Force and Velocity Set to Set Analysis of Accentuated Eccentric Loaded Squats in Resistance-trained Women

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Introduction

Accentuated eccentric loading (AEL) is a training method that couples eccentric and concentric muscle actions and uses heavier eccentric loads than concentric loads during the movement (4). Studies have found both acute and chronic effects on performance characteristics, including enhancement of force and power production (1, 2) as well as the ability to enhance cross-sectional area of type IIx muscle fibers (3). There is a lack of research involving female performance of the AEL back squat using weight releasers. Therefore, the purpose of this study was to examine the effect of multiple sets of accentuated eccentric loading on force-time characteristics in the back squat in resistance-trained women using 100% 1RM on the eccentric portion and 80% 1RM on the concentric portion. The researchers hypothesized that propulsive force-time and velocity characteristics in women would decrease from set to set of accentuated eccentric loaded back squats performed with 100% 1RM eccentric load and 80% 1RM concentric load.

Methods

- 13 resistance-trained women (age: 23.7 ± 2.7 years, body mass: 70.5 ± 8.7 kg, height: 166.4 ± 6.8 cm, one repetition maximum [1RM] back squat: 103.9 ± 11.5 kg, relative 1RM back squat: 1.5 ± 0.2 kg/kg) with previous back squat experience participated in two testing sessions.
- The first session was used to determine the 1RM back squat and familiarize the subjects with the AEL weight releasers.
- During the second session, subjects performed three sets of three repetitions of the back squat using weight releasers on the first repetition of each set. During this session, subjects performed the AEL back squat with an eccentric load of 100% and concentric load of 80% of their 1 RM back squat.
- Subjects stood on a Bertec force plate as they completed the first repetition with the AEL hooks on the bar and the second and third repetitions with the weight having dropped off.
- A series of one-way repeated measures ANOVA were used to examine the potential differences in propulsive force-time and barbell velocity characteristics across the three sets performed.
- Hedge's *g* effect sizes were also calculated to determine the magnitude of the differences between sets.

Results

Table 1. Propulsive force-time and velocity characteristics of each accentuated eccentric loaded back squat set performed with eccentric and concentric loads of 100 and 80% 1RM respectively.

	Mean Force (N/kg)	Duration (s)	Impulse (N.s)	MBV (m/s)	PBV (m/s)
100-80 Set 1	2.6 ± 0.8	1.06 ± 0.23	187.1 ± 52.1	0.51 ± 0.07	1.03 ± 0.11
100-80 Set 2	2.5 ± 0.4	1.05 ± 0.20	179.4 ± 19.8	0.51 ± 0.07	1.03 ± 0.13
100-80 Set 3	2.4 ± 0.6	1.12 ± 0.31	174.3 ± 29.7	0.50 ± 0.08	1.02 ± 0.13
Hedge's *g*	0.15 - 0.27	0.04 - 0.26	0.19 - 0.29	0.00 - 0.13	0.00 - 0.08

Note: Effect sizes show range of differences across all sets. MBV = mean barbell velocity; PBV = peak barbell velocity.

Figure 1. Bar loaded with the weight releasers prior to the eccentric phase of the back squat.

Figure 2. Weight releasers falling off during the transition from eccentric to concentric during the back squat.

Conclusions

- There were no significant differences across sets for PMF, PDur, PImp, MBV, or PBV.
- Only trivial to small differences existed across all sets for every variable.
- Propulsive force-time and barbell velocity characteristics were maintained across multiple AEL back squat sets.

Practical Applications

- Resistance-trained women can maintain force and velocity metrics across multiple sets of AEL back squats using heavy loading combination of 100% and 80% 1RM during the eccentric and concentric phases, respectively.
- This loading combination may be implemented as an effective strength stimulus for resistance-trained women.
- Further research is needed to determine if a heavier or lighter load combination may provide superior results.

References

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