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Relationships Between Lean Body Mass and Fat Mass with Physical Fitness Performance in Deputy Sheriff Recruits

Blake N. Carlock¹ ♦ Matthew R. Moreno¹ ♦ Joseph M. Dulla² ♦ J. Jay Dawes³ ♦ Robin M. Orr⁴ ♦ Robert G Lockie¹

¹Center for Sport Performance, Department of Kinesiology, California State University, Fullerton, CA, USA. ²Recruit Training Unit, Training Bureau, Los Angeles County Sheriff's Department, Los Angeles, CA, USA.

³Department of Health Sciences, University of Colorado-Colorado Springs, Colorado Springs, CO, USA.

⁴Tactical Research Unit, Bond University, Robina, Qld, Australia.



ABSTRACT

Law enforcement can be a physically demanding profession, where officers may be required to complete low- and high-intensity efforts at various times while on duty. The purpose of academy training is to prepare recruits for these demands. It could be expected that a greater amount of lean body mass (LBM), and less fat mass (FM), would be beneficial to fitness and job-specific performance in law enforcement recruits. Several studies have analyzed these relationships in law enforcement populations, but not in deputy sheriff recruits at the start of academy. The purpose of this study was to measure the relationships between body composition (LBM and FM) and fitness test performance in deputy sheriff recruits prior to academy. A retrospective analysis was conducted on 284 (230 males, 54 females) recruits from three academy classes. Health and fitness tests included: LBM and FM as a percentage of body mass derived using bioelectrical impedance analysis; grip strength for both left (L) and right (R) hands; arm ergometer revolutions in 60 s; push-ups and sit-ups completed in 60 s; a 75-yard pursuit run (75PR); seated medicine ball throw (MBT) with a 2 kg medicine ball; vertical jump (VJ); and number of shuttles in the multistage fitness test (MSFT). Partial correlations controlling for sex were used to derive relationships between FM, LBM, and the fitness tests ($p < 0.05$). Fat mass had small, but significant, negative correlations with: grip strength (L), VJ, push-ups, sit-ups, and MSFT shuttles ($r = -0.19$ to -0.27). A small, but significant, positive correlation was found between FM and the 75PR ($r = 0.23$). LBM also demonstrated small, but significant, positive correlations with: grip strength (L), VJ, push-ups, sit-ups, and MSFT shuttles ($r = 0.15$ - 0.25). A negative relationship between LBM and the 75PR was also found ($r = -0.22$). Although correlation strength was generally small, recruits with lower FM and higher LBM tended to perform better on the aerobic and anaerobic fitness tests, while recruits with higher FM and lower LBM tended to perform worse on these measures. Although these relationships may be expected, they have not been documented in a deputy sheriff recruit population. This is important given that the academy training period of 22 weeks, in conjunction with less-than-optimal training methods (high running volumes with restricted recovery), could lead to reductions in LBM. Law enforcement agency staff should monitor changes in FM and LBM over the course of academy.

INTRODUCTION

- Law enforcement is typically a physically demanding profession, where officers may be required to carry, drag, push, pull, lift, vault, jump, sprint, use force, and sustain running at varied periods when on-duty.^{2,4} Academy training is used to prepare recruits for these demanding tasks and the physicality necessary for duty.¹
- It could be expected that greater lean body mass (LBM), and less fat mass (FM), should be beneficial to physical fitness and job-specific performance in law enforcement recruits.
- There has been some analysis of this in state highway patrol officers, with Dawes et al.² finding significant negative correlations in fitness test performance amongst officers with higher amounts of FM. However, there has been no analysis of the body composition of deputy sheriff recruits at the start of academy.
- The purpose of this study was to measure the relationships between body composition (e.g., LBM and FM), and fitness test performance in deputy sheriff recruits prior to the start of academy.

METHODS

- A retrospective analysis was conducted on recruits from three academy classes. This encompassed a total of 284 recruits (230 males: age 38 ± 18 years, height 162 ± 34 cm, and body mass 86.5 ± 32.5 kg), and (54 females, age 32.5 ± 12.5 years, height 160.5 ± 11.5 cm, and body mass 64 ± 15 kg).
- Health and physical fitness tests occurred in the week prior to the start of academy. The tests included: LBM and FM as a percentage of body mass measurements derived using bioelectrical impedance analysis; grip strength for both left (L) and right (R) hands; revolutions on an arm ergometer in 60 s; push-ups and sit-ups completed in 60 s to measure muscular endurance; a 75-yard pursuit run (75PR), which was a simulated foot pursuit involving sprinting and direction changes about a grid (Figure 1);³ seated medicine ball throw (MBT) with a 2 kg medicine ball and vertical jump (VJ) as measures of upper- and lower-body power, respectively; and number of shuttles in the multistage fitness test (MSFT) to measure aerobic fitness.
- Partial correlations controlling for sex were used to determine if significant relationships existed between LBM, FM, and the fitness tests ($p < 0.05$) on the pooled recruit data ($n = 284$).

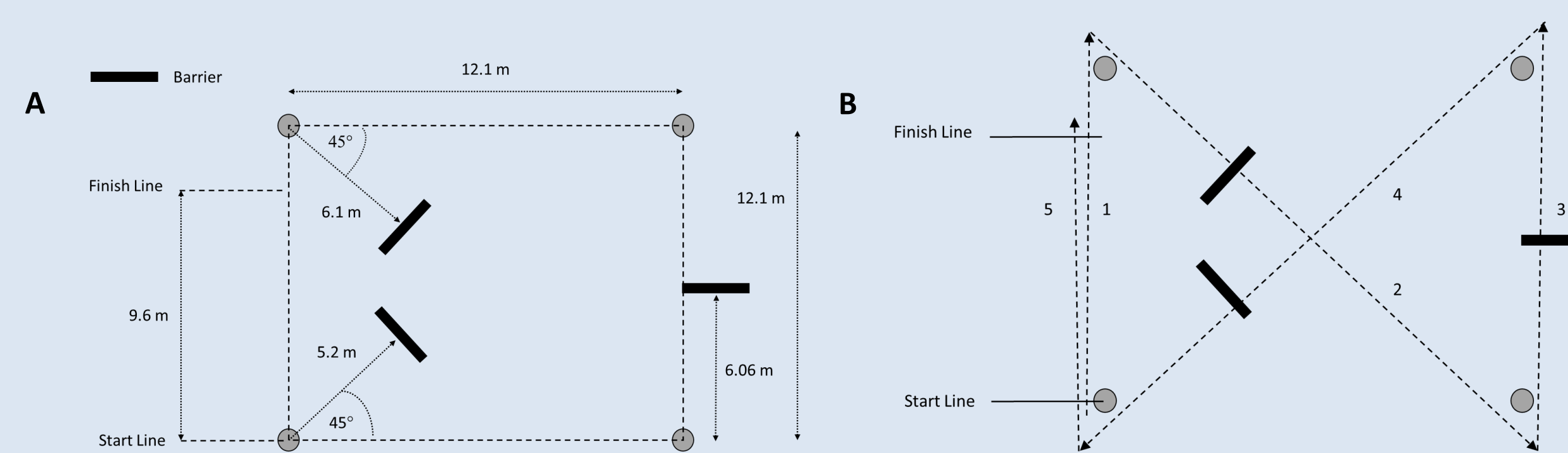


Figure 1. (A) The dimensions for the 75-yard pursuit run in meters (m) and (B) the running direction (numbered in order) for the 75-yard pursuit run. The barriers were 2.44 m long and 0.15 m high.

RESULTS

- The test performance data for the three recruit classes is shown in Table 1.
- LBM had small, but significant, positive correlations with: grip strength for both hands, push-ups, sit-ups, VJ, and MSFT shuttles. LBM also had a small, but significant, negative correlation with the 75PR.
- FM had small, but significant, negative correlation with: grip strength (L), push-ups, sit-ups, VJ, and MSFT shuttles. FM also had a small, but significant, positive correlation with the 75PR.

Table 1. Correlation table for all recruit physical fitness performances. Descriptive data is also indicated in the correlation table.

Physical Fitness Tests	Descriptive Data Mean \pm SD	LBM Relationships		FM Relationships	
		r value	p value	r value	p value
Grip Strength L (kg)	45.77 \pm 11.85	.15*	.01	-.15*	.01
Grip Strength R (kg)	47.05 \pm 11.25	.12*	.04	-.11	.07
Arm Ergometer	132.67 \pm 20.09	.06	.33	.01	.91
Push-ups (no.)	42.73 \pm 16.14	.19*	.00	-.21*	.00
Sit-ups (no.)	36.24 \pm 10.74	.18*	.00	-.19*	.00
75PR (s)	17.14 \pm 1.25	-.22*	.00	.23*	.00
MBT (m)	6.05 \pm 1.33	.05	.37	.02	.74
VJ (cm)	54.33 \pm 13.31	.16*	.01	-.17*	.01
MSFT shuttles (no.)	53.88 \pm 17.91	.25*	.00	-.27*	.00

* Significant ($p < 0.05$) relationship between the two variables.

CONCLUSIONS

- Although correlation strength was generally small, recruits with higher LBM and lower FM tended to perform better on the aerobic and anaerobic fitness tests, while recruits with lower LBM and higher FM tended to perform worse on these measures.
- Although these relationships between anthropometric measures (body mass, LBM, and FM) and fitness test performance may be expected, they have not been documented in a deputy sheriff recruit population.
- Dawes et al.² recommends that decreasing FM and increasing LBM could lead to positive changes in physical fitness performance in law enforcement populations. This is important given that the academy training period of 22 weeks, in conjunction with less-than-optimal training methods (high running volumes with restricted recovery),⁴ could lead to reductions in LBM.
- Law enforcement agency staff should monitor changes in recruits LBM and FM over the course of the 22-week academy period.

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