Developing Normative Data within the Load-Velocity Relationship: A Cohort Study

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INTRODUCTION

The load-velocity relationship is defined as the inverse relationship between resistance and velocity of movement (Picerno et al., 2016). It is not well understood the extent to which these two variables are related and the exact curvature of this relationship. Velocity based training has gained popularity within collegiate athletics as it has well supported translation into sport performance. But an exact method in which a load is assigned based on desired velocity has not yet been defined. The purpose of this cohort study was to determine normative values on loads lifted and the velocity outcomes. This is to benefit strength and conditioning coaches and sport performance practitioners in evaluating the best suited load to maximize velocity in each lift.

LITERATURE REVIEW

Selection criteria within this review included identical velocity tracking technology, subject selection, and movements assessed.
In one analysis, authors concluded that an average load velocity relationship in the bench press was 50% 1RM with a mean velocity of .65 m/s and 70% 1RM with a mean velocity of .50 m/s using tether technology (Perez et al. 2021).
In another, authors recorded a mean velocity of .9 m/s at 50% 1RM and .68 m/s at 70% 1RM in the deadlift using tether technology (Benevides-Ubric et al., 2020)
Finally, (Martinez-Cava et al., 2018) reported 50% 1RM .97 m/s and 70% 1RM at .74 m/s in the full squat using force plate technology.
Due to the inconsistencies within these findings, normative data is necessary to collect to further assess this relationship.

METHODOLOGY

10 master's students (ages 22 – 25-year-old, co-ed cohort, 15 years +/- 2 of reported weightlifting/athletic experience) completing a movement analysis assignment, signed an informed consent form and performed an assigned load, volume and movement to complete. 5 set of 5 reps at a reported load between 50 – 75% of their one rep max. Velocity was recorded and reported using camera-based velocity tracking technology. All data is kept on a password protected computer and will be discarded 7 years post publication. Data was analyzed using IBM SPSS Statistics and a scatterplot was created using an excel spreadsheet to determine the curvature of the load-velocity relationship.

RESULTS

Bench Press Load-Velocity Relationship

$y = -0.218\ln(x) + 1.5263$
$R^2 = 0.1489$
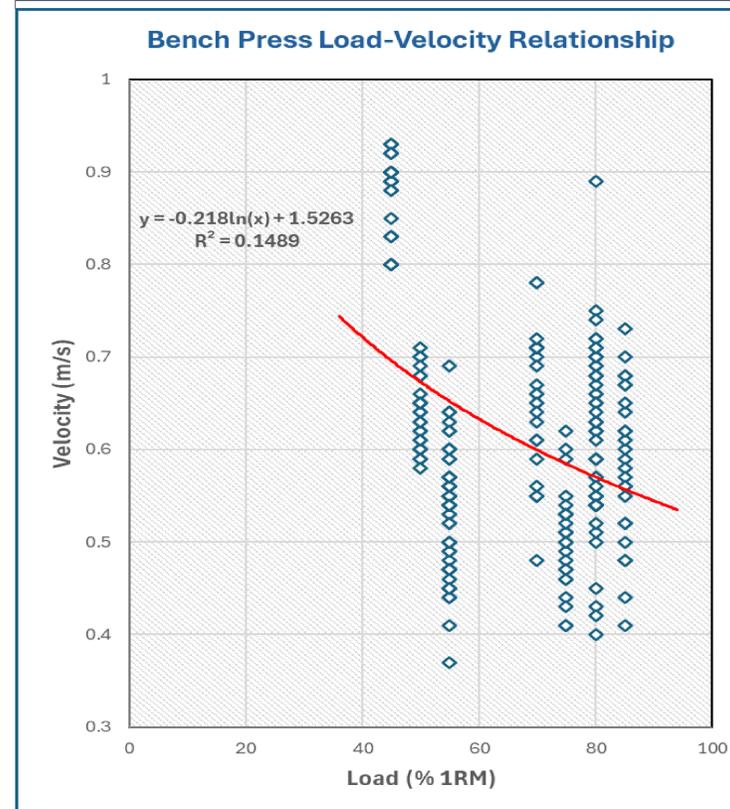
45% 1RM - .88 m/s MV

50% 1RM - .64 m/s MV

70% 1RM - .66 m/s MV

80% 1RM - .61 m/s MV

DISCUSSION

A well-known method of velocity-based training, conjugate weightlifting, suggests a velocity assignment of .8 m/s with a load as high as 60% 1RM with 25% of accommodating resistance in elite powerlifters (Simmons, 2022, p. 64). Conversely, athletes with minimal weightlifting experience have an average velocity of .75 m/s at 60% 1RM. These conflicts make it difficult to effectively and accurately assign load based on desired velocity with a primary difference attributed to the experience of the athlete. Based on the data collected, normative values do not represent this accepted form of velocity-based training seen in some conjugate methods of lifting. With further normative data, load and assigned velocity can be more realistic and accurate with a broader range of subjects with given consideration to experience. Currently, experience of the athlete and technique within the movement heavily influence the velocity that should be assigned. Further research is needed to evaluate how velocity assignments may differ from a novice athlete and an advanced athlete. Nonetheless, these normative values and continued suggestions upon which loads are appropriate depending on maximizing mean velocity.

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