The Effects of Different Warm-up Strategies in Olympic Weightlifting

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Abstract

This study investigated the effects of two types of warm up routines utilizing the clean pull movement on maximal ground reaction force and barbell velocity during the second pull phase of the full clean movement. Five male and female national caliber weightlifters randomly completed a control condition (C) or one of two treatment conditions (T1, T2) in a crossover design. The control condition served to establish baseline data against which the kinematic and kinetic parameters of the two treatment conditions were compared. A repeated measures ANOVA was used to compare means between conditions. No significant differences were found between C, T1 and T2. These findings suggest that both warm up routines are equally effective at preparing the lifter for the subsequent attempt. However, the lower volume of work performed in T1 may result in less accumulated fatigue over the course of a weightlifting meet and could theoretically contribute to better performance toward the end of the competition.

Introduction

This is a pilot study that evolved from USA weightlifting coaches over the past years. In this investigation the research conducted is of an original origin and will need to be explored into greater depths within the scientific community to fully understand the phenomenon that exists in warming for weightlifting. Due to the nature of this investigation there are no previous studies to base this study off of. Most of our references come from USA Weightlifting coaches in the field and from Dr. Mike Stone USOC (United States Olympic Committee) sports science program director.

Purpose

The purpose of this study was to investigate the effectiveness of two types of clean pull routines of different work volume, commonly used during competition, and in practice. During the Clean and Jerk portion of an Olympic weightlifting competition, athletes keep warmed-up and prepare themselves for their next lifting attempt by performing clean pulls (Figure 1). A clean pull is defined as the beginning stage of the movement from where the barbell breaks from the floor to the completion of the triple extension phase of the clean.
Weightlifting Competition Procedures

Once competition begins, the barbell is loaded to the lowest weight requested by an athlete. Each athlete is allowed only three attempts during the competition and they make those attempts when the barbell reaches the weight the athlete requested, either at the start of the competition or in between each successive attempt. The barbell is never reduced in weight and after an athlete makes a successful lift he/she tells the officials of his/her next attempt weight. The athlete then goes ‘back into the rotation’ and waits until the next weight they requested is loaded onto the barbell. There are times when the athlete goes so far back into the rotation that they are in need of additional warm-ups in order to stay prepared for their next attempt. Under normal conditions weightlifters need a ‘warm-up’ attempt for every 3 attempts that is conducted out on the competition platform this is a strategy known as counting. However, once the competition has begun and an athlete has made their first attempt staying ‘warm’ is different than getting ‘warmed-up’. What to do as an intermediate warm-up has always been an area of debate, and many successful methods have been developed. The idea behind this study was to compare two of those methods to see which one may be of more, practical, benefit during an actual competition.

Methods

Five male and female national caliber weightlifters were served as subjects. After a standardized warm-up consisting of 3 repetitions at 30, 50, 65, and 75% of 1-RM (the maximum weight that can be lifted one time) of full clean, subjects randomly completed a control conditions (C; two sets of one repetition at 85% of 1-RM of full clean) or one of two different treatment conditions (T1, T2) in a crossover design. In T1, subjects completed one clean pull at 100% of his/her full clean 1-RM 4 minutes prior to executing a full clean at 85% 1RM. In T2, subjects completed three clean pulls (each separated by 20 seconds) at 85% of the full clean 1-RM 4 minutes prior to executing a full clean at 85% 1RM. The control condition served to establish baseline data (average of 85% clean) against which the kinematic and kinetic parameters of the two treatment conditions were compared in order to establish their effectiveness. Kinematic data for the barbell velocity was sampled at 250 Hz using a six-camera infrared motion capture system (figure 2). Kinetic data for ground reaction forces (GRF) were collected at 1250 Hz using Kistler force plates (figure 3). A repeated measures ANOVA was used to compare means between conditions.

Results
The total load lifted (volume) in T2 was 2.54 times as high (**p = .0001) as in T1 (Figure 4). There were no significant differences between kinetic (Figure 5) and kinematic (Figure 6) parameters across any of the conditions. See (Table 1).

![Figure 4: Volume Load](image1)

![Figure 5: Maximum GRF](image2)

![Figure 6: Maximum Bar Velocity](image3)

| Table 1 |
|------------------|------------------|------------------|
|                  | Maximum Bar Velocity (m/s) | Maximum GRF (N) | Volume (kg) |
| Condition        | C                 | T1              | T2            | C              | T1              | T2            | T1              | T2              |
| Mean±SD          | 1.78±.14          | 1.80±.12        | 1.78±.13      | 2965±426       | 3039±459        | 3019±445      | 91.3±22.2      | 232.7±56.7**    |
Conclusion

The lack of statistical differences between the two treatment conditions indicates that both are sufficient to keep an athlete warmed-up and prepared for their next lifting attempt. Performing one clean pull at 100% has a reduced volume compared to 3 pulls at 85% and would, theoretically perform better towards the end of the competition. For a weightlifter in competition, warming-up with higher intensity lower volume partial movement may provide advantages over a lower intensity, higher volume warm-up over the course of a competition.

Practical Application

The practical application of this study leads to the suggestion that when an athlete approaches their opening attempt their last warm-up should be a ‘pull’ at 100% of the opening attempt. If, after the opening attempt, the athlete goes back into the rotation, more than 3 platform attempts out from their next lift the athlete would benefit from doing a ‘pull’ at 100% of the next attempt at that time.

Sydney 2000 – Tara Knott Olympic Champion

References

2. USA Weightlifting Regional Coaches Course. 33-76, 1993.
4. USA Weightlifting Senior Coaches Course, 1993, 7-94.