Effects of Maximal and Supramaximal Accentuated Eccentric Loading in the Barbell Bench Press

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ABSTRACT

This study examined the effects of maximal and supramaximal accentuated eccentric loading (AEL) on barbell bench press mean and peak performance metrics across a variety of concentric and eccentric loads. 14 strength trained males participated. Analysis of the data revealed significant velocity changes between conditions at loads of ≥ 50% and significant power changes between conditions at 80%. This provides more insight into how to advantageously implement AEL into resistance training.

INTRODUCTION

In training programs, different exercise selection and loading strategies are used to develop strength and power in athletes. One method of acutely enhancing concentric kinetics and kinematics, such as force, velocity, and power, is accentuated eccentric loading (AEL). As an alternative resistance training method, AEL is achieved by overloading the eccentric action and maintaining normal movement mechanics in exercises that involve coupled concentric and eccentric muscle actions, thereby promoting stretch shortening cycle (SSC) activity.[1] Statistically significant increases in RFD eccentrically were observed which may suggest a more rapid concentric phase may be achieved with greater eccentric overloading (120% 1-RM).[1] However, concentric potentiation effects were absent when 105% 1-RM was prescribed, perhaps indicating inadequate magnitude of applied loading, emphasizing the importance of optimal load prescriptions.[2] The implementation of eccentric overloading has demonstrated potentiating effects on subsequent concentric performance in previous research [3,4], although results reported in existing AEL literature are inconclusive when maximal and supramaximal loading have been prescribed during the bench press exercise.

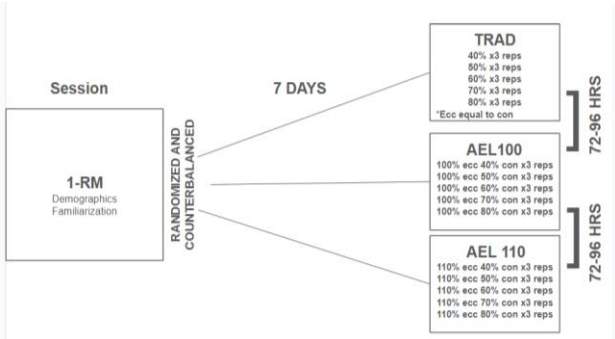
PURPOSE

The purpose of this study was to further explore the acute effects of maximal and supramaximal AEL in the bench press across a spectrum of loads.

METHODS

- 14 resistance trained males (age: 23.8 ± 4.0 years; height: 180.2 ± 5.7 cm; body mass: 95.8 ± 6.6 kg, training age: 2 ± 14 years; one repetition maximum (1RM) bench press (BP), completed 4 testing sessions over the course of two and a half weeks
- Anthropometric measurements were taken during the first day of testing

Figure 1.



RESULTS

- Statistical significance for MV and PV was found between TRAD vs AEL100 and TRAD vs AEL110 at loads ≥ 50%; AEL100 vs AEL110 at loads of ≥ 60%
- Statistical significance was found for MP between TRAD vs AEL100 and AEL100 vs AEL110 at a load of 80%.
- No significant changes were seen for PP although a decline was observed as load increased.
- No significant changes were seen between conditions at 40% for any variable.

Figure 2.

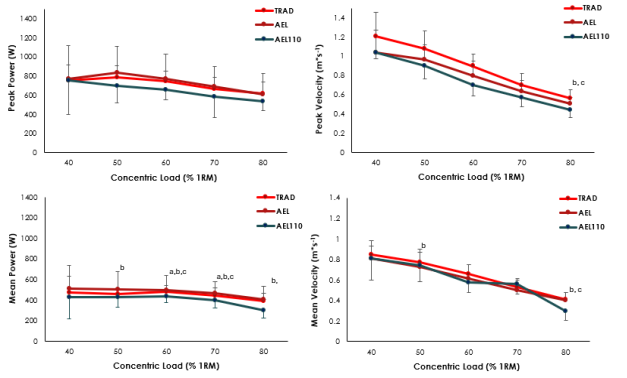


Figure 2. *Significant differences in mean values across conditions. Data are presented as mean ± standard deviation. a= significant difference between TRAD and AEL100 (p<.05), b= significant difference between TRAD and AEL110 (p<.05), c= significant difference between AEL100 and AEL110 (p<.05)*

Table 1. *Descriptive statistics and loading comparisons in the bench press between traditional loading (TRAD) and maximal accentuated eccentric loading (AEL100) and supramaximal AEL (AEL110).*

Condition	MV (m/s)	PV (m/s)	MP (W)	PP (W)
		40% 1RM		
TRAD	0.9 ± 0.1	1.2 ± 0.2	470.8 ± 161.2	754.1 ± 161.1
AEL100	0.8 ± 0.1	1.0 ± 0.2	509.2 ± 230.7	771.9 ± 345.6
AEL110	0.8 ± 0.2	1.0 ± 0.1	429.1 ± 210.7	751.6 ± 352.4
		50% 1RM		
TRAD	0.8 ± 0.1	1.1 ± 0.2 [b]	459.6 ± 59.0	784.6 ± 123.0
AEL100	0.7 ± 0.2	1.0 ± 0.2	504.4 ± 175.7	833.3 ±278.8
AEL110	0.7 ± 0.2	1.0 ± 0.1	428.6 ± 99.1	700.4 ± 177.4
		60% 1RM		
TRAD	0.7 ± 0.1[b]	0.9 ± 0.1 [a, b]	477.3 ± 66.1	743.9 ± 109.1
AEL100	0.6 ± 0.1	0.8 ±0.2 [c]	493.8 ± 143.2	772.0 ± 259.4
AEL110	0.6 ± 0.1	0.7 ± 0.1	432.6 ± 58.6	656.5 ± 101.7
		70% 1RM		
TRAD	0.5 ± 0.1	0.7 ± 0.1 [a, b]	445.3 ± 71.4	665.30 ±119.8
AEL100	0.5 ± 0.1	0.6 ±0.1 [c]	463.9 ± 115.8	692.25 ± 203.2
AEL110	0.6 ± 0.1[b]	0.6 ± 0.1	428.6 ± 99.1	580.21 ± 213.6
		80% 1RM		
TRAD	0.4 ± 0.1[b]	0.6 ± 0.1[b]	393.2 ± 70.6 [b]	614.2 ± 125.0
AEL100	0.4 ± 0.1[c]	0.5 ± 0.1	403.8 ± 133.0 [c]	611.9 ± 216.0
AEL110	0.3 ± 0.1	0.4 ± 0.9	296.0 ± 68.6	532.3 ± 95.0

Note: All statistically significant values are Bonferroni post hoc adjusted. TRAD, AEL100, and AEL110 loading percentages were based on concentric loading. MV = mean barbell velocity, PV = peak barbell velocity, MP = mean barbell power, PP = peak barbell power; ; a=significant difference between TRAD and AEL100 (p<0.05), b= significant difference between TRAD and AEL110 (p<0.05), c= significant difference between AEL100 and AEL110 (p<0.05).

DISCUSSION

- The aim of this study was to examine the acute effects of AEL at maximal and supramaximal loads on concentric bench press power and velocity.
- Mean and peak velocity outputs showed significant changes between TRAD and AEL100 as well as TRAD and AEL110 at loads of ≥ 50%. Loads of ≥ 60% also showed significance between AEL100 and AEL110.
- No significant changes were seen between conditions at 40% for any variable.
- Mean power showed to be affected at a load of 80% between TRAD and AEL100 as well as AEL100 and AEL110.
- No significant changes were seen for PP but a gradual decline was seen as load increased.

CONCLUSION

The mean and peak barbell velocities produced during TRAD and AEL100 conditions were similar across the loading spectrum. In contrast, there was a drop in MV and PV across loads in the AEL110 condition. Finally, although differences between loads were not statistically significant, a gradual decline in PP was observed with increasing load, whereas loading condition appeared to have little or no effect.

PRACTICAL APPLICATIONS

AEL100 was similar to TRAD in concentric outcomes related to barbell velocity and power. The loading during the AEL110 condition may be too heavy to improve concentric performance in examined population. AEL may be implemented to train the eccentric portion of the bench press while maintaining concentric performance with AEL100 but not AEL110. Further research should examine AEL with different set structures and loading parameters to determine the optimal prescription for improving bench press performance.

REFERENCES