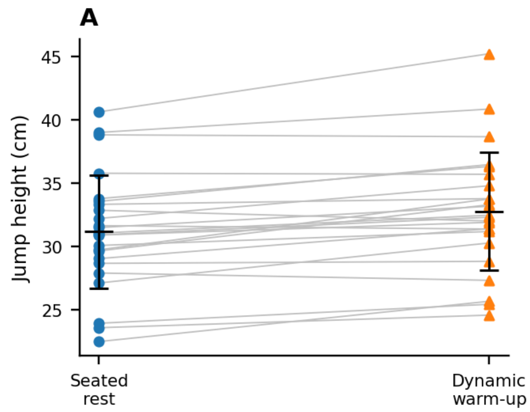

Figure 1. Fictional individual and group responses for countermovement jump height (A) and perceived readiness (B) after seated rest and dynamic warm-up conditions.

Discussion

The purpose of this fictional study was to examine whether a brief dynamic warm-up improved vertical jump performance and perceived readiness in recreationally active college students. The primary finding was that a 10-minute dynamic warm-up resulted in greater countermovement jump height and peak power compared with seated rest. Perceived readiness was also significantly greater following the dynamic warm-up. These findings support the hypothesis that a short, structured warm-up can improve acute explosive performance and subjective readiness (2,4).

The increase in jump height following the dynamic warm-up may be explained by several physiological and neuromuscular mechanisms. Dynamic movement may increase muscle temperature, improve nerve conduction velocity, enhance joint mobility, and increase coordination of the muscles involved in jumping (1,2,4). The inclusion of progressive jumping drills may have also provided a task-specific preparation effect by allowing participants to rehearse the movement pattern before maximal testing (2,6).

Peak power was also higher following the dynamic warm-up. This suggests that participants were able to generate force more rapidly or effectively after completing the warm-up. Because peak power is influenced by both force production and movement velocity, the warm-up may have improved participants ability to coordinate the countermovement and propulsive phases of the jump (5,7,10).

Perceived readiness showed the largest relative difference between conditions. This finding is practically important because athletes and recreational exercisers often use subjective readiness to guide effort and confidence during training (4). A dynamic warm-up may not only prepare the muscles and nervous system but may also help individuals feel more alert, focused, and prepared for maximal effort.

Reactive strength index modified was not significantly different between conditions, although the p-value suggested a possible trend. This may indicate that the warm-up improved overall jump height and peak power more than it improved the timing characteristics of the jump (9). It is also possible that recreationally active participants were not skilled enough in maximal jumping to consistently alter time to takeoff across conditions.

This fictional study has several limitations. First, the sample consisted only of recreationally active college students, so the results may not apply to trained athletes, older adults, or sedentary individuals. Second, only the acute effects of one 10-minute warm-up were examined. Different warm-up durations, intensities, or exercise selections may produce different outcomes. Third, the study did not include physiological measures such as muscle temperature, electromyography, or heart rate, which limits interpretation of the mechanisms responsible for the observed changes.

In conclusion, this made-up example demonstrates how a short dynamic warm-up could be associated with improved countermovement jump height, peak power, and perceived readiness in recreationally active college students (1-4). These findings suggest that a simple, structured warm-up may be a practical strategy for improving acute lower-body power performance before exercise or sport activity.

References

1. Bishop D. Warm up I: Potential mechanisms and the effects of passive warm up on exercise performance. Sports Medicine. 2003;33(6):439-454.
2. Bishop D. Warm up II: Performance changes following active warm up and how to structure the warm up. Sports Medicine. 2003;33(7):483-498.
3. Behm DG, Chaouachi A. A review of the acute effects of static and dynamic stretching on performance. European Journal of Applied Physiology. 2011;111(11):2633-2651.
4. McGowan CJ, Pyne DB, Thompson KG, Rattray B. Warm-up strategies for sport and exercise: Mechanisms and applications. Sports Medicine. 2015;45(11):1523-1546.
5. Cormie P, McGuigan MR, Newton RU. Developing maximal neuromuscular power: Part 1-biological basis of maximal power production. Sports Medicine. 2011;41(1):17-38.
6. Markovic G, Mikulic P. Neuro-musculoskeletal and performance adaptations to lower-extremity plyometric training. Sports Medicine. 2010;40(10):859-895.
7. Suchomel TJ, Nimphius S, Stone MH. The importance of muscular strength in athletic performance. Sports Medicine. 2016;46(10):1419-1449.
8. Buckthorpe M, Morris J, Folland JP. Validity of vertical jump measurement devices. Journal of Sports Sciences. 2012;30(1):63-69.
9. Kipp K, Kiely MT, Geiser CF. Reactive strength index modified is a valid measure of explosiveness in collegiate female volleyball players. Journal of Strength and Conditioning Research. 2016;30(5):1341-1347.
10. McMahon JJ, Suchomel TJ, Lake JP, Comfort P. Understanding the key phases of the countermovement jump force-time curve. Strength and Conditioning Journal. 2018;40(1):96-106.
11. Riebe D, Ehrman JK, Liguori G, Magal M, editors. ACSM's Guidelines for Exercise Testing and Prescription. 10th ed. Philadelphia: Wolters Kluwer; 2018.