

A Comparison of Three Protocols for Determining Bench Press Single Repetition Maximum in Resistance Trained Males and Females

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ABSTRACT

BACKGROUND: An individual's one repetition maximum (1RM) is a vital metric for most practitioners and strength and conditioning professionals. 1RM has utility for aspects such as the proper implementation of periodization principles throughout an athlete or client's training plan, along with commonly being utilized to assess the effectiveness of various training and rehabilitation protocols. While a plethora of methods exist to estimate 1RM through previously established prediction equations and repetition maximums, the most accurate way is to directly assess 1RM for a given exercise. However, a multitude of 1RM testing protocols exist throughout the literature and little is known as to how the resultant 1RM from these protocols compare. Additionally, the degree to which having a standardized protocol may impact a 1RM as opposed to the well-trained athlete determining it themselves using methods they may be more comfortable with and that better reflect their typical training practices.

PURPOSE: To assess the agreement, or lack thereof, between two previously established and a novel method for determining bench press one repetition maximum.

METHODS: Twenty-three resistance-trained males (n=12, 22±6.1 yrs, 181±6 cm, 88.6±10.6 kgs) and females (n=11, 23±6 yrs, 163±7 cm, 74.8±16 kgs) completed three laboratory visits in which bench press 1RM was assessed using one of three protocols. During the first visit, body composition was assessed, after which a 5-minute general warm-up utilizing a self-selected pace and intensity on a cycle ergometer was completed, followed by a 5-minute self-selected warm-up period. Upon the completion of the warm-up, the participant's bench press 1RM was determined utilizing one of three protocols, two standardized protocols found throughout the literature (P1, P2) and a self-selected protocol in which the participant was able to select the weight increases, rep ranges for each set, and rest time between attempts themselves (Self Selected). On visits two and three, the participants completed the same previously described warm-up but then completed one of the remaining 1RM protocols. The order in which the protocols were completed was randomized. A one-way repeated measures ANOVA was utilized to determine if the resultant 1RM differed between protocols.

RESULTS: No significant differences were seen between protocols (p=0.638, P1: 84.5±33.4kgs, P2: 84.9±33.7kgs, Self Selected: 84.3±32.7kgs).

CONCLUSIONS: These data suggest that the resultant bench press 1RM did not differ whether a standardized protocol was used or the participant was able to utilize their own method. Additionally, the type of standardized protocol did not impact the final 1RM in a laboratory setting.

PRACTICAL APPLICATIONS: Since no statistically significant differences were detected in the 1RM determined by the three methods, the practitioner can feel comfortable utilizing various protocols for 1RM testing that best suit the needs of the athlete and the setting. Special considerations can be made for aspects such as time constraints such as choosing a protocol with standardized rest times and percentages to streamline efficiency with larger participant groups. In situations where the assessment is with a smaller group, selecting a protocol that makes the athlete more comfortable could be just as beneficial.

BACKGROUND

- A trainee's one repetition maximum (1RM) is an invaluable piece of information to the strength and conditioning professional due to its utility in exercise programming to assign loads on a given day or track progression.
- Additionally, an individual's 1RM is commonly utilized in research settings to establish the efficacy of various acute and chronic interventions.
- As such, being able to best evaluate an individual's 1RM is vital to properly program for that individual's specific fitness goals, as well as to properly track program progression and determine future training loads.
- While the requirement for a 1RM for strength training programming is well established, the methods for testing this metric are varied throughout the literature.
- With this in mind, there has been little to no literature on the comparison between previously established 1RM testing protocols or if these established protocols would result in a different 1RM than the athlete guiding themselves.

Table 1. Participant Characteristics

	Males (n = 12)	Females (n = 11)	Full Sample (n = 23)
Age (yrs)	22 ± 6.1	23 ± 6	23.6 ± 5.9
Weight (kg)	88.6 ± 10.6	74.8 ± 16	83.2 ± 15.5
Height (cm)	181 ± 6	163 ± 7	172.1 ± 10.8
Years Trained (yrs)	7.8 ± 4.2	4.1 ± 2.7	6.1 ± 4
Body Fat %	20.3 ± 5.5	32 ± 9.7	25.9 ± 9.7

PURPOSE

To assess the agreement, or lack thereof, between two previously established and one novel method for determining bench press one repetition maximum.

METHODS

Experimental Overview

- Twenty-three resistance-trained males and females (Table 1) completed three laboratory visits in which bench press 1RM was assessed using one of three protocols in a randomized crossover fashion.
- During the first visit, height, weight, and body composition was assessed via BIA (Inbody H2On), after which a 5-minute general warm-up utilizing a self-selected pace and intensity on a cycle ergometer was completed, followed by a 5-minute self-selected warm-up period. The self-selected portion of the warm-up was documented by a research so participants could repeat the same warm up at visits 2 and 3.
- Upon the completion of the warm-up, the participant's bench press 1RM was determined utilizing one of three protocols, two standardized protocols found throughout the literature (P1, P2) and a self-selected protocol in which the participant was able to select the weight increases, rep ranges for each set, and rest time between attempts themselves (Self Selected).
- On visits two and three, the participants completed the same previously described warm-up followed by one of the remaining 1RM protocols.

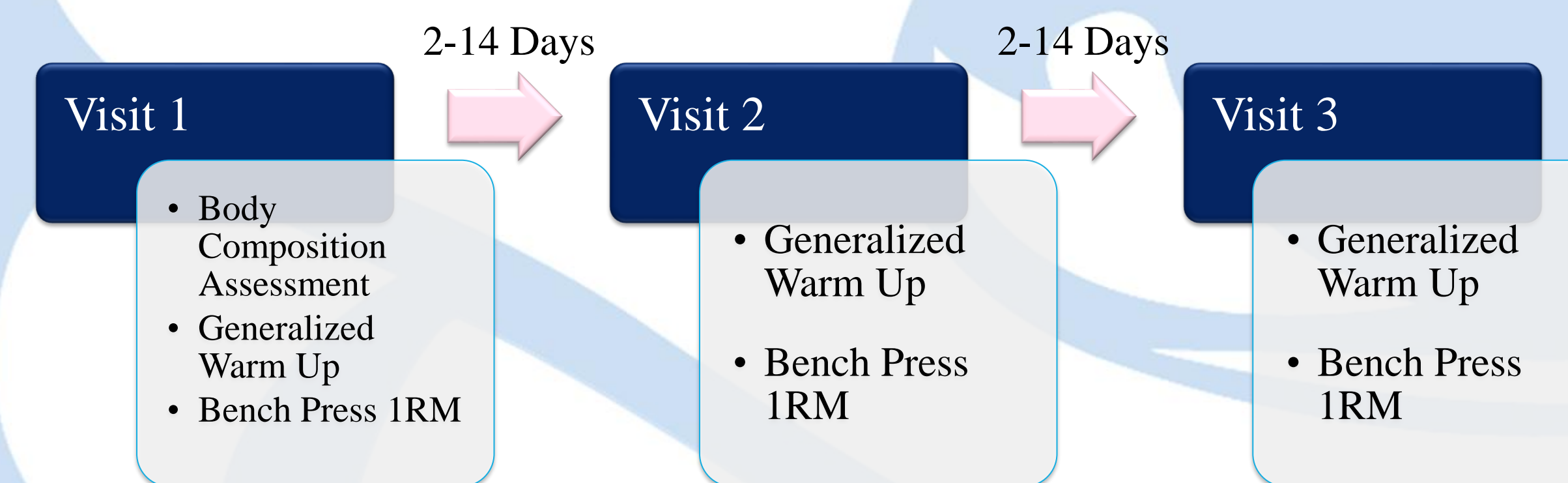


Figure 1. Timeline and Overview of Study Procedures.

Protocol 1

Empty Bar for 10 Repetitions
↓ 1 minute rest
8-10 Reps with 40-60% of Perceived 1RM
↓ 2 minute rest
3-5 Reps with 60-80% of Perceived 1RM
↓ 3 minute rest
2-3 Reps with an additional 5-10%
↓ 3 minute rest
1RM Attempt

Protocol 2

Empty Bar for 10 Repetitions
↓ 1 minute rest
5 Reps with 20% of Perceived 1RM
↓ 2 minute rest
3 Reps with 50% of Perceived 1RM
↓ 2 minute rest
2 Reps with 75% of Perceived 1RM
↓ 2 minute rest
2 Reps with 75% of Perceived 1RM
↓ 3 minute rest
1RM Attempt

1RM was found within 5 attempts for both protocols

Figure 2. Overview of the two protocols used to determine 1RM.

Statistical Analysis

- A one-way repeated measures ANOVA was utilized to determine if the resultant 1RM differed between protocols.
- Statistical significance was accepted at $p \leq 0.05$.

RESULTS

- No significant differences were seen between protocols for the resultant 1RM (p=0.638, P1: 84.5±33.4kgs, P2: 84.9±33.7kgs, Self Selected: 84.3±32.7kgs). (Figure 3)

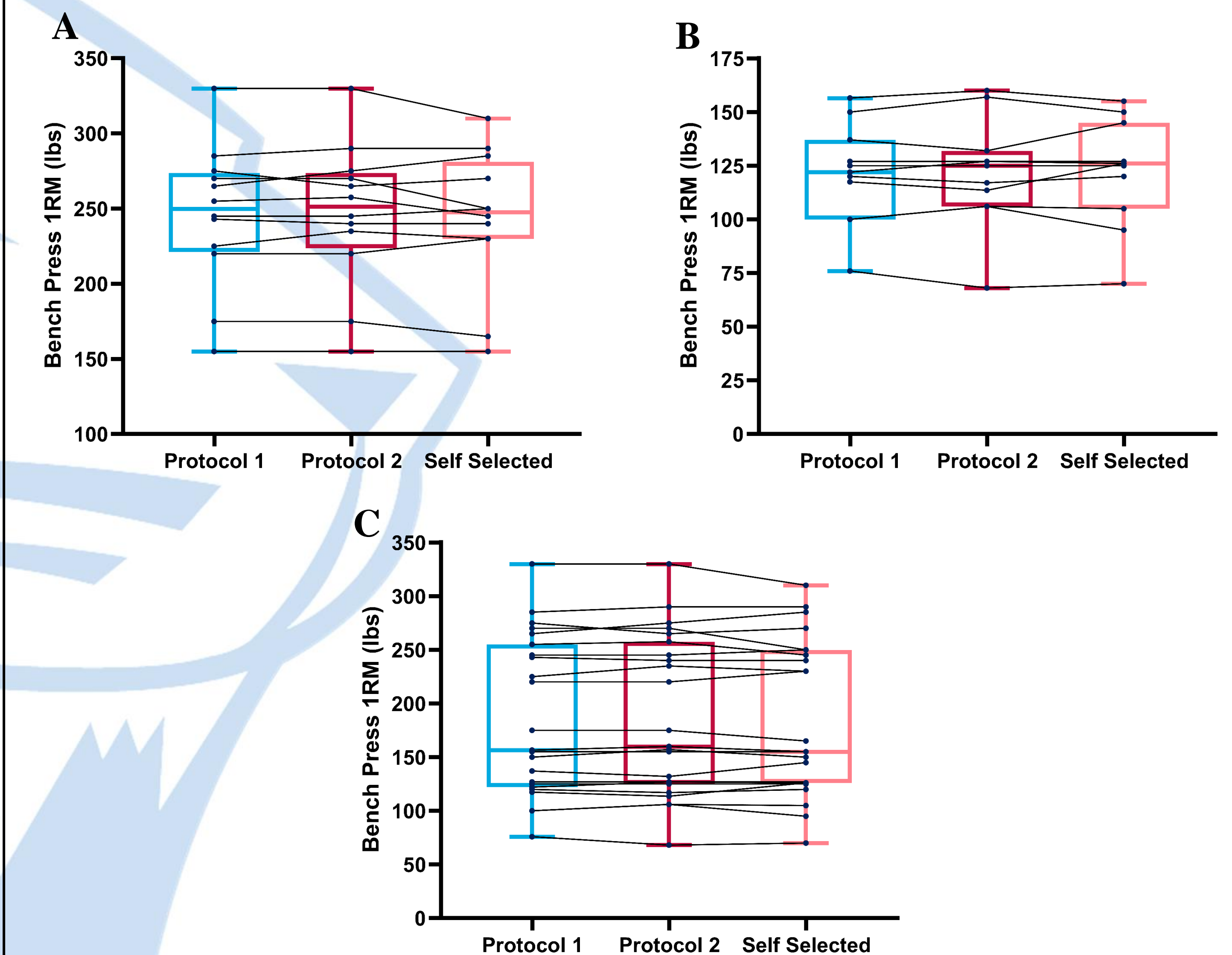


Figure 3. Resultant barbell bench press 1RM values for a group of 23 resistance trained males (A) and females (B) and the full sample (C) when assessed using three different protocols.

CONCLUSIONS

- These data suggest that the resultant bench press 1RM was not impacted by whether a standardized protocol was used, or the participant was able to utilize their own method.
- Additionally, the type of standardized protocol did not impact the final 1RM in a laboratory setting.

PRACTICAL APPLICATIONS

- As no statistically significant differences were detected in the 1RM determined by the three methods, the practitioner can feel comfortable utilizing various protocols for 1RM testing that best suit the needs of the athlete and the setting. Although, it would still be recommended to keep the method consistent within the participant.
- Special considerations can be made for aspects such as time constraints such as choosing a protocol with standardized rest times and percentages to streamline efficiency with larger participant groups.
- In situations where the assessment is with a smaller group or individual, the practitioner may consider utilizing a protocol that makes the athlete more comfortable without concern of compromising the final 1RM.