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Original Research Article

# The Acute Effects of Dynamic vs Static Stretching on Vertical Jump in Female Athletes

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### **Abstract**

**Introduction:** This study aimed to determine which type of stretching technique used during a warm-up was appropriate before power exercise in female athletes. The effects of static stretching and dynamic stretching were compared using explosive force production during a vertical jump exercise.

**Methods:** Participants (N = 40) were all DIII female athletes between the ages of 18-22 years of age. Participants completed three separate experimental sessions with a full 48 hours in between each session. The first session participants were asked to self-pace jog 400m before completing three consecutive vertical jumps with a counter movement. The best of the three jumps were recorded. The second session the participants were asked to self-pace jog the same 400m distance, but perform a static stretching routine focusing on necessary muscles to perform the vertical jump. After static stretching, participants performed three consecutive vertical jumps with the best jump recorded. The third and final session, participants jogged a self-paced 400m distance and performed a dynamic stretching routine that focused on muscles important to vertical jump. After dynamic stretching, participants performed three consecutive vertical jumps with the best jump recorded. **Results:** Mean vertical jump performance following control, static, and dynamic conditions were  $18.6 \pm 2.1$  in,  $18.6 \pm 2.1$  in, and  $19.5 \pm 2.0$  in, respectively. Vertical jump was significantly greater ( $p < 0.05$ ) following a dynamic warmup when compared to static stretching or control conditions. **Conclusions:** Our findings support use of a dynamic warmup to improve vertical jump performance in an athletic population.

**Key Words:** Exercise, Physiology, Warmup

## Introduction

The explosiveness needed for athletes to perform at their optimal capabilities is set-up in their daily workouts and warm-up styles. Each warm-up routine is tailored to a specific team and sport. There are two types of warm-ups that coaches have their athletes do; these warm-ups include static stretching and dynamic stretching. Between the two warm-ups, static stretching is shown to have detrimental effects on competition<sup>1</sup>. Static stretching has been demonstrated to reduce isometric peak performance, vertical jump, muscular endurance, and lastly sprint speed<sup>1-2</sup>. While static stretching might seem detrimental, it is a vital part of athletic performance and is crucial in developing flexibility, which is an important physical feature that most athletes strive for. Static stretching helps athletes obtain their flexibility goals to have their peak performance in their particular sport.

Dynamic stretching is defined as active movements of muscle that bring forth a stretch but are not held in the end position<sup>3</sup>. Dynamic stretching varies from static stretching due to the difference in holding stretches and in actively moving to stretch the muscles. Dynamic stretching has been reported to either facilitate power and jump performance or have no adverse effect<sup>4</sup>. Dynamic stretching is preferred over static stretching because it gives muscular development and activity a greater result while jumping<sup>4</sup>. The purpose

of this study to determine which type of stretching technique used during a warm-up was appropriate before power exercise in female athletes.

## Methods

### Participants

The study consisted of 40 highly trained female collegiate athletes who exercised at moderate-to-vigorous intensity for 60-to-120 minutes, 5 times a week with a competitive match occurring at least 2 times each week. Each female participant was either a part of the women's tennis team, women's volleyball team, or the women's soccer team. Each participant were informed in detail of the experimental procedures and the possible risks and benefits of this study. The participants were asked if they have or had any musculoskeletal injury that could hinder with the results of this study as well as have or are continually taking any sort of performance enhancing substance that could also have an effect on the results of this study. Written and informed consent were collected as well as health history and a short questionnaire. Participants were also be informed that they could withdraw from the study at any time without penalty.

### Experimental Design

The participants performed three experimental test sessions at the same time of day, with 48 hours of rest in between each testing session. For the first testing session, the participants performed a 400m

self-paced jog. The participants then performed three consecutive vertical jumps. The best jump was recorded for further analysis. The second testing session consisted of a 400 m self-paced jog. The participant performed five static stretches, each held for 30-45 seconds. Each stretch was demonstrated for proper technique to reduce errors in analysis. Each stretch was performed one time. Muscles that were targeted included hamstrings, glutes, adductors, quadriceps, and calf muscles. The participant then performed three consecutive vertical jumps. The best jump was recorded for further analysis. The third testing session consisted of a 400 m self-paced jog. The participant was given dynamic stretches that target the hamstrings, glutes, adductors, quadriceps, and calf muscles. Each stretch was demonstrated for proper technique to reduce errors in analysis. Following the dynamic stretches, the participant performed three consecutive vertical jumps. The best jump was recorded for further analysis. For this study, an indoor

track, a stopwatch, and a Vertex testing device will be used.

### Statistical analyses

All analyses were performed using SPSS Version 22.0 (Chicago, IL). Measures of centrality and spread are presented as mean  $\pm$  SD. Paired t-tests were performed to compare vertical jump performance between control and static stretching, control and dynamic stretching, and static and dynamic stretching. The probability of making a Type I error was set at  $p \leq .05$  for all statistical analyses.

### Results

The vertical jump performance outcomes for each of the three experimental conditions are presented in Table 1. There were no significant differences ( $p > 0.05$ ) in mean vertical jump performance between control and static conditions. In contrast, vertical jump performance following dynamic stretching was significantly ( $p < 0.05$ ) higher when compared to both the static stretching and the control conditions.

**Table 1.** Vertical jump performance under the three experimental conditions. (Values are mean  $\pm$  SD).

Variable	Control	Static	Dynamic
Vertical jump (in)	18.6 $\pm$ 2.1	18.6 $\pm$ 2.1*	19.5 $\pm$ 2.0*

\* Mean is significantly different from control and static conditions,  $p < 0.05$ .

### Discussion

The purpose of this study was to determine which type of stretching technique, static or dynamic, had the greatest effect on power exercise. Several studies recommend

dynamic stretching during warm-up for power activities. The current study supported the hypothesis that dynamic stretching is more beneficial for warm-up in increasing athlete performance. Ryan and colleagues (2013) observed the different

volumes of dynamic stretching on vertical jump performance and found an increase in vertical jump after dynamic stretching<sup>5</sup>. Likewise, Chourou and colleagues (2013) also found that dynamic stretching produced an increase in maximal performance in studying the effect static and dynamic stretching on the diurnal variations of jump performance<sup>6</sup>. Although the studies aren't identical, each came to a conclusion and recommendation that dynamic stretching should be used as a warm-up before power activities.

This study had a few limitations. Our study fell short of finding fifty participants to participate all three sessions. Another limitation was making sure each participant came in at the same time for each of the three days. Due to scheduling differences, it was difficult for some participants to be tested at the same time each session. We also faced the limitation that some participants may have worked out or had a longer day of classes one day compared to the other days. Strengths of this study were increasing the reliability and validity. To make this study more reliable, we had each participant performed three jumps each day. To increase the validity of this study, we controlled the amount of time spent on each stretch and that the rest time between stretches and jumps were consistent.

Coaches and athletes have a competitive drive to be the best. Sports that aim towards a more powerful and explosive type of exercise would benefit greatly in their performance by using a dynamic stretching exercise as a warm-up. The results of this study with current research can help aid to design the most beneficial warm-up for athletes.

### References

1. Baechle TR, Earle RW. (2008). *Essentials of Strength Training and Conditioning. Chapter 13: Warm-Up and Stretching, (300)*. Champaign, IL: Human Kinetics.
2. Brown L. (2007). *Strength Training. Chapter 8: Safety, Soreness, and Injury, (151)*. Champaign, IL: Human Kinetics.
3. *What is Dynamic Stretching? Why is Dynamic Stretching important?* - NorCal Strength & Conditioning. (2011, May 20). Retrieved December 13, 2015, from <http://www.norcalsc.com/what-is-dynamic-stretching-why-is-dynamic-stretching-important/>
4. Carvalho F, Carvalho M, Simao R, Gomes T, Costa P, Neto L, Carvalho R, Dantas E. (2012). Acute effects of a warm-up including active, passive, and dynamic stretching on vertical jump performance. *J Strength Cond Res*, 26, 2447-2452.
5. Ryan ED, Everett KL, Smith DB, Pollner C, Thompson BJ, Sobolewski EJ, Fiddler RE. (2014). Acute effects of different volumes of dynamic stretching on vertical jump performance, flexibility and muscular endurance. *Clin Physiol Funct Imaging*, 34, 485-492.
6. Chtourou H, Aloui A, Hammouda O, Chaouachi A, Chamari K, Souissi N. (2013). Effect of static and dynamic stretching on the diurnal variations of jump performance in soccer players. *PLoS ONE*, 8, 1-6. doi:10.1371/journal.pone.0070534