

THE EFFECTS OF ACCOMMODATING RESISTANCE ON POWER CHARACTERISTICS DURING FREE WEIGHT BACK SQUAT SETS

Ronit Goswami, Daniel C. Gans, Anthony R. Deldin, David J. Sanders, & Cameron S. Mackey
Loyola University Chicago

INTRODUCTION

Post-activation Potentiation (PAP) refers to the increase in muscle fiber twitch and force that improves performance following subsequent conditioning exercises. Though PAP has been associated with rate of force development (RFD) and suggests that it is beneficial for short-term performance, the use of accommodating resistance as a conditioning vehicle in increasing muscle power has become prevalent.

METHODS

This study included 16 resistance trained males (age = 25.5 ± 2.3 years; height = 179.6 ± 4.2 cm; body mass = 92.7 ± 5.6 kg; 1RM back squat = 150.9 ± 10.7 kg; relative 1RM back squat to body mass = 1.6 ± 0.2). Following a one-repetition (1RM) maximum back squat and 7 minutes of recovery, back off sets were performed with 1, 2, 3, and 4 repetitions at 90, 70, 50, and 30% of the 1RM with 7 minutes of rest between sets. Accommodating resistance (AR-1RM) was implemented by looping three resistance bands around the hole(s) on both sides from the top of a power rack and followed the same 1RM protocol. The control day (CON) session did not include a 1RM, but followed the same 1, 2, 3, and 4 repetitions at 90, 70, 50, and 30% of the 1RM with 7 minutes of rest between sets. Mean velocity (MV) and mean power (MP) were recorded using a commercially designed linear position transducer. Statistical Analysis was carried out by utilizing a repeated-measures one-way analyses of variance (ANOVA) to determine whether MV or MP significantly differed during each time point. If a significant interaction was detected, a paired samples T-test was conducted post-hoc to determine the specific level of interaction. An independent samples T-Test was run to examine the differences between the 1RM and AR-1RM loads. Alpha criterion was set at $p \leq 0.05$.

Table 1. Mean power (watts) and mean velocity (m/s) between conditions, 1RM, CON, and AR-1RM, for subsequent squat back off sets.

| | | 1RM | CON | AR-1RM | P | ES | | |
|-----|----|----------------|----------------|----------------|---------|-----------|--------------|--------------|
| | | | | | | 1RM & CON | 1RM & AR-1RM | AR-1RM & CON |
| 90% | MP | 967.5 ± 131.9 | 813.5 ± 308.3 | 915.0 ± 274.4 | 0.483 | 0.70* | 0.26 | 0.35 |
| | MV | 0.42 ± 0.08 | 0.36 ± 0.14 | 0.39 ± 0.14 | 0.364 | 0.57* | 0.31 | 0.20 |
| 70% | MP | 1218.0 ± 146.1 | 1259.3 ± 191.0 | 1200.5 ± 182.5 | 0.154 | -0.24 | 0.11 | -0.31 |
| | MV | 0.63 ± 0.09 | 0.65 ± 0.10 | 0.62 ± 0.10 | 0.258 | -0.23 | 0.11 | -0.32 |
| 50% | MP | 1429.3 ± 153.9 | 1414.3 ± 83.5 | 1303.0 ± 133.6 | 0.011\$ | 0.13 | 0.88# | -1.02# |
| | MV | 0.86 ± 0.11 | 0.85 ± 0.06 | 0.78 ± 0.09 | 0.013\$ | 0.12 | 0.73* | -0.87# |
| 30% | MP | 1500.5 ± 183.9 | 1457.8 ± 60.9 | 1385.5 ± 114.9 | 0.287 | 0.35 | 0.77* | -0.82# |
| | MV | 1.10 ± 0.16 | 1.07 ± 0.04 | 1.02 ± 0.11 | 0.332 | 0.31 | 0.64* | -0.73* |

Data are presented as mean ± SD; MP, mean power; MV, mean velocity; 1RM, one repetition max; CON, control; AR-1RM, accommodating resistance one repetition max; ES, effect size.
\$ Indicates significant difference between conditions ($p < 0.05$)
* Indicates moderate effect size
Indicates large effect size

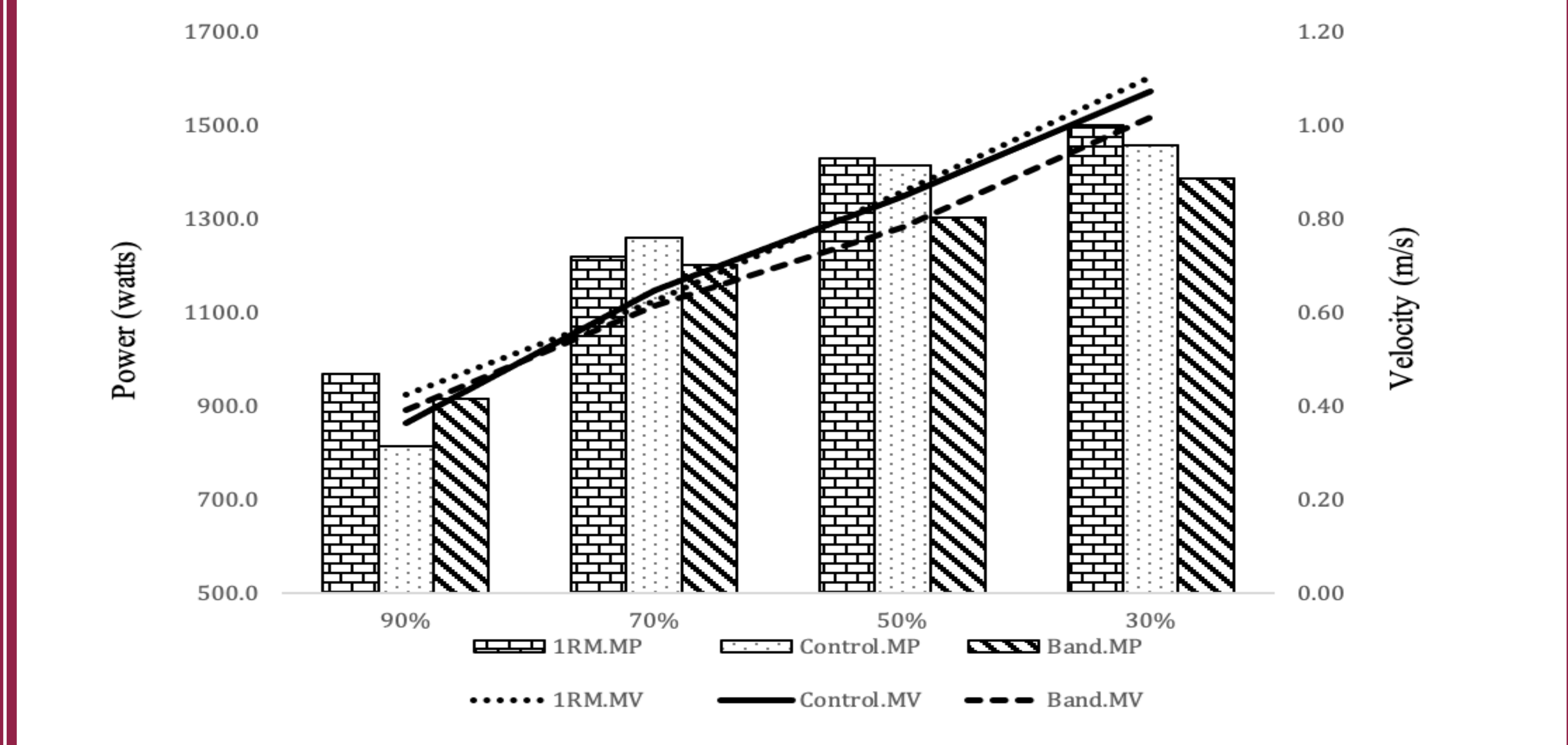


Figure 2. Mean Power vs. Mean Velocity in each condition.

RESULTS

Results of the Repeated Measures ANOVA showed a significant difference in MV and MP for only the 50% condition ($p < 0.011-0.013$). No other significant differences in MV and MP were found at any other time point ($p > 0.05$ for all other conditions). Post hoc paired samples T-test determined that MV and MP were significantly different in the 1RM and CON, when compared to the AR-1RM day ($p = 0.005-0.030$). No significant differences in MP and MV during the 50% load were found between 1RM and CON ($p > 0.05$).

CONCLUSIONS

The study found that a free weight 1RM, as compared to an AR-1RM, showed an increase in performance in subsequent submaximal squats completed seven minutes after a 1RM is reached, when compared to a control. The use of this kind of training may increase the performance of subsequent squats following a 1RM, potentially leading to a positive performance increase in MP and MV in subsequent submaximal back off sets.

Figure 1. Visual representation of the study design for the one repetition maximum (1RM), accommodating resistance 1RM (AR-1RM), and control session.

