The Impact of a Countermovement and Load on the Force-time Characteristics of the Hexagonal Barbell Jump in Resistance-Trained Men

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INTRODUCTION

The hexagonal barbell jump (HEXJ) is a commonly prescribed exercise used to train the rapid force production characteristics of athletes (4). In fact, researchers have shown that the HEXJ may produce greater power outputs compared to the jump squat and jump shrug exercises, especially at heavier loads (2, 3). The HEXJ can be performed with a countermovement (HEXJ-CM) to realize the benefits of the stretch-shortening cycle (SSC) but is also commonly performed from a static starting position (HEXJ-S). While the HEXJ-S eliminates the storage of elastic energy during the SSC (1), this variation may allow athletes to apply force over a longer duration to generate a greater impulse. There is no currently no research that has compared the force-time characteristics between the HEXJ-S and HEXJ-CM. Therefore, the purpose of this study was to compare the force-time characteristics of the HEXJ-S and HEXJ-CM. It was hypothesized that the HEXJ-S would result in lower net forces, but greater phase durations and net impulses compared to the HEXJ-CM.

METHODS

- 20 resistance-trained men (age = 23.5 ± 3.0 years, height = 175.1 ± 8.7 cm, body mass [BM] = 79.6 ± 11.8 kg, relative one repetition maximum back squat = 1.90 ± 0.28 kg/kg) participated in two separate testing sessions.
- Subjects completed maximal strength testing and were familiarized with the HEXJ-S and HEXJ-CM during the first session.
- During the second session, subjects performed unloaded HEXJ-S and HEXJ-CM repetitions and loaded repetitions with loads equal to 20, 40, 60, 80, and 100% of their BM.
- Force-time data were used to determine propulsion net relative mean force (NetRelMF), duration (Dur), and net impulse (NetIMP). The average performance was used for statistical comparison.
- A series of 2 (Type) x 6 (Load) repeated measures ANOVA were used to examine the differences between jump types and loads. Hedge's g effect sizes were calculated to examine the magnitude of the differences.

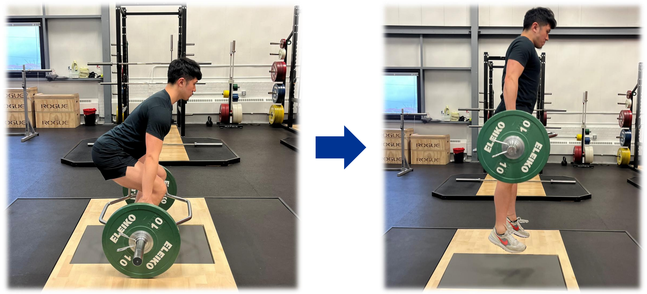

Figure 1. HEXJ-S movement sequence.

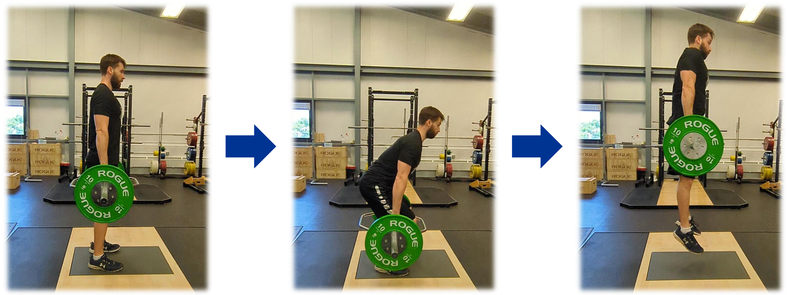

Figure 2. HEXJ-CM movement sequence.

RESULTS

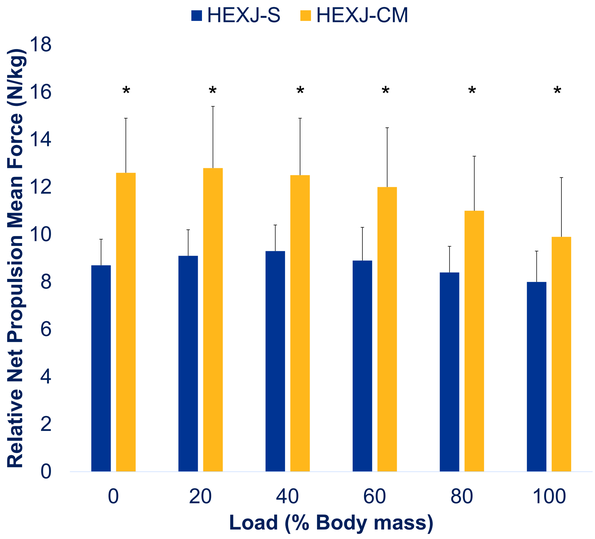

Figure 3. Relative net propulsion mean force differences between HEXJ-S and HEXJ-CM across percentage of body mass loads. * = significantly greater than HEXJ-S ($p < 0.001$; g = 0.94-2.13).

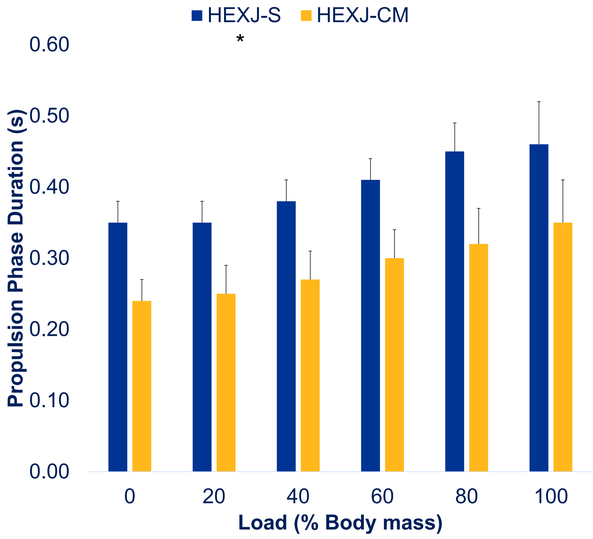

Figure 4. Propulsion phase duration differences between HEXJ-S and HEXJ-CM across percentage of body mass loads. * = significant type main effect showing longer durations during HEXJ-S (g = 1.80-3.59).

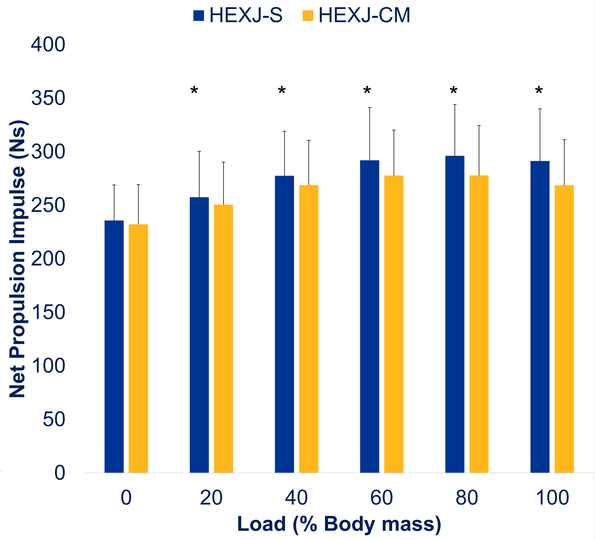

Figure 5. Net propulsion impulse differences between HEXJ-S and HEXJ-CM across percentage of body mass loads. * = significantly greater than HEXJ-CM ($p < 0.05$; g = 0.10-0.49).

CONCLUSIONS

- Propulsion NetRelMF, Dur, and NetIMP were significantly impacted by the jump type and external load.
- Greater NetRelMF magnitudes and shorter Dur times were produced during the HEXJ-CM.
- Significantly greater NetIMP magnitudes were produced during the HEXJ-S.

PRACTICAL APPLICATIONS

- HEXJ-CM may provide a superior training stimulus for propulsive rapid force production compared to the HEXJ-S due to greater forces being produced over shorter durations.
- HEXJ-S may produce greater propulsion NetIMP; however, the impulses may be characterized by lower NetRelMF produced over longer durations.
- Practitioners should note that using percentages of BM has its shortcomings and that individuals may respond differently to the prescribed loads.

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