RELATIONSHIPS BETWEEN RELATIVE STRENGTH AND BRAKING IMPULSE DURING ACCENTUATED ECCENTRIC LOADED BACK SQUATS IN RESISTANCE-TRAINED WOMEN

B.A. Campbell [1,2], C.J. Cantwell [2], L.K. Marshall [2,3], Z.S. Schroeder [2,4], J.B. Chard [2], A.E. Sundh [2], C.B. Taber [5], T. J. Suchomel [2]

[1]Sport Performance Department, University of Wisconsin- Whitewater, Whitewater, WI, USA
[2]Department of Human Movement Sciences, Carroll University, Waukesha, WI, USA
[3]Sport Performance Department , University of Wisconsin- Platteville, Platteville WI, USA
[4]Sport Performance Department, Morningside University, Sioux City, IA, USA
[5]Department of Exercise Science, Sacred Heart University, Fairfield, CT, USA

Introduction

Accentuated eccentric loading (AEL) is a training method that applies greater loads during the eccentric (braking) phase of a movement compared to the concentric (propulsion). (4). To be considered AEL, the weight release during the transition phase needs to have limited disruptions to the mechanics of the movement being performed.

Researchers have found that AEL can be beneficial to muscle architecture properties, strength, power, speed, and overall performance (1, 2). Further researches have considered the role of strength in AEL. Researchers have determined that stronger individuals may require heavier eccentric loads to maximize concentric performance compared to weaker individuals (3). While these studies may provide a starting point, further research is needed to indicate the role relative strength plays on braking impulse at different loads.

The purpose of this study was to examine the relationship between relative strength and braking impulse during AEL back squats in resistance-trained women. It was hypothesized that significant relationships between relative strength in women and braking impulse exist will across multiple loading conditions.

Methods

- 13 resistance-trained women (age = 23.7 ± 2.7 years, height = 166.4 ± 6.8 cm, body mass = 70.5 ± 8.7 kg) with previous back squat experience participated in two testing sessions.
- The first session was used to determine the 1RM back squat, calculate relative strength, and familiarize the subject with AEL weight releaser hooks.
- The second session required the subjects to perform sets of three back squat repetitions each with 50, 60, 70, 80% of their 1RM. The eccentric phase of the first repetition of each set was performed with a load equivalent to 110% of their 1RM using weight releasers.
- Participants 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.
- Braking impulse of each repetition was calculated as the product of braking mean force and duration and the average performance across repetitions were used for correlational analysis.
- Pearson correlation coefficients (r) and coefficients of determination (R^2) were used to examine the relationships between relative back squat strength and braking impulse produced.

Results

Table 1. Descriptive statistics and relationships between relative back squat strength and the braking impulse produced during accentuated eccentric loaded back squat sets.

	Relative Back Squat Strength ($kg \cdot kg^{-1}$)	110-50 Braking Impulse ($Ns \cdot kg^{-1}$)	110-60 Braking Impulse ($Ns \cdot kg^{-1}$)	110-70 Braking Impulse ($Ns \cdot kg^{-1}$)	110-80 Braking Impulse ($Ns \cdot kg^{-1}$)
	1.5 ± 0.2	2.8 ± 0.4	2.7 ± 0.4	2.6 ± 0.3	2.4 ± 0.4
r	-	0.686*	0.745*	0.713*	0.460
R^2	-	0.389	0.555	0.508	0.212

Notes: Pearson correlation coefficients (r) and coefficients of determination (R^2) values relate to relative back squat strength. 110-50 = 110% 1RM eccentric and 50% 1RM concentric; * = statistically significant at the $p \leq 0.01$ level

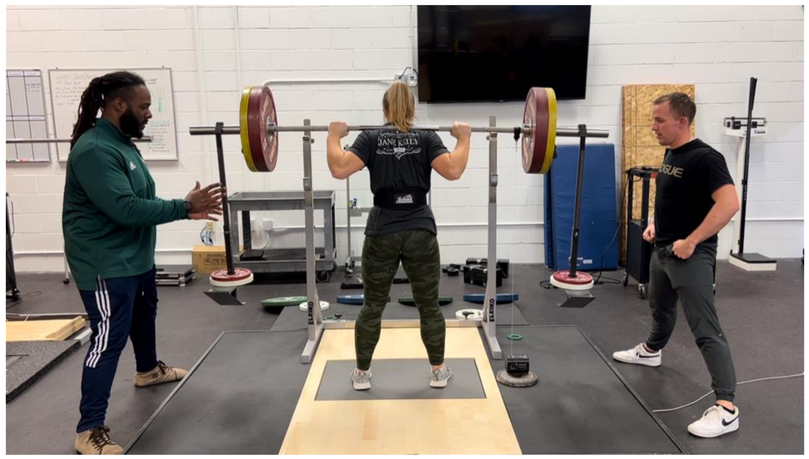

Figure 1.Starting position of the participant on the force platform after unracking the bar with weight releasers.

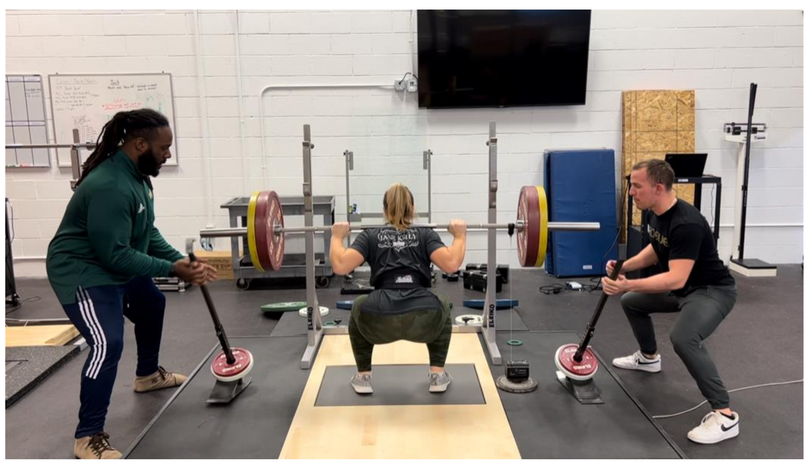

Figure 2. Weight releasers falling off during the transition from eccentric to concentric during the bottom position of the squat.

Conclusions

- Significant relationships existed between relative BS strength and the braking impulse produced during AEL BS sets performed with a concentric load of 50, 60, and 70% 1RM, but not during the set with 80% 1RM.
- Moderate to very large relationships existed between relative BS strength and the braking impulse characteristics produced during AEL BS.
- 38.9, 55.5, 50.8, and 21.2% of the braking impulse variance was explained by relative BS strength when the concentric phase was performed with 50, 60, 70, and 80% 1RM, respectively.

Practical Applications

- The current results suggest that greater relative BS strength may have a positive effect on the braking stimulus experienced during AEL BS sets in resistance-trained women.
- Practitioners should be cautious when interpreting these results as smaller portions of braking impulse variance were explained at the lightest and heaviest load combinations examined.

References

1. Douglas J, Pearson S, Ross A, Mcguigan M. Effects of Accentuated Eccentric Loading on Muscle Properties, Strength, Power, and Speed in Resistance-Trained Rugby Platers. *J Strength Cond Res* 32(10): 2750-2761, 2018.

2.Merrigan JJ, Tufano JJ, Falzone M, Jones Mt. Effectiveness of Accentuated Eccentric Loading: Contingent on Concentric Load. *Int J Sports Physiol Perform* 16(1):66-72, 2021.

3. Sheppard JM & Young K. Using Additional Eccentric Loads to Increase Concentric Performance in the Bench Throw. *J Strength Cond Res* 24(10): 2853-2856, 2010.

4. Wagle JP, Taber CB, Cunanan AJ, Bingham GE, Carroll KM, DeWeese BH, et al. Accentuated Eccentric Loading for Training and Performance: A Review. Sports Med 47(12):2473-95, 2017.

@Brooke988

Brookelyncamp@gmail.com