



The Effects of Stretching on Anaerobic Power

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Abstract

INTRODUCTION: Warming up prior to exercise or participating in athletic events has been considered essential in preventing injury. The most debatable question among athletes and the general population alike is what type of warm-up to do and which is either beneficial or detrimental to performance. Research has shown that performing a dynamic warm-up prior to exercise has improved performance in power compared to static stretching.

PURPOSE: The purpose of the study was to examine the effects of different types of stretching techniques on anaerobic power.

METHODS: Six college males (mean \pm SD: age, 23.33 \pm 1.11 years; height, 179.48 \pm 4.78 cm; weight, 83.80 \pm 7.24 kg) volunteered to participate in the study. Each subject signed an informed consent document and filled out demographic information prior to testing. The participants were tested for six visits with at least 24 hours of rest in between each. Each performed a Wingate Anaerobic Test (WAnT) during the first three visits and a vertical jump test (VJ) during the last three. A practice WAnT and VJ were assigned prior to applying stretching intervention for familiarization with each test. Half of the subjects were randomly assigned to perform a dynamic warm-up (Dy) prior to the second WAnT and VJ. The other half performed the static routine (St) on the final visit of each performance test. Each routine focused on the major muscle groups of the lower body including the quads, hamstrings, gluteal, and calf muscles. The static routine consisted of 7 stretches, held for 20 seconds for 2 times per leg while the dynamic routine consisted of 7 exercises routines performed for 1 lap of 40 feet. Data analysis was performed using Excel 2010. The alpha level for significance was set at $p \leq 0.05$.

RESULTS: The variables analyzed (mean \pm SD) for each routine (Dy & St) on the WAnT were as follows: Peak Power (Dy: 1274.83 \pm 130.64 W, St: 1180.83 \pm 166.47 W), Mean Power (Dy: 584.50 \pm 86.60 W, St: 574.83 \pm 97.38 W), Relative Peak Power (Dy: 15.22 \pm 0.93 W/kg, St: 14.10 \pm 1.57 W/kg), and Relative Mean Power (Dy: 6.94 \pm 0.54 W/kg, St: 6.83 \pm 0.77 W/kg). The variables analyzed (mean \pm SD) for each routine (Dy & St) on the VJ were as follows: Peak Power (Dy: 8546.71 \pm 524.88 W, St: 8254.10 \pm 511.47 W), Mean Power (Dy: 1804.32 \pm 224.89 W, St: 1704.10 \pm 213.29 W), Relative Peak Power (Dy: 102.54 \pm 8.70 W/kg, St: 99.09 \pm 9.16 W/kg), and Relative Mean Power (Dy: 21.53 \pm 1.98 W/kg, St: 20.35 \pm 2.04 W/kg). There was no significant difference between the stretching techniques in each variable ($p > 0.05$) on the WAnT. There was a significant difference in the variables between the stretching techniques on the VJ (PP: $p = 0.0003$, MP: $p = 0.0003$, rPP: $p = 0.00007$, rMP: $p = 0.00007$).

CONCLUSION: The results of this study indicated that performing a dynamic routine yields greater power output on a vertical jump than a static routine, but has no significant difference in a Wingate Anaerobic Test. A dynamic warm-up improves performance on exercise bouts of 1-3 seconds but not on maximal anaerobic tests of 30 seconds.

Purpose

The purpose of this study was to examine the effects of different types of stretching techniques on anaerobic power. The null hypothesis was that there would be no significant difference on anaerobic power between different types of stretching techniques as measured by a Wingate anaerobic power test (WAnT) and vertical jump test.

Introduction

Why Is Stretching Important?

As one starts to implement an exercise regimen into their daily lives, a common question sparks the interest in whether or not performing a stretching routine prior to exercise is important. Stretching has been demonstrated as an effective means to increase range of motion (ROM) about the joint and is commonly utilized by athletes to decrease muscle soreness, reduce or prevent the risk of injury resulting from tight musculature, and rehabilitation after injury. Although the debate between which type of stretching technique to be performed continues, past research suggests that initiating any kind of warm up prior to exercise is very important to reduce the risk of injury.

Different Types of Stretching Techniques

Although the general population is often trying to decide in either a static or dynamic routine, there are actually four commonly used stretching routines depending on the sport activity, training program, or personal preference: static stretching, dynamic stretching, ballistic stretching, proprioceptive neuromuscular facilitation stretching.

Anaerobic Power, Testing, and the Effects of Stretching

Anaerobic power is one of the main indicators in measuring performance in those who are either recreationally active or elite competitors. Maximal power is defined as the rate of performing work and is the product of strength and speed of movement. Speed is a characteristic that is changed little with training, thus the main factor that affects short-term maximal power output is short-term improvements in strength. Therefore, one must look into the type of warm-up to perform in order to achieve an improvement in performance on short term bouts of exercise. Applying a stretching technique prior to exercise may have an effect in power output on short term bouts of exercise amount of 1-3 seconds or even up to 30 seconds

Methods

Subjects

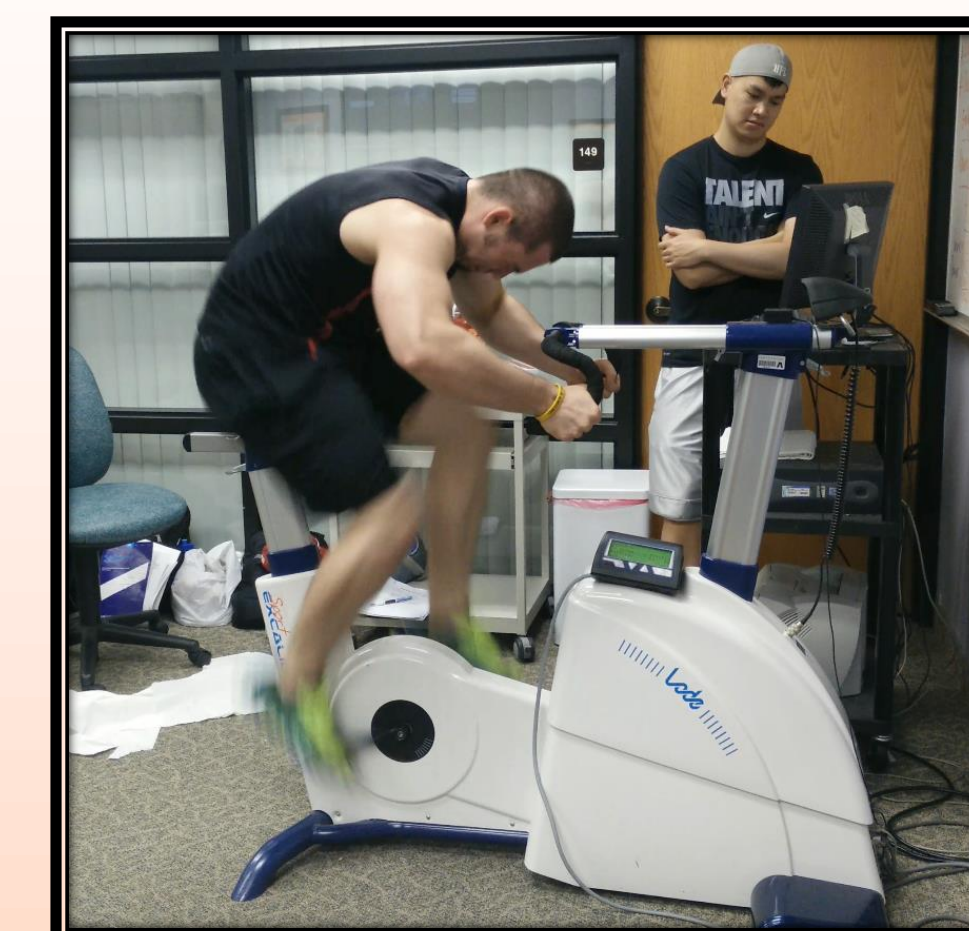
- Six male students from the Department of Kinesiology at UT Arlington
- Each signed a consent form and filled out demographic data
- A practice test was performed by each subject before applying stretching intervention. Half of the group was randomly selected to perform a (static, dynamic) routine prior to a Wingate anaerobic test and vertical jump test. The remaining stretching routine was done during the second visit of each test.

Stretching Intervention

- Static stretching
 - Included 7 stretches focusing on the quadriceps, hamstrings and calves. Each stretch was performed twice for twenty seconds on each leg.
 - Each was performed in the following order: standing quadriceps stretch, hamstring stretch on a bench, semi-side lunge, piriformis pigeon pose, standing gastroc stretch, standing soleus stretch, seated anterior tibialis stretch.
- Dynamic stretching
 - Included 7 specific routines that targeted the muscles of the lower body. Each routine was performed for 1 lap of 40 feet in a racquetball court.
 - The following routines were performed in the following order: high knees, butt kicks, piriformis dynamic stretch, “Frankensteins,” semi-side lunge, semi-forward lunge with twist, carioca.

Performance Testing

- The Wingate anaerobic test required pedaling for 30 seconds at maximal speed against a constant force or resistance and induced a noticeable development of fatigue within the first few seconds. The resistance was automatically removed at the end of 30 seconds.
- A vertical jump test was administered using a Vertec. The vertical distance was measured between the heights of the highest vane tapped during the standing vertical reach and the vane tapped at the highest point of the jump. After the recording was done, each subject repeated the jump two more times to get an average of the height differences. The best of three trials was recorded to the nearest 0.5 inches which was then converted to centimeters.



Statistics

- The independent variables include the types of stretching techniques (static and dynamic). The dependent variables include the measurement of peak, mean, relative peak, and relative mean power during each of the tests. The alpha level of significance was set to $p \leq 0.05$. Dependent *t*-tests were used to analyze any differences between the stretching techniques during a Wingate anaerobic test and a vertical jump test using Microsoft Excel 2010.

Results

Demographic Variables

Variable	Mean	\pm SD
Age (yrs)	23.33	\pm 1.11
Height (cm)	179.48	\pm 4.78
Weight (kg)	83.80	\pm 7.24

Performance Variables After Stretching Intervention In A Wingate Anaerobic Test

Variable	Dynamic	Static
Peak Power (W)	1274.83 \pm 130.64	1180.83 \pm 166.47
Mean Power (W)	584.5 \pm 86.60	574.83 \pm 97.38
Relative Peak Power (W/kg)	15.22 \pm 0.93	14.10 \pm 1.57
Relative Mean Power (W/kg)	6.94 \pm 0.54	6.83 \pm 0.77

Performance Variables After Stretching Intervention In A Vertical Jump

Variable	Dynamic	Static
Peak Power (W)	8546.71 \pm 524.88	8254.10 \pm 511.47
Mean Power (W)	1804.32 \pm 224.89	1704.10 \pm 213.29
Relative Peak Power (W/kg)	102.54 \pm 8.70	99.09 \pm 9.16
Relative Mean Power (W/kg)	21.53 \pm 1.98	20.35 \pm 2.04

Statistical Analysis

- There were no significant differences between static and dynamic stretching in performance of a Wingate Test ($p > 0.05$).
- Listed below are the significant differences between static and dynamic stretching on a vertical jump test:
 - Peak Power: $p = 0.0003$
 - Mean Power: $p = 0.0003$
 - Relative Peak Power: $p = 0.00007$
 - Relative Mean Power: $p = 0.00007$

Conclusions

- The findings of the analysis revealed no significant difference between the stretching techniques during a Wingate anaerobic test ($p > 0.05$). A separate analysis between the variables on a vertical jump test presented significant *p*-values for all variables ($p < 0.01$).
- Performing a dynamic warm up may elicit different physiological effects that improves performance on short bouts of exercise. These physiological principles may have a larger effect on bouts of exercise that last 1-3 seconds such as a vertical jump or shot-put. The effects of decreased viscosity after a static warm up, for example, may diminish during the 30 second maximal power test due to the fact that an increase in body temperature would occur during the prolonged bout of exercise.
- The null hypothesis was rejected due the results showing a significant difference between stretching techniques on a vertical jump test even though there was no significant difference between a dynamic and static warm up during a Wingate.
- Performing a dynamic warm-up rather than a static routine significantly increases performance on short-term exercise bouts of 1-3 seconds, but has a lesser effect on exercise bouts ranging upwards to 30 seconds.