FORCE-LOAD AND VELOCITY-LOAD CURVES FOR CLEAN PULL SHRUGS OFF BOXES – LESS VARIABILITY THAN EXPECTED

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Introduction

Recent research has examined how velocity-based training (VBT) might be used for the sport of weightlifting (WL) and the use of WL derivative lifts for other sports (Kissick et al. 2025, Suchomel et al. 2025).

Purpose

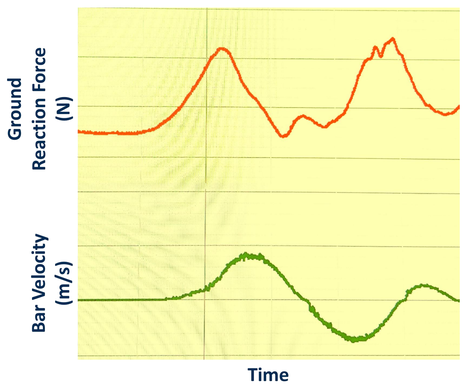
The purpose of the present study was to determine how removal of the eccentric phase by lifting from boxes affects both the concentric forces and velocities for different relative loads during the clean pull shrug exercise.

Methods and Materials

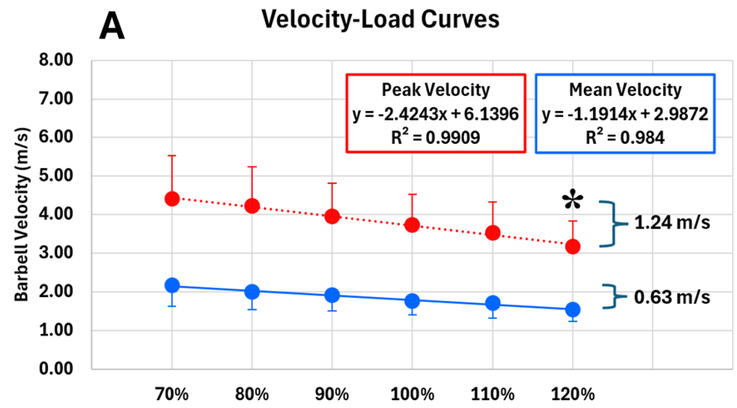
Ten well-trained competitive weightlifters (n=5 females, n=5 males) performed multiple clean pull shrugs from the mid-thigh position with the bar starting from a static position while setting on lifting boxes with 2" increments. Single repetitions were performed at 70%, 80%, 90%, 100%, 110% and 120% of clean 1 RM loads. System (body + bar) vertical ground reaction forces (GRF) were assessed with a 1-dimensional force plate (RoughDeck, Rice Lake, WI) and vertical bar velocities were assessed with a linear velocity transducer (Transducer Techniques, Temeculah, CA) positioned immediately above the bar. Resulting electrical signals were acquired and analyzed with a data acquisition system sampling at 1000 Hz (BioPac MP150, Golota, CA). Peak and mean values for bar velocity ($m \cdot s^{-1}$) and system GRF (N) at each load were used to determine the velocity-load and force-load curves as determined by linear regression. Additionally, 1-way ANOVAs with Tukey post hoc analyses determined if any dependent variables significantly differed between relative loads ($p<.05$). Data are reported as mean ± SD.

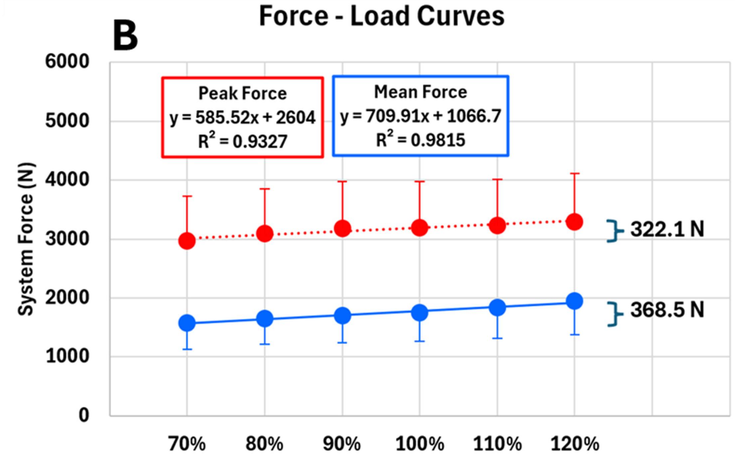
Results

Values for each dependent variable are shown in the figure on the far right (X±SD; *$p<.05$ vs. 70% 1RM). Regression equations and R^2 values for each variable are shown in the inset boxes. It should be noted that the relative loads (% 1 RM) were expressed as decimals (i.e., 70% = 0.70), resulting in the slope values reported for all variables. Coefficients of variability (%CV) for all variables at each load ranged between 20.3%-28.9%.



Figures –
Above – Sagittal view of the starting & ending positions for the clean pull shrug exercise off boxes.
Left – Representative force-time and bar velocity-time traces for a clean pull shrug exercise off boxes.
Top Right – Velocity-Load (A) and Force-Load (B) curves for the clean pull shrug exercise off boxes at loads ranging from 70% - 120% clean 1 RM loads. * $p<.05$ vs. 70% 1 RM





Discussion & Conclusions

Due to the high velocities for all loads of this exercise, only peak velocity at 70% and 120% 1 RM were sig. different, influenced in part by the large CV% for velocity at each load, but also by the small differences in velocity across the load spectrum. No sig. differences were observed across loads for peak or mean force. Despite external masses increasing 71% from 70% 1 RM to 120% 1 RM, forces only increased 10.8% and 23.4% for peak and mean forces, respectively. Apparently, the large increases in bar mass were countered by critical decreases in bar and body accelerations that resulted in very small changes in vertical forces. All regression line slopes are considerably lower than those previously reported for most resistance exercises.

Practical Applications

VBT does not appear to be a valuable tool for this type of exercise. Bar velocity does not effectively differentiate training loads for this weightlifting derivative, and the forces produced by the external loads used were surprisingly similar. This illustrates how many different loads of this weightlifting derivative exercise may generate the desired velocities and forces.

Acknowledgements

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