

IFSI Certified Firefighter II Academy

Academy Physical Fitness Program – Spring 2005

Conclusion Report

Submitted by Steven J. Petruzzello, Ph.D.
Department of Kinesiology

In the Spring of 2005, the Department of Kinesiology (Associate Professor Steven J. Petruzzello) collaborated with the Illinois Fire Service Institute to conduct an evaluation of the IFSI Certified Firefighter II Academy course, specifically examining the effects of the Academy's recently implemented Physical Training (PT) Program. As noted in the Standard Operating Guidelines (SOG #10) for the Academy's PT program:

The mission of the Physical Training (PT) program at the Academy is threefold. First, to safely train candidates so they are able to overcome physical challenges in the next 6 weeks and graduate the Academy. Secondly, to prepare candidates to meet the physical demands of their future assignments. Thirdly, to instill the importance of a high level of personal fitness in their fire service careers.

In addition to our threefold mission, the program strives to achieve additional objectives. The program strives to progressively condition and toughen candidates for firefighting duties, develop candidates' self-confidence, discipline, and team spirit. The program strives to develop healthy life-styles through education, and improve physical fitness to the highest level possible. A firefighter's level of physical fitness has a direct impact on his emergency response.

To this end, the objective of the evaluation undertaken by IFSI and the Department of Kinesiology was to determine the extent of change in various fitness parameters that occurred over the course of the 6-week Academy program. The PT program itself was led by Academy staff and was conducted every morning, Monday-Thursday, for approximately 30 minutes. The program was designed to be progressively challenging to candidates. Candidates' initial and ending physical fitness levels were evaluated using the Academy Physical Fitness Test. Additionally, several other fitness parameters were assessed at the beginning and end of the program. These evaluations were deemed important for determining the physical readiness of the individual candidates. The Academy PT Staff used such information in planning the PT schedule, modifying the PT Program Outline, and dividing the Academy into conditioning groups based on candidate fitness levels. The initial assessments were necessary to allow the PT program to be challenging enough (based on the intensity or duration of the conditioning phase) to provide the candidates with the best chance to improve their fitness levels. Candidates could also use that information in setting personal goals and motivating each other to improve performance.

The Academy Physical Fitness Test

The specific testing developed for the Firefighter II Academy candidates was referred to as the Academy Physical Fitness Test (APFT). This is a three-event physical performance test to assess cardiorespiratory fitness and muscular endurance. Performance on the APFT is strongly linked to the candidates' fitness level and their ability to perform physical tasks on the fireground. Following a warm-up consisting of stretching and basic calisthenic exercises (e.g., jumping jacks), the candidates completed three separate tests: (a) 1.5 mile run for time (i.e., time to complete 1.5 mile course; measure of cardiorespiratory fitness); (b) 1 minute sit-up test (i.e., number of sit-ups completed in 60 seconds);

*Academy Physical Fitness Program Conclusion Report
Submitted 8-17-2005*

and (c) 1 minute push-up test (i.e., number of push-ups completed in 60 seconds). The latter two tests provide an index of muscular endurance. In addition to these field tests, several additional measures were obtained during the course of the first and last weeks of the Academy course. Candidates were measured for height and weight, had resting heart rate and blood pressure recordings taken, had circumference measures taken of their waist and hips, and underwent a skinfold assessment for body composition analysis. Specifically, the 3-site assessment method was used for body composition. This entailed measures of chest, abdomen and thigh (for males) or triceps, suprailiac and thigh (females). The Jackson-Pollock 3-site equations were used to calculate first body density [Male Body Density = $(1.1093800 - (0.0008267 * (\text{Sum of 3}))) + (0.0000016 * (\text{Sum of 3} * \text{Sum of 3})) - (0.0002574 * (\text{Age}))$]; Female Body Density = $(1.0994921 - (0.0009929 * (\text{Sum of 3}))) + (0.0000023 * (\text{Sum of 3} * \text{Sum of 3})) - (0.0001392 * (\text{Age}))$] and then body composition [% Bodyfat = $((4.95 / \text{Body Density}) - 4.50) * 100$]. On a separate day candidates completed a slightly modified version of the YMCA muscular endurance test. This involved bench pressing a constant weight (85 pounds for males, 35 pounds for females) at a specified cadence (1 complete repetition every 2 seconds) either until exhaustion or the cadence could no longer be maintained. As noted, the candidates were tested at the beginning and end of the Academy. Individual candidates are encouraged to set goals and to strive to improve themselves physically.

Results

Due to the nature of the Academy's PT program, it is not too surprising that the overall outcome of the training was an improvement in physical fitness parameters. Testing was done with two consecutive Academy courses, involving a total of 45 candidates (mean age = 27.3 yrs). The overall results are shown below in Table 1.

	Pre-Test		Post-Test		Pre-to-Post Change	Significant Change?
	Mean	SD	Mean	SD		
Weight	195.9	33.7	195.3	30.2	-0.60	Yes
Resting Heart Rate (bpm)	80.0	12.6	70.2	9.4	-9.8	Yes
Resting SBP (mmHg)	125.4	12.1	123.2	11.6	-2.2	Yes
Resting DBP (mmHg)	83.1	9.2	75.1	10.0	-8.0	Yes
Waist Circumference (in)	35.6	4.5	34.7	3.9	-0.9	Yes
Hip Circumference (in)	35.8	3.7	35.1	3.4	-0.7	Yes
Sum of Skinfolds (mm)	49.8	13.6	46.2	1.99	-3.6	Yes
Body Composition (%)	14.80	4.33	12.70	4.27	-2.1	Yes
1.5 Mile Run Time (min:sec)	13:29	1:58	11:40	1:16	-1:49	Yes
1-min Push-ups (#)	37.0	13.7	56.2	13.8	19.2	Yes
Muscular Endurance (bench press) (#)	23.6	9.5	33.1	11.2	9.5	Yes
1-min Sit-ups (#)	30.4	9.3	37.5	9.1	7.1	Yes

Note: SD refers to standard deviation, a measure of the variability within the sample.

As is clear from the results presented in the Table, the PT program resulted in significant changes in all of the physical fitness parameters assessed. These results compare favorably to a previous report of the PT program (although this report only included the 3 events from the APFT). In that report, a +10

improvement was seen in push-up performance (compared to +19 in the current sample), a +8 improvement was seen in sit-up performance (compared to +7 in the current sample), and a 1:25 reduction was seen in the 1.5 mile run time (compared to -1:49 in the current sample). Given the relatively short length of the PT program, these changes are to be viewed rather positively. Despite little change in overall weight, there were fairly marked changes in the sum of skinfolds and thus body composition. Given the minor change in body weight, this reflects the fact that while fat weight was reduced, muscle mass increased somewhat.

In essence, the candidates left the Academy in better physical condition than they entered. Additionally, anecdotal reports from many of the candidates gave the impression that they felt better able to handle the requirements of the job of being a firefighter as the course progressed, in part because they felt better equipped physically as a result of the PT program. The ultimate goal of the PT program is to show the candidates that working toward their set goals and possibly competing against other candidates leads to improved physical fitness. Perhaps most importantly, seeing improvements in their physical fitness will motivate them to continue a high level of personal fitness in their fire service career.

Contact Information:

Dr. Steven Petruzzello
 Professor of Kinesiology and Psychology
 University of Illinois at Urbana-Champaign
 906 S. Goodwin Ave
 Urbana, IL 61801
 (217) 244-7325
petruzze@uiuc.edu

Dr. Denise L. Smith
 Professor and Chair Department of Exercise
 Skidmore College
 (217) 265-6564

IFSI Staff:

Kurt Glosser
 Physical Training Coordinator
 (217) 265-0582
kglosser@fsi.uiuc.edu

Greg Elliott
 Physical Training Coordinator
gelliott@fsi.uiuc.edu

Tad Schroeder
 Firefighting Assistant Director
 (217) 333-8927
tjschroe@fsi.uiuc.edu

Brian Brauer
 Firefighting Director
 (217) 333-9027
brbrauer@fsi.uiuc.edu