Only the strong survive: Relationships between lower-body strength and power with the 75-kg and 91-kg body drag

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Only The Strong Survive: Relationships Between Lower-Body Strength and Power with the 75-kg and 91-kg Body Drag

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ABSTRACT

INTRODUCTION: One of the critical job tasks identified for law enforcement officers is the ability to rescue a person in immediate danger. For this reason, some law enforcement agencies (LEA) administer a body drag (BD) as part of their state-mandated Work Sample Test battery (WSTB). The BD is one of five events in the WSTB, and recruits must pass this test to graduate training academy. However, the dummy used for this test weighs 75 kg while the average US adult male currently weighs ~91 kg. Before agencies can update their standards, research is needed to determine the physical characteristics required to successfully perform the BD with lighter and heavier masses. **PURPOSE:** To examine how lower-body strength and power correlate to dragging a 75-kg and 91-kg dummy. **METHODS:** Thirty (19 male, 11 female) college-aged students were recruited for this study. Subjects were age-matched to a typical law enforcement recruit cohort. Testing occurred over three days; day 1 included anthropometrics, standing broad jump (SBJ), vertical jump (VJ), and a 1RM hexagonal bar deadlift (HBDL). Relative SBJ was calculated from SBJ scores (RSBJ), peak anaerobic power measured in watts (PAPw) was calculated from VJ and body mass, relative power was calculated by dividing the PAPw value by the participants body mass. Relative strength was calculated by dividing the HBDL by the participant's body mass (RHDBL). A counterbalanced approach was used for days 2 and 3 which consisted of dragging a 75-kg dummy or a 91-kg dummy 9.75 m. The BD was performed according to the LEA standards. Subjects squatted down and put their arms under the dummy's arms and across its chest. The subject then lifted the dummy and stood in an upright position and started backpedaling towards the finish line. Timing started once the dummy's feet crossed the start line and ended when the feet crossed the finish line. Velocity was calculated by dividing 9.75 m by the BD time. Partial correlations controlling for sex calculated the relationship between the performance measures and the BD velocities. **RESULTS:** Table 1 displays the partial correlations data. HBDL and PAPw were significantly correlated with performance on both dummy masses. SBJ and VJ were only correlated with performance in the 75-kg dummy. Body mass also correlated with 91 kg BD velocity. **CONCLUSIONS:** Controlling for sex, absolute strength (HDBL) and absolute power (PAPw) were important physical qualities for BD performance regardless of the dummy mass. Combined with the findings that the relative measures were not significant for both masses, these results suggest that the heavier dummy mass requires a specific amount of absolute strength and power to successfully move. **PRACTICAL APPLICATIONS:** LEA staff, should they upgrade their BD testing to heavier dummies or wish to develop the physical capability of dragging a heavier mass, should emphasize maximal lower-body strength and power training to ensure successful task performance.

INTRODUCTION

- One of the most critically important job tasks for law enforcement officers is the rescue of a civilian or fellow officer from immediate danger.[1] As such, the state of California utilizes a body drag test as a part of it's state mandated Work Sample Test Battery (WSTB).
- The WSTB is a battery of 5 events designed to screen recruits for their ability to perform work-related tasks.[4,6] Recruits must successfully pass the WSTB in order to graduate from academy.[4]
- In the BD event, recruits must drag a 75-kg dummy 9.75 meters with a standardized grip.
- However, there are some issues with the current structure of the test. The 75-kg dummy used for the BD test is currently underweight compared to current population norms. Indeed, the 75-kg dummy is more comparable to the average male body mass in 1965.[7] Current population norms for adult males place the average body mass at approximately 91-kg.[3]
- It is currently unknown what physical characteristics are essential to BD test performance, and maximal strength has not been measured relative to BD test performance in the literature.[5]
- Therefore, this study intended to examine the relationships between several lower-body performance measures (vertical jump [VJ], standing broad jump [SBJ], one-repetition maximum hexagonal bar deadlift [HBDL], and their relative measures: peak anerobic power measured in watts [PAPw], power-to-body mass ratio [P:BM], relative SBJ [RSBJ] and relative HBDL [RHBDL]) with BD tests with 75-kg and 91-kg dummies.

METHODS

- Thirty (age = 24 ± 3.2 years, height = 174.5 ± 9.05 cm, body mass = 77.9 ± 16.8 kg) college-aged individuals consisting of 19 males (age = 24.05 ± 3.9 years, height = 179 ± 7.1 cm, body mass = 85 ± 16.3 kg) and 11 females (age= 24 ± 1.73 years, height = 166.8 ± 6.6 cm, body mass = 65.7 ± 8.9 kg) were recruited for this study. Subjects were age-matched to a typical cohort of LEO recruits.[2]
- Testing occurred over three days; Day 1 included anthropometrics, SBJ, VJ, and HBDL (and their relative measures). PAPw was derived from the Sayers equation, and P:BM, RSBJ, and relative HBD (RHBDL) were determined by dividing the performance test value by the subject's body mass. Days 2 and 3 included the BD tests with a 75-kg and 91-kg dummy in a counterbalanced approach.
- The BD was performed according to LEA standards,[4] and involved the dummy starting in a seated position on the floor. The subject would then squat down and place their arms under the dummy's arms and across its chest. Then, the subject would lift the dummy into a standing position and backpedal 9.75 m towards the finish line. Timing began once the feet crossed the start line and finished when the feet crossed the finish line. Velocity was derived from dividing the subject's time by 9.75 (*velocity = displacement/time*).
- Partial correlations controlling for sex calculated the relationship between the performance measures and BD velocities. The correlation strength was designated as: an *r* value between .0 and ±0.3 will be considered small; ±.31 to .49 will be moderate; ±.50 to ±.69 is large; ±.79 to ±.89 is very large; and ±.9 to ±1 is near perfect.

RESULTS

- Figure 1 displays the BD times for all subjects combines, males, and females. Table 1 displays the partial correlations controlling for sex results. The HBDL significantly correlated with both the 75-kg and 91-kg BD velocities, and the strength of both correlations was large.
- VJ and SBJ had significant moderate relationships with BD velocity for the 75-kg dummy only. PAPw also had significant large correlations with BD velocities for the 75-kg and 91-kg dummies.
- Additionally, body mass had a significant moderate correlation with only the 91-kg BD velocity.

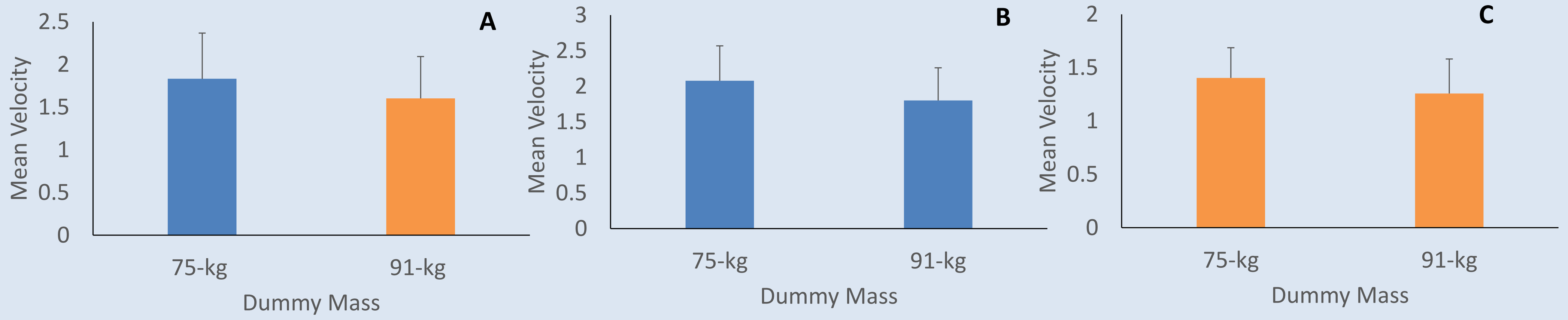

Figure 1. Mean velocity for the pooled sexes (A), males (B) and females (C) for the 75-kg and 91-kg masses.

Table 1. Partial Correlations controlling for sex between anthropometrics, performance variables and the BD test velocities for the 75-kg and 90-kg dummies.

		Age	Height	Body Mass	VJ	PAPw	P:BM	SBJ	RSBJ	HBDL	RHBDL
75-kg Velocity	r	.047	.112	.329	.371*	.719**	.175	.377*	-.128	.704**	.344
	p	.807	.563	.081	.047	.000	.364	.044	.509	<.001	.068
91-kg Velocity	r	.001	.089	.374*	.304	.703**	.149	.283	-.153	.670**	.316
	p	.996	.645	.046	.109	.000	.441	.137	.428	<.001	.095

*Denotes $p < .05$, ** Denotes $p < .001$

CONCLUSION

- When controlling for sex, maximal lower-body strength (HBDL) and absolute power (PAPw) were important physical qualities for performance on the BD test regardless of dummy mass.
- Combining these results with the findings that relative measures such as P:BM, RSBJ, and RHBDL did not have significant relationships with BD velocity, this suggests that there is specific maximal strength and maximal power requirements to successfully complete the BD test regardless of the mass of the dummy.
- Thus, it may not necessarily matter if someone is relatively strong/powerful for their height or body mass, as the dummy mass is set and therefore requires a specific amount of absolute lower-body strength and power.

PRACTICAL APPLICATIONS

- The findings from this study have important implications for the training and testing of LEO recruits. Should LEAs update their BD mass to fit the current trend of population mass, LEAs may need to emphasize a different approach to their training in order to ensure their LEOs can successfully perform the task.
- LEAs should focus on developing the qualities of lower-body maximal strength and power to successfully prepare their recruits to drag a victim of any mass.
- Smaller and/or lighter recruits should specifically target maximal strength and power as they are limited by their body size.

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