

## Changes in fitness over an 11-week training program among firefighter trainees

Stone, BL; Dawes, Jay; Goatcher, JD; Orr, Rob Marc; Lockie, Robert G.; Alvar, B

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# CHANGES IN FIRE FIGHTER RECRUIT FITNESS LEVELS OVER AN 11-WEEK FIRE ACADEMY SESSION

<sup>1</sup>Stone, BL, <sup>2</sup>Dawes JJ, <sup>2</sup>Goatcher JD, <sup>3</sup>Orr RM, <sup>4</sup>Lockie RG, <sup>5</sup>Alvar B.

<sup>1</sup>Department of Health and Exercise Science, University of Oklahoma, Norman, OK, USA

<sup>2</sup>College of Nursing and Health Sciences, University of Colorado- Colorado Springs, USA

<sup>3</sup>Tactical Research Unit, Bond University, Gold Coast, QLD, Aus

<sup>4</sup>Department of Kinesiology, California State University, Fullerton, Fullerton, USA

<sup>5</sup>Point Loma Nazarene University, San Diego, USA



## ABSTRACT

**Purpose:** To determine baseline physical fitness characteristics and assess the effectiveness of an 11-week training program among firefighter recruits.

**Methods:** Archived data for twenty-three (n=23, age 27.75 ± 3.64, ht: 178.5 + 6.9 cm, wt: 85.9 + 10.1 kg, BMI: 26.94 + 2.7) firefighter trainees were used for this analysis. This data included: age (yrs); height (cm); weight (kg), vertical jump height, grip strength, upper-body strength (i.e. pull-ups), lower-body strength (3-RM hex-bar deadlift), and aerobic fitness (20-meter multi-stage fitness test). The training program consisted of three 1-hour physical training sessions per week (2 resistance training and 1 running aerobic session) in addition to their normal skill-specific training. Paired sample T-tests were used to determine if significant changes occurred over the 11-weeks.

**Results:** Significant changes from pre-to-post academy for body mass (-3%, p<0.001), BMI (-15.4%, p<0.001), pull-ups (24.5%, p<0.001), lower-body absolute strength (12.2%, p<0.001), lower body relative strength (14.8%, p<0.001), and 20MSFT (38.7%, p<0.001).

**Conclusion:** Fitness can be improved during fire training academy with minimal equipment and specific fire ground training over an 11-week training academy.



## METHODS

- Archived data for a cohort of 23 male fire academy recruits was analyzed to determine the effects of an 11-week fire academy session on body mass, BMI, and physical fitness.
- Anthropometric Tests: height(cm), body mass(kg), and BMI.
- Pre and post training Fitness tests: vertical jump(anaerobic power), grip strength(upper-body strength), maximal repetition pullup test (muscular endurance), a 1-3-RM hex-bar deadlift test(lower-body strength), and the 20-meter multi-stage fitness test (Aerobic fitness). Measures of power in watts (PAPw) using body mass and vertical jump height were also calculated using the Sayers equation, and relative strength (estimated 1RM Hex bar deadlift/body mass) were also calculated for further analysis.
- ❖ **Training Program:**
  - Formal physical training was performed two days a week for an hour and fifteen minutes
  - Training consisted of a dynamic warm-up, agility, hypertrophy/strength training, core, and cooldown.
  - Limited equipment was available, with dumbbell, single leg, and body weight exercises being used.
- ❖ **Statistical analyses (SPSS):** A series of paired sample t-tests were performed to determine changes in anthropometrics pre and post training academy. All analysis were set an a priori level of p ≤ 0.05.

## RESULTS

- See Table 1 and Figures 1-4

**Table 1: Descriptive Statistics**

Measure	Pretraining	Posttraining	% Change
Height (cm)	178.3±6.9	178.3±6.9	0.00
Body Mass (kg)	85.9±10.1	83.5±9.3**	-2.9
BMI	26.9±2.7	23.3±2.2**	-15.4
Hex-bar 1RM (lb)	307.1±49.2	350.3±47.8**	12.2
Hex-bar Relative (1RM/Body Mass)	1.6±0.3	1.9±0.2**	14.8
20MSFT Completed Shuttles	41.0±14.2	66.8±16.3**	38.7
Pull-up	8.83±4.9	11.7±5.1**	24.5
Vertical Jump (in)	24.1±3.5	24.2±2.8	0.4
Power (PAPW)	5546.2±582.3	5445.9±549.6	-1.8
R Hand Grip (kg)	55.8±6.8	53.6±7.8	-4.1
L Hand Grip (kg)	54.3±6.7	52.7±6.9	3.0

\*=p<0.05, \*\*=p<0.001

**Figures 1-4: Significant Changes in Fitness Measures**



## DISCUSSION

- Lower body strength has not been shown as a significant factor for firefighting job task performance and may be an important factor for performing maximal strength efforts in an emergency situation (e.g. dragging a victim from a burning building).
- Significant increases in lower body strength (relative & absolute) significantly increased as well as the 20MSFT.
- Previous research has shown similar increases in fitness measures after implementing a training program with similar populations.
- Hand grip and vertical jump did not significantly change over the 11-week period,
- The average time spent performing formal aerobic training was less than an hour per week, suggesting that significant increases in 20MSFT scores were partially due to fireground training.

## PRACTICAL APPLICATION

- Utilizing body weight training, single leg movements, and other dumbbell exercises in conjunction with adapting to the demands of firefighting are enough to significantly increase fitness measures in fire academy recruits.
- Fireground training may present a sufficient level of aerobic adaptations where traditional aerobic training may not be necessary during a fire academy session.

## REFERENCES

- Andrews KL, Gallagher S, and Herring MP. The Effects of Exercise Interventions on Health and Fitness of Firefighters: A Meta-Analysis. Scand J Med Sci Sports, 2019.
- Cornell DJ, Gnacinski SL, Meyer BB, and Ebersole KT. Changes in Health and Fitness in Firefighter Recruits: An Observational Cohort Study. Med Sci Sports Exerc 49: 2223-2233, 2017.
- Fahs CA, Smith DL, Horn GP, Agiovlasis S, Rossow LM, Echols G, Heffernan KS, and Fernhall B. Impact of excess body weight on arterial structure, function, and blood pressure in firefighters. The American journal of cardiology 104: 1441-1445, 2009.
- Gnacinski SL, Ebersole KT, Cornell DJ, Mims J, Zamzow A, and Meyer BB. Firefighters' cardiovascular health and fitness: An observation of adaptations that occur during firefighter training academies. Work (Reading, Mass) 54: 43-50, 2016.

## INTRODUCTION

- Fire training academy attempts to prepare new firefighters to be 'fit for duty' to sustain the extensive physical demands required by the job. Subsequently, training should focus on developing physical fitness during training academy.
- Evidence has shown declines in fitness scores post-academy training and overall inadequate levels of physical fitness required by the demands of firefighting (2, 3).
- Numerous time and equipment constraints often exhibit challenges in training academy populations which necessitates strength and conditioning professionals utilizing the limited resources available to attain and maintain the required level of occupational fitness to support the physical demands of required job tasks

