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The Effects of Resistance-Based Warm-ups on Linear Speed and Power Output

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Abstract

PURPOSE: The aim of this study was to examine the speed (yard/sec) and power (Inertial Power Units) of an athlete via the modalities of a 20-yard dash (yards/sec), a broad jump (m), and a portable conical pulley (CP) (*VersaPulley*, *Santa Ana, CA*; Inertia 0.27 kg· m^2) device. Subjects were tested after completing resistance versus non-resistance based warm-ups. Research of overall effectiveness of warm-ups in direct correlation to athletic performance has been field-tested in a variety of different forms. This study was designed to create a baseline for each athlete and then take the same warm-up and by applying resistance, determine the improvement on straight line speed and power output via a broad jump and the Versa Pulley machine. **METHODS**: Fourteen subjects performed two assessments separated by 1 week. The experiment consisted of a two-week testing period. Upon arrival, anthropometric measurements of the subjects were taken. During the first week, both groups went through the same warm-up with no resistance. Warm-up consisted of predetermined dynamic movements completed in 20-yard increments. Speed and power output were assessed by three different means: the 20-yard dash (yards/sec), broad jump (m), and the portable CP. Subjects were given 30 seconds rest in between trials and 1 min between tests. This provided an individualized baseline for the second day of testing. For week 2, group 1 (n=9) completed the same warm-ups but used a weighted vest as a form of resistance (w=20lbs). The subjects then proceeded to complete the speed and power assessments. Group 2 (n=5) went through the same protocol as the week prior (no resistance). **RESULTS**: Statistical analysis of the data was carried out using SPSS v. 25. A 3-way ANOVA was taken comparing the resistance-based warm-up vs. the control for all three modalities. Power output from the portable CP was the only modality that showed statistical significance (p=0.034). There was no significance in reduced sprint times (p=0.955) and resistance-based warm-ups (20 lbs); nor was there significance between the altered warm-ups and the broad jump (p=0.496). **CONCLUSION**: The results indicate that in a power-based movement, like a portable CP, may benefit the athlete to participate in resistance based dynamic warm-ups to the similar movement pattern of their specific sport or activity.

Methods

A total of 14 college athletes participated in this study (x age=20.1 years, SD±1.8 years, x ht=183.06cm, SD±6.86cm, x wt=85.89, SD±9.65kg). Subjects were required to attend 2 sessions. The first being an introduction to the warm-up protocol we had created, the 20-yard dash, the broad jump, and the portable conical pulley (VersaPulley). At this session, the subjects were read through an informed consent form. Upon consent, the subjects anthropometric measurements were taken as well as their resting heart rate (radial pulse for 15 sec). The subjects then were then asked to perform the warm-up protocol, without any resistance, that we verbally instructed them how to perform. Demonstrations were done if subjects had questions on any part of the warm-up. Immediately completing the warm-up protocol, the subjects heart rates were taken and recorded. Then, the subjects were allotted a 60 sec rest while transitioning to the first of three tests. First, subjects were asked to perform two sets of their maximum effort on the portable conical pulley (VersaPulley). Per subject, 30 secs rest was given between sets. Data from the CP of both trials were then recorded, and subjects were then given an additional 60 secs rest to get set for the next test. Two sets of max effort for both broad jump and 20-yard dash, with a 30 sec rest in between sets. Broad jump was measured using a standard tape measure and then converted to meters (m). 20-yard dash was measured using a handheld stopwatch (yard/sec). In order to ensure consistency, the 20-yard dash times were recorded by the same researcher. Immediately, upon completion of the final test, the subjects heart rate was taken and recorded. The subjects were then separated into 2 groups for the second, and final, session (experimental n=9, control n=5). For week 2, group 1 (n=9) completed the same warm-ups, but used a weighted vest as a form of resistance (w=20lbs). Next, the subjects were asked to remove the form of resistance and proceed to complete the same tests as week 1. Group 2 (n=5) followed the same protocol as week 1 without an form of resistance. Once all collection was completed, data was entered into statistical programs to assess for significance.

Introduction

The overall effectiveness of warm-ups, in direct correlation to athletic performance, has been field-tested in a variety of different forms. Variances in timing, modality, amount, and extensiveness, of preparing one's body for competition, is an unquestioned prerequisite. But how much of one's output is affected by the aforementioned factors is up for research discusssion.

It is an established belief in the Exercise Science field, that the more sport specific, or applicable, the warm-up is to the performance-based movement, the higher the rate of success will be. But what additional resistance was added to that warm-up? Would the mental exposure to additional stimuli force the body to generate more power, at the appropriate time for competition?

In recent years, the portable conical pulley (CP) (VersaPulley, Santa Ana, CA, Inertia 0.27kg.m2) product has been introduced to the athletic training field; but its current research status is minimal. The purpose of this study was to investigate the effects of resistance-based, dynamic warm-ups on sprint speed and power output using the CP VersaPulley along with two additional methods-the broad jump and the 20-yard dash. This study will utilize the VersaPulley's ability to examine power output, compare resistance vs. non-resistance-based warm-ups, and lay a foundation for future CP research.

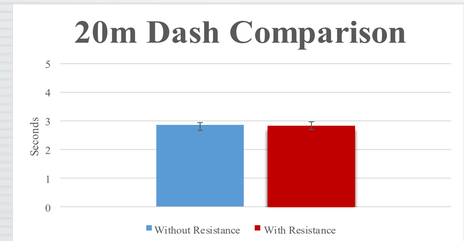

Figure 1: Bar graph comparing the control vs. experimental 20m dash results

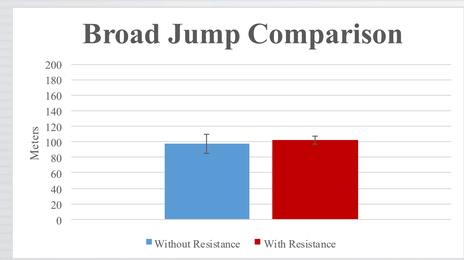

Figure 2: Bar Graph comparing the control vs. experimental broad jump results

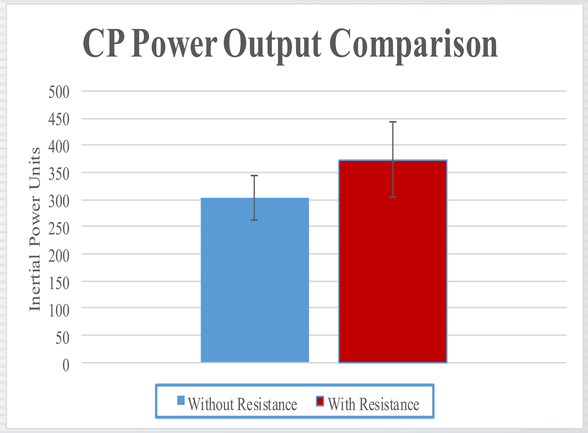

Figure 3: Bar graph comparing the control vs. experimental CP power output results

Results

Statistical analysis of the data was carried out using SPSS v. 25. A 3-way ANOVA, comparing the resistance-based warm-up vs. the control for all three modalities, showed significance solely in power output (x WOR=303.56, SD±40.39, x WR=373.2, SD±69.82, p=0.034). However statistical analysis shows, there was no significance in reduced sprint times (20-yard dash) (x WOR=2.85s, SD±0.104, x WR=2.84, SD±0.19, p=0.955) and resistance-based warm-ups (20 lbs); nor was there significance between the altered warm-ups and the broad jump (x WOR=97.33m, SD±12.2, x WR=101.97, SD±11.64m, p=0.496).

Figure 4: Subject using the portable conical pulley (CP) device.

Conclusion

The results indicate a power-based movement, like the VersaPulley (Versaclimber.com, Santa Ana), may benefit the athlete to participate in his/her dynamic warm-ups with applied resistance to a/the similar movement pattern(s). The same cannot be statistically concluded from our study for the 20 yard dash (yards/sec) or the broad jump (yards). Some limiting factors internally could include the use of two separate Versapulley units which included variance in rope length and altered times in recovery in the waiting time frame; as well as the learning curve that came with using the VersaPulley, for the first time. Additionally, there was no way to control additional external factors that college students enjoy-namely intramurals, sleep cycles and study habits-all taxing the overarching neuromuscular system. Future research could collaborate with the University's Strength and Conditioning Coach to include only a specific type of athlete/sport.

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