THE FORCE-TIME CHARACTERISTICS OF ACCENTUATED ECCENTRIC LOADED COUNTERMOVEMENT JUMPS DURING DIFFERENT LOADING CONDITIONS

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Introduction

Accentuated eccentric loading (AEL) is a training tactic in which the eccentric load is greater than the concentric load during a movement that requires both eccentric and concentric actions to be performed (2,3). An example would be an AEL countermovement jump (CMJ) where the individual performs a countermovement with dumbbells, drops the dumbbells at the lowest point of the countermovement, and then jumps as high as possible without the weight. Although researchers have shown that jump height and power output can be improved after training with AEL CMJs (1), there is limited research that has examined different loading percentages on their force production characteristics. The purpose of this study was to examine the braking and propulsion force-time characteristics of AEL CMJ performed with different percentages of body weight (BW) and percentages of a one repetition maximum (1RM) back squat. It was hypothesized that heavier loads will lead to greater braking forces produced over longer durations.

Methods

- 11 resistance-trained men (body mass = 78.9 ± 10.5 kg, height = 174.6 ± 7.7 cm, relative 1RM back squat strength = 1.96 ± 0.35 kg/kg) and 8 resistance-trained women (body mass = 69.7 ± 8.6 kg, height = 166.3 ± 6.7 cm, relative 1RM back squat strength = 1.39 ± 0.26 kg/kg) participated in 3 separate training sessions.
  - Session 1: subjects performed a 1RM back squat and AEL jump familiarization
  - Sessions 2 and 3: subjects performed 3 sets of AEL jumps with dumbbell weight equating to either 10%, 20%, and 30% BW or their 1RM back squat.
- All AEL CMJ were performed on a force platform and the force-time data were used to calculate mean braking force (MBF), braking duration (BDur), mean propulsive force (MPF), and propulsive duration (PDur).
- A series of 2 (condition) x 3 (load) repeated measures ANOVA were used to compare each variable between conditions.
- Hedge's g effect sizes were used to examine the magnitude of the differences.

Results

Table 1. Accentuated eccentric countermovement jump (CMJ) force-time characteristics using different loading methods (mean ± SD).

Load	CMJ MBF (N/kg)	CMJ BDur (s)	CMJ MPF (N/kg)	CMJ PDur (s)
	% Body Weight			
10%	19.7 ± 2.2	0.18 ± 0.04	20.4 ± 2.4	0.25 ± 0.05#
20%[b]	21.0 ± 2.1	0.20 ± 0.04	19.9 ± 2.1#	0.23 ± 0.05#
30%[b]	21.7 ± 2.1	0.22 ± 0.04	19.4 ± 2.1#	0.20 ± 0.05#
Load	**% 1RM Back Squat[a]**			
10%	21.0 ± 1.9	0.19 ± 0.03	20.6 ± 2.2	0.24 ± 0.06
20%[b]	21.9 ± 2.0	0.23 ± 0.04*	19.2 ± 2.2	0.18 ± 0.06
30%[b]	22.0 ± 2.5	0.28 ± 0.08*	17.9 ± 2.9	0.15 ± 0.06
Hedge's g	0.14-0.61	0.11-0.88	0.07-0.57	0.23-0.84

MBF = mean braking force, MPF = mean propulsive force, BDur = braking duration, PDur = propulsive duration, g = Hedge's g effect size across all loads; * = significantly greater than corresponding % body weight load (p<0.001); # = significantly greater than corresponding % 1RM back squat load (p<0.05); a = significantly greater MBF compared to % body weight condition (p=0.007); b = significantly greater MBF compared to 10% conditions (p<0.001)

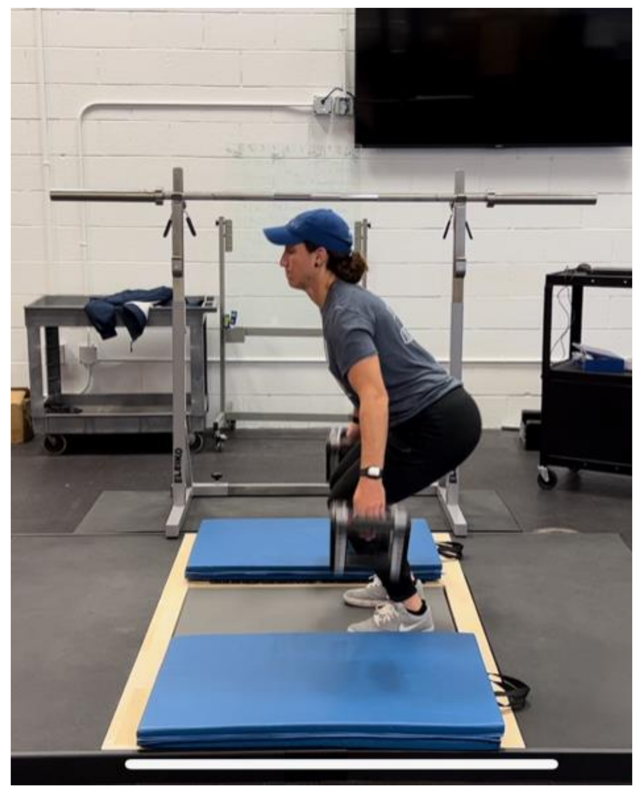

Figure 1. Bottom position of descent of AEL jump.

Figure 2. Propulsion and flight of initial AEL jump.

Conclusions

- Larger mean braking forces and braking duration were produced during the % 1RM loading condition compared to the % BW.
- Mean propulsive force and propulsive duration magnitudes were greater during the % BW condition compared to % 1RM.
- Heavier loads increased mean braking forces and braking duration but decreased mean propulsive forces and propulsive duration.

Practical Applications

- AEL CMJ may provide a novel training stimulus compared to traditional CMJ for braking and propulsive force production.
- Using heavier loads during an AEL CMJ may provide greater braking force characteristics.
- Lighter loads may promote greater propulsive characteristics.

References

1) Sheppard JM, Hobson S, Barker M, Taylor K, Chapman D, McGuigan M, Newton RU. The effect of training with accentuated eccentric load counter-movement jumps on strength and power characteristics of high-performance volleyball players. *Int J Sports Sci Coach* 3: 355-363, 2008.

2) Suchomel TJ, Wagle JP, Douglas J, Taber CB, Harden M, Haff GG, Stone MH. Implementing eccentric resistance training—part 1: A brief review of existing methods. *J Funct Morphol Kinesiol 4*, 38, 2019.

3) Wagle JP, Taber CB, Cunanan AJ, Bingham GE, Carroll KM, DeWeese BH, Sato K, Stone MH. Accentuated eccentric loading for training and performance: A review. *Sports Med* 47: 2473-2495, 2017.

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