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STRENGTH-DEPENDENT DIFFERENCES IN DOWNWARD PHASE DURATIONS DURING TRADITIONAL AND ACCENTUATED ECCENTRIC LOADED BACK SQUATS

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Introduction

Accentuated eccentric loading (AEL) is an increasingly popular training method that leverages enhanced eccentric loads during eccentric-concentric coupled movements while maintaining minimal disruption to natural movement mechanics[5]. Previous research has demonstrated mechanistic underpinnings that may potentially provide beneficial adaptations in comparison to traditional resistance training[4]. Furthermore, both acute and chronic changes have been seen in response to AEL during a variety of tasks including squats[4], jumps[2], and the bench press[3].

However, there is limited research comparing stronger and weaker participants through the various modalities of AEL and especially the change in phase durations as a response to AEL. Therefore, the purpose of this study was to examine the differences in downward phase durations between stronger and weaker men during traditional (TRAD) and accentuated eccentric loaded (AEL) maximal and supramaximal back squats (BS).

Methods

- 14 resistance-trained men were split into two separate groups based on their relative one repetition maximum (1RM) BS performance. Both stronger (n = 7, body mass = 78.7 ± 11.2 kg, height = 172.7 ± 5.6 cm, relative 1RM BS strength = 2.3 ± 0.1 kg·kg^{-1}) and weaker (n = 7, body mass = 91.4 ± 12.4 kg, height = 182.9 ± 6.2 cm, relative 1RM BS strength = 1.8 ± 0.1 kg·kg^{-1}) groups participated in four separate testing sessions.
- The initial testing session consisted of a 1RM BS protocol and AEL BS familiarization with weight releasers. The second through fourth testing sessions were completed in randomized order with either a TRAD session or one of the AEL sessions. The TRAD session consisted of the subjects performing three BS repetitions each with 50, 60, 70, and 80% of their respective 1RM. The AEL sessions consisted of an identical protocol but with either the equivalent of 100% or 110% of their individual 1RM during the downward phase of the first repetition by using weight releasers (*Figure 1 and Figure 2*).
- All BS repetitions were performed on a force platform and the raw force-time data were used to determine the downward phase duration of the first repetition of each BS set, which was identified as the duration from the start of the unweighting phase to the end of the braking phase.
- A within-between repeated measures ANOVA was performed to assess the differences in downward phase durations within various loading schemes and between the stronger and weaker subjects. Finally, estimation statistics and Hedge's *g* effect sizes were calculated to assess the magnitude of differences between strength groups across all conditions (*Figure 3*).

Results

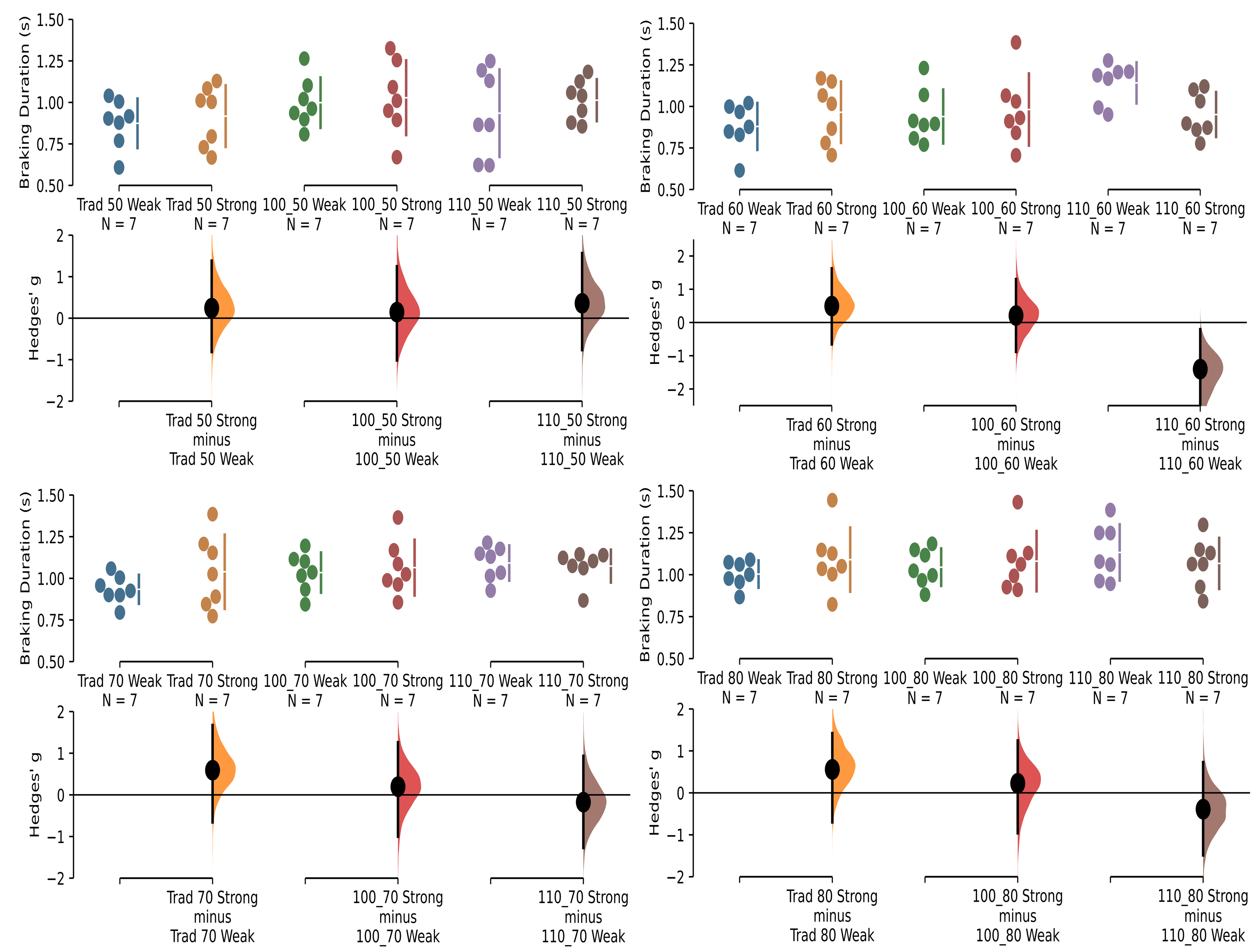

Figure 3. Gardner-Altman estimation plots with Hedges' g effect size comparisons[1]. **Trad** = same eccentric/concentric load; **100** = 100% 1RM during downward phase; **110** = 110% 1RM load during downward phase; **50** = 50% 1RM during concentric phase; **60** = 60% 1RM during concentric phase; **70** = 70% 1RM during concentric phase; **80** = 80% 1RM during concentric phase; **Strong** = 1RM BS ≥ 2.0 kg·kg^{-1}; **Weak** = 1RM BS < 2.0 kg·kg^{-1}.

Figure 1. Unracking the bar with the weight releasers

Figure 2. Partial unloading during the amortization phase

Conclusions

Stronger and weaker resistance-trained men showed similar downward phase durations during TRAD and AEL BS.

Practical Applications

Stronger individuals may be able to maintain their downward phase duration regardless of the loading condition during TRAD and AEL BS due to their greater ability to decelerate a load. AEL can be beneficial for individuals with higher and lower strength levels, however, those with greater strength may benefit from greater variations in loading.

References

1. Ho J, Tumkaya T, Aryal S, Choi H, Claridge-Chang A. Moving beyond P values: data analysis with estimation graphics. *Nature methods* 16: 565-566, 2019.
2. Sheppard J, Newton R, McGuigan M. The effect of accentuated eccentric load on jump kinetics in high-performance volleyball players. *Int J Sports Sci Coach* 2: 267-273, 2007.
3. Taber C, Morris J, Wagle J, Merrigan J. Accentuated eccentric loading in the bench press: Considerations for eccentric and concentric loading. *Sports* 9: 54, 2021.
4. Wagle JP, Taber CB, Carroll KM, et al. Repetition-to-repetition differences using cluster and accentuated eccentric loading in the back squat. *Sports* 6: 59, 2018.
5. Wagle JP, Taber CB, Cunanan AJ, et al. Accentuated eccentric loading for training and performance: A review. *Sports Med* 47: 2473-2495, 2017.

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