Validation of Various Load-velocity Relationships for Estimation of Bench Press 1-repetition Maximum

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ABSTRACT

Estimating 1-repetition maximum (1RM) by measuring mean concentric velocity (MCV) is an indirect method that has gained popularity in the field of strength and conditioning. It has previously been recommended that 4 – 6 loads ranging from 30 – 85% 1RM be used when estimating 1RM via MCV. Nonetheless, the validity of fewer loads at varying intensities is an area in need of further investigating. **Purpose:** The purpose of this study was to validate various load-velocity relationships to predict bench press 1RM values. **Methods:** 20 resistance-trained individuals (50% males) participated in this study. Warm-up sets consisted of subjects bench pressing loads at 50 (5-repetitions), 70 (3-repetitions) and 90% (1-repetition) of estimated 1RM. Following the warm-up loads, a maximal of 4 attempts were performed in order to determine measured 1RM. The MCV (m·s^{-1}) was recorded using a linear position transducer during the warm-up and 1RM trials in order to develop load-velocity profiles. Specifically, four different velocity-based 1RM equations (EQ) were determined using the warm-up loads of 50, 70, and 90% (MCV-EQ1), 50 and 90% (MCV-EQ2), 70 and 90% (MCV-EQ3), and 50 and 70% (MCV-EQ4). **Results:** Evaluation of mean differences revealed the constant error (CE) for the MCV prediction equations were not statistically significant for any comparisons (CEs = 0.80 to 2.96 kg; all p > 0.05). In addition, the correlation coefficients between the MCV prediction methods and measured 1RM were near perfect for all comparisons (r ≥ 0.98; all p < 0.001). The validity statistics indicated the standard error of estimate (SEE) and 95% limits of agreement (LOAs) was lowest for MCV-EQ1 (7.86 kg and ±15.00 kg, respectively) and highest for MCV-EQ3 (9.24 kg and 17.74 kg, respectively). Nonetheless, the SEEs and 95% LOAs for MCV-EQ2 (8.10 kg and ±15.55 kg, respectively) and MCV-EQ4 (8.38 kg and ±16.08 kg, respectively) were similar as MCV-EQ1. **Conclusions:** The current study findings revealed that MCV-EQ3 produced the largest individual error (SEE and 95% LOAs). Therefore, practitioners may consider employing the load-velocity relationships of MCV-EQ1, MCV-EQ2, or MCV-EQ4. Collectively, the current study findings reveal that 2 (MCV-EQ2 and MCV-EQ4) or 3 (MCV-EQ1) warm-up loads can easily be employed to estimate velocity-based 1RM on the bench press.