



ABSTRACT

Muscular strength is a key fitness component often assessed in occupational testing for tactical populations. Currently, the US Army uses a 3-repetition maximum (RM) hexagonal bar deadlift (HBD) as its measure of lower-body strength. RM testing can be highly time-consuming and equipment intensive, especially when testing large groups. Heavy dynamic lifts may also pose a higher injury risk for those with limited resistance training experience (e.g., basic training recruits). The leg/back dynamometer (LBD) is an isometric test that may provide an effective measure of lower-body strength, while also serving as a safer, portable, and cost-efficient alternative to RM testing. **PURPOSE:** This study aimed to determine relationships and predictive capability between LBD and 1RM HBD performance in resistance-trained individuals. **METHODS:** The current study is part of a larger investigation that tested two dynamic strength tests. Fifteen resistance-trained subjects (8 males, 7 females) participated in this study. Each subject completed three testing sessions. During the first two sessions, subjects completed a 1RM HBD or 1RM conventional deadlift (CD; data not used in this study) and were also familiarized with the LBD. The HBD and CD testing were counterbalanced. The third testing session consisted of three LBD trials. Both maximal and average LBD scores were recorded. Pearson's correlations ($p < 0.05$) calculated relationships between absolute and relative 1RM HBD and maximum and average LBD. Stepwise regression ($p < 0.05$) determined whether the LBD could predict 1RM HBD. **RESULTS:** Both maximum ($r = 0.74$) and average ($r = 0.79$) LBD performance had strong, positive relationships to 1RM HBD performance. However, only the average absolute LBD performance significantly predicted absolute HBD performance ($R^2_{Adjusted} = 0.60$). Relative strength performance showed similar results with both maximum ($r = 0.78$) and average ($r = 0.84$) relative LBD performance strongly correlating to relative HBD performance and average relative LBD performance being the only predictor of relative HBD performance ($R^2_{Adjusted} = 0.69$). **CONCLUSIONS:** The strong correlations between LBD and HBD performance indicate the LBD's potential to provide a measure of absolute and relative lower-body strength. Regression results indicate that average LBD performance may predict the 1RM HBD (Figure 1). Although average LBD performance showed predictive application, equipment modifications, such as a similar handle set-up to HBD, may strengthen predictive relationships. **PRACTICAL APPLICATIONS:** These results are highly applicable to tactical populations implementing physical fitness testing to large groups with varying skill levels. The predictive value of the LBD relative to the HBD indicates its ability to test muscular strength. Moreover, LBD testing requires minimal equipment and is safer and less fatiguing for participants of all ages, gender, and skill level.

INTRODUCTION

- Muscular strength is a key fitness component often assessed in occupational testing for tactical populations. Currently, the US Army uses a 3-repetition maximum (RM) hexagonal bar deadlift (HBD) as its measure of lower-body strength in the Army Combat Fitness Test (4).
- Tactical populations, such as military and first responder organizations, may need to accommodate a wide variety of individual physical fitness capabilities. These variations may be due to differences in age, sex, or occupational role of tactical personnel. Additionally, these organizations recruit from the general population, where physical training experience may be limited (4,5).
- Historically, dynamic strength tests such as 1-RM lifts have been used as valid measures of lower-body strength. However, RM testing can be highly time-consuming and equipment-intensive, especially when testing large groups. Heavy dynamic lifts may also pose a higher injury risk for those with limited resistance training experience (e.g., basic training recruits) (6).
- The leg/back dynamometer (LBD) is an isometric test that may provide an effective measure of lower-body strength, while also serving as a safer, portable, and cost-efficient alternative to RM testing (1,3).
- Therefore, this study aimed to determine the relationships and predictive capability between LBD and 1RM HBD performance in resistance-trained individuals.

Leg/back dynamometer performance may predict the 1RM hexagonal bar deadlift. These results are highly applicable to tactical populations implementing physical fitness testing for large groups with varying skill levels.

METHODS

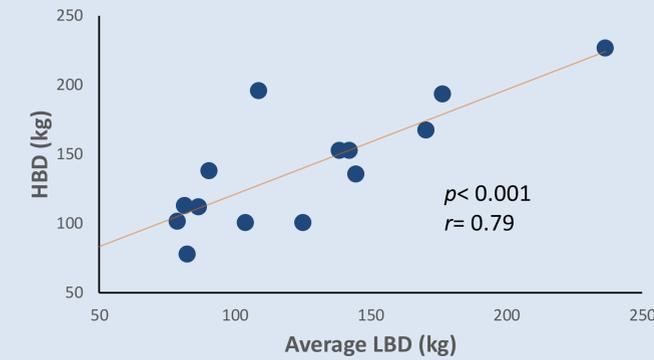
- The current study is part of a larger investigation that tested two dynamic strength tests.
- Fifteen resistance-trained subjects participated in this research study including 8 males (age=22.63±2.45 years, height=175.38±6.19 cm, body mass=78.39±6.99 kg) and 7 females (age=24.00±4.62 years, height=163.71±6.96 cm, body mass=79.04±20.84 kg).
- Each subject completed three testing sessions separated by approximately 48-72 hours. During the first two sessions, subjects completed a 1RM HBD or 1RM conventional deadlift (CD; data not used in this study) and were also familiarized with the LBD. The HBD and CD testing were counterbalanced. The third testing session consisted of three LBD trials. Both maximal and average LBD scores were recorded.
- Pearson's correlations ($p < 0.05$) calculated relationships between absolute and relative 1RM HBD and maximum and average LBD performance. Stepwise regression ($p < 0.05$) determined whether the LBD could predict 1RM HBD.

RESULTS

- Both maximum ($r = 0.74$) and average ($r = 0.79$) LBD performance had strong, positive relationships to 1RM HBD performance. However, only the average absolute LBD performance significantly predicted absolute HBD performance ($R^2_{Adjusted} = 0.60$) (Figure 1).

- Relative strength performance showed similar results with both maximum ($r = 0.78$) and average ($r = 0.84$) relative LBD performance strongly correlating to relative HBD performance and average relative LBD performance being the only predictor of relative HBD performance ($R^2_{Adjusted} = 0.69$).

Figure 1. Regression between average leg/back dynamometer (LBD) performance and one-repetition maximum hexagonal bar deadlift (HBD) performance.



CONCLUSIONS

- The results of this study showed strong correlations between LBD and HBD performance, indicating the LBD's potential to provide a measure of both absolute and relative lower-body strength as measured by the HBD.
- Regression results indicated that average LBD performance may predict the 1RM HBD. This finding is consistent with past studies that state that averaged isometric performance may provide a more accurate representation of a muscle's force-generating capacity compared to a single maximal isometric contraction (2).
- Although average LBD performance showed predictive application, equipment modifications, such as a similar handle set-up to HBD, may strengthen predictive relationships.
- Stronger relative strength relationships may be due to the combined analysis of males and females. Future research should control the influence of sex during data analysis.

PRACTICAL APPLICATIONS

- These results are highly applicable to tactical populations implementing physical fitness testing to large groups with varying skill levels.
- The predictive value of the LBD relative to the HBD indicates its ability to test muscular strength. Moreover, LBD testing requires minimal equipment and is safer and less fatiguing for participants of all ages, gender, and skill level.

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