SEX DIFFERENCES IN FORCE-TIME CHARACTERISTICS DURING ACCENTUTED ECCENTRIC DUMBBELL JUMPS USING BACK SQUAT PERCENTAGES

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Introduction

Accentuated eccentric loading (AEL) is a training mechanism that overloads the eccentric action during exercises involving the complete stretch-shortening cycle: both eccentric and concentric movements (2). Specifically, AEL countermovement jumps (CMJ) have been found to improve propulsive and braking characteristics as well as drop jump (DJ) and single leg jump (SLJ) performance among resistance-trained males (1). There is currently limited research regarding AEL jumps between sexes and prescribed loading methods and analyzing its effect on strength and power characteristics. Because of this, the purpose of this study was to examine the differences in force-time characteristics between males and females across multiple sets of AEL CMJ performed with 10, 20, and 30% of their respective one-repetition maximum (1RM) back squats.

Methods

- Nineteen resistance-trained subjects including 11 men (age: 25.4 ± 4.9 years, body mass: 79.0 ± 10.5 kg, height: 174.6 ± 7.7 cm, relative 1RM back squat: 1.97 ± 0.35 kg·kg^{-1}) and 8 women (age: 22.3 ± 2.2 years, body mass: 69.7 ± 8.6 kg, height: 166.3 ± 6.6, relative 1RM back squat: 1.39 ± 0.27 kg·kg^{-1}) participated in two testing sessions.
  - Session one: 1RM back squat followed by familiarization of AEL CMJ.
  - Session two: subjects performed three sets of an AEL CMJ with dumbbells equating to 10, 20, and 30% of their 1RM back squat.
- Jumps were performed on a force platform and the force-time data were used to calculate AEL CMJ braking mean force (BMF) and duration (BDur) and propulsion mean force (PMF) and duration (PDur).
- A three (load) x two (sex) repeated measures ANOVA test was used to compare the AEL performances between sexes across each loading condition. Hedge's g effect sizes were calculated to examine the magnitude of the differences between the various conditions.

Results

Table 1. Accentuated eccentric loaded countermovement jump braking and propulsion force-time characteristics of men and women.

Load (% 1RM)	CMJ BMF (N·kg^{-1})		CMJ BDur (s)		CMJ PMF (N·kg^{-1})		CMJ PDur (s)	
	Men	Women	Men	Women	Men	Women	Men	Women
10%[cd]	21.6 ± 1.6	20.2 ± 2.0	0.19 ± 0.03	0.18 ± 0.04	21.5 ± 1.9	19.3 ± 2.0	0.23 ± 0.06	0.25 ± 0.05
g	0.71		0.38		1.10		0.32	
20%[ab]	22.5 ± 1.8	21.1 ± 2.0	0.25 ± 0.03	0.21 ± 0.04	19.6 ± 2.5	18.6 ± 1.7	0.17 ± 0.07	0.19 ± 0.04
g	0.73		1.13		0.41		0.23	
30%[b]	22.4 ± 2.6	21.5 ± 2.4	0.28 ± 0.09	0.28 ± 0.08	18.2 ± 3.3	17.6 ± 2.4	0.18 ± 0.07	0.12 ± 0.03
g	0.38		0.02		0.20		0.81	

BMF = braking mean force; BDur = braking duration; PMF = propulsive mean force; PDur = propulsive duration; % 1RM = percentage of one repetition maximum back squat distributed between dumbbells in each hand; a = significantly greater BMF compared to 10% ($p = 0.009$); b = significantly greater BDur compared to 10% ($p < 0.001$); c = significantly greater PMF compared to 20 and 30% ($p < 0.01$); d = significantly greater PDur compared to 20 and 30% ($p < 0.001$)

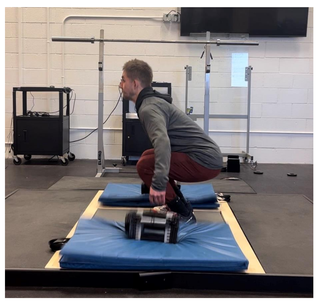

Figure 1. Bottom position of descent of AEL jump

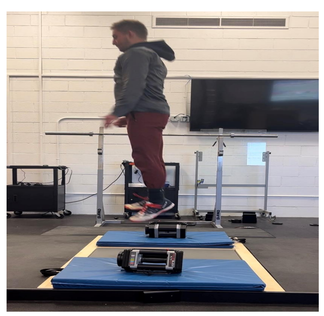

Figure 2. Propulsion and flight of AEL jump.

Conclusions

- Resistance-trained men generally produced larger BMF and PMF magnitudes over similar durations compared to women.
- The differences between sexes varied based on the loads that were examined.
- There were no practically meaningful differences across sets for any variable as indicated by the effect sizes.

Practical Applications

- Both resistance-trained men and women can receive a unique training stimulus during AEL CMJ compared to traditional CMJ due to the additional load used during the braking phase of the movement.
- Practitioners working with these populations should consider the load prescribed during AEL CMJ as heavier and lighter loads may promote BMF and PMF adaptations, respectively/
- The relative strength of each individual should be taken into account when using AEL as stronger individuals may tolerate higher BMF and may thus be able to use heavier loads.
- Further research is necessary to examine the impact of different prescribed loads relative to an individual's 1RM back squat across multiple sets to improve training prescription.

References

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