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Effects Of A Six-Week Functional Training Program On Fitness And Body Composition Of Fire Science Majors

Kristen Anne LeBrun
Eastern Kentucky University

EFFECTS OF A SIX-WEEK FUNCTIONAL TRAINING PROGRAM ON FITNESS AND BODY COMPOSITION OF FIRE SCIENCE MAJORS

By

Kristen A. LeBrun

Thesis Approved:

Chair, Advisory Committee
Dr. Jim Larkin

Member, Advisory Committee
Dr. Michael Lane

Member, Advisory Committee
Paul Grant

Dean, Graduate School
Dr. Jerry J. Pogatshnik

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By
Kristen A. LeBrun
Bachelor of Science
Hanover College
Hanover, Indiana
2011

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DEDICATION

This thesis is dedicated to
Eric Robinson
and all firefighters for their
honorable service.

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I would like to thank my major professor, Dr. Jim Larkin, for his guidance and patience through every step on this journey. I would also like to thank the other committee members, Dr. Michael Lane and Paul Grant, for their influential comments and assistance during this past year. I would like to express my thanks to my fiancé, Jonathan, for his positive encouragement, reminding me that there is a light at the end of the tunnel. I would also like to thank my colleague, Jessica Moody, for her confidence in making a difference in the firefighting community. I owe her many thanks for the organization and completion of this study. I would also like to thank the members of my family, my parents, Steve and Julie LeBrun, and adventurous siblings, Stephanie, Kerry, Sarah, and Casey LeBrun. With God all things are possible.

ABSTRACT

Introduction: The leading cause of on duty death of firefighters is sudden cardiac events. Current research has shown the effects of fire physical training programs on firefighters, but has not researched fire specific physical training programs for the fire science major population. **Purpose:** The purpose of this study was to examine the effects of a six-week functional program on fitness and body composition of fire science majors. **Methods:** Fire science college students (N = 16) volunteered to take part in a six-week fire specific fitness program. The subjects that fully completed the study (N = 12) were randomly assigned to a control group (CG; n=6) or an exercise group (EG; n=6). Both groups underwent pre and post testing prior to and following the six-week training period. Subjects performed a battery of fitness tests which included: one-mile run, body fat percentage, height, weight, waist and hip circumference, push-up, sit-up, flexed-arm hang, and a fire specific physical performance test. The CG was asked to resume their usual fitness and nutrition regimen. The EG participated in the six-week, four-day per week training program. **Results:** Age (yr.), EG: 21.8 $\pm$ 3.5; CG: 22.2 $\pm$ 4.5; Height (in.), EG: 72.0 $\pm$ 5.5; CG: 71.6 $\pm$ 3.1; Weight (lbs.), EG: 203.8 $\pm$ 40.1; CG: 170.1 $\pm$ 21.8. The EG showed a greater percent change than the CG in body weight, body fat percentage, the one-mile run, the stair climb, and the push-up tests. No significant differences were found for any of the tests. **Discussion:** The results suggest that the low sample size was a major limitation in this study. Although no significant differences were found for the battery of tests, beneficial trends were shown in the percent changes in comparison of EG to CG from pretest to posttest. With a greater sample size, potential improvements from fire specific training could be revealed.

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CHAPTER I – INTRODUCTION

Introduction

Obesity has reached epidemic levels in the United States. According to the Center for Disease Control (CDC) more than one-third (78.6 million) of U.S. adults are obese (Adult Obesity Facts, 2014). The obesity problem appears to have a simple solution: adequate exercise, physical activity and nutrition. However, obesity is affecting every age group from youth to adulthood and is visible in almost any working sector. In particular, firefighters are at high risk for obesity. Current studies show that 70% or more of firefighters have a body mass index (BMI) that is categorized as obese or overweight (Wilkinson et al., 2014; Fahy, LeBlanc, & Molis. 2006; Smith et al., 2012). Steps should be taken, to promote exercise in firefighters before and after they are hired, as well as continually throughout their career.

College is an essential time to build foundations for lifetime wellness and fitness. Lifelong habits are formed during the young adult years (Sweeney, 2011). Fire science students become highly educated in the field which intellectually prepares them for their future career. Unfortunately, they lack the physical preparation needed to meet the physiological demands of firefighting.

Firefighters are commonly required to take a standardized physical performance test in order to get hired by a department. The Candidate Physical Ability Test (CPAT) is used in fire departments across the United States and is composed of a circuit of fire simulation activities (Williams-Bell, Villar, Sharratt, & Hughson, 2009). Physical performance tests such as the CPAT are designed to mimic the anaerobic and aerobic demands of firefighting (Williams-Bell, Villar, Sharratt, & Hughson, 2009). Muscular endurance and strength as well as tactical preparedness are challenged in firefighter performance tests. Intense training is required to pass the physical performance tests. However, once an individual has passed the test and is hired by a department, many fire departments do not require their firefighters to retake the test ever again. A major concern with this current standard is the decline of fitness and health of firefighters as they age.

Fire specific training as well as general cardiovascular and muscular fitness is needed throughout the entire career of a firefighter. Without physical training regimens firefighters are becoming statistics. Myocardial infarctions or ‘heart attacks’ are the leading cause of firefighter duty related deaths in the United States and account for almost 45% of deaths (Soteriades, Smith, Tsismenakis, Baur, & Kales, 2011; Smith et al., 2012). Diseases associated with obesity are prevalent in firefighters as well which include: hypertension, type II diabetes and high cholesterol. The health of firefighters is not only a concern to the wellbeing of the firefighter but also to public safety. Thus, effective functional fitness programs are the foundation for lifelong healthy habits and optimal physical performance for firefighters throughout their career.

Need for the study

Firefighters are extensively trained to extinguish fires, perform rescues, and respond to emergencies (Bureau of Labor Statistics, 2014). Fire fighting also requires the individual to be physically capable of performing fire-related tasks from the moment they are hired until they retire. To prepare for this, firefighters should participate in a functional physical training program that simulates tasks at a fire scene as well as regular fitness maintenance. As of now, it is the decision of each fire department to provide exercise prescription or training programs for firefighters. The National Fire Protection Association (NFPA) has recommended but not required physical training for fitness in firefighters (Findley, Brown, Whitehurst, Gilbert & Apold, 1995). The fire science major at the university is a unique opportunity to incorporate fire-related physical training as part of the fire science curriculum. In doing so, the fire science majors will be provided the exposure to fire simulation exercises as well as a basis for a functional fitness program they can continue throughout their career. The goal of the current study was to show that proper physical training can be performed utilizing readily available equipment found at the fire station as well as simple body weight exercises.

Statement of the problem

The purpose of this study was to determine the effects of a six-week functional fitness-training program on fitness and body composition of college-aged fire science students.

Research Hypotheses

It was hypothesized that:

1. the exercise group (EG) would increase cardiovascular fitness and muscular endurance compared to the control group (CG);
2. the exercise group (EG) would decrease body composition compared to the control group (CG);

3. the exercise group (EG) would perform the stair climb in a faster time posttest than pretest.

Delimitations

All subjects completed testing in the same order in pre testing and post testing. The subjects were students enrolled in fire science majors at the university. The subjects were not career firefighters. The subjects were randomly assigned to the workout group or the control group. The independent variable was the four-day per week, six-week functional fitness training that the exercise group participated in. The dependent variable was the cardiovascular fitness, muscular endurance and body composition of the subjects.

Limitations

1. A low subject sample size, which was limited by statistical power.
2. The subjects were college students who volunteered for the study and therefore were not a true representation of the fire science major population.

Assumptions

1. Subjects followed directions properly throughout the study.
2. Subjects truthfully answered the physical activity readiness questionnaire.
3. Dietary habits of all subjects did not change throughout the course of the study.
4. Subjects in the exercise group maintained proper form and technique throughout training period.
5. Subjects in the control group maintained the same exercise habits as before the study.

6. The fitness assessment instruments were valid to assess the overall fitness level of subjects.

Operational Definitions

1. Candidate Physical Ability Test (CPAT): "content based circuit of activities designed for screening of potential firefighter candidate recruits" (Williams-Bell, Villar, Sharratt, & Hughson, 2009).
2. Exercise: "a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness (Thompson, Gordon & Pescatello, p. 2, 2010).
3. Physical Fitness: "a set of attributes or characteristics that people have or achieve that relates to the ability to perform physical activity" (Thompson, Gordon & Pescatello, p.2, 2010).
4. Firefighter: individuals who control and extinguish fires or respond to emergency situations where life, property, or the environment are at risk (Bureau of Labor Statistics, 2014).
5. Myocardial Infarction: complete obstruction of blood flow to the cardiac tissue resulting in tissue death or necrosis (Thompson, Gordon & Pescatello, 2010).
6. Periodization: systematic variation in program design, of exercise, resistance, sets and rest periods (Bompa & Buzzichelli, 2015).
7. Physical Activity: "any bodily movement produced by the contraction of skeletal muscles that result in a substantial increase over resting energy expenditure" (Thompson, Gordon & Pescatello, p.2, 2010).

CHAPTER II - REVIEW OF LITERATURE

Introduction

The study on the effects of a six-week functional training program on fitness and performance of fire science subjects has been researched and is divided into the following sections: 1) firefighters and obesity, 2) physical demands of firefighting, 3) training for firefighters, and 4) need for physical fitness training in students majoring in fire science.

Firefighters and Obesity

The prevalence of obesity in the United States is rampant. Obesity affects more than one third of adults in the U.S. (Ogden, Carroll, Kit & Flegal, 2014). Sedentary lifestyles and poor nutrition are factors in causing this epidemic. Obesity has risen to epidemic levels in the workplace as well. Specifically firefighting is an occupation that has been negatively impacted by the effects of obesity. Although physical fitness is required in firefighting, obesity is a major hindrance to the duties of firefighters. Additionally, obesity poses major health risks to the firefighter, and also to public safety.

More than 70% of firefighters are obese (Wilkinson et al., 2014). Firefighters that are obese have the risk of developing diseases that are associated with obesity. These diseases include: hypertension, high cholesterol, diabetes, cancer and cardiovascular disease, all which can be prevented. Although these risks are associated with anyone who is obese, firefighters are called to perform at high-intensity workloads while on duty. Lack of physical fitness and inadequate heart health has led to daunting statistics that call for action in fire departments across the United States.

Sudden cardiac arrests or 'heart attacks' are the leading cause of firefighter duty related deaths in the United States (Soteriades, Smith, Tsismenakis, Baur, & Kales, 2011). Approximately 45% of firefighter duty related deaths are from sudden cardiac events, making this the highest percentage among occupational groups (Smith et al., 2012). Deaths tend to occur in the time following a fire scene response. When a fire call occurs the firefighters are called from rest to immediate action. The immediate physiological response to a fire call triggers the sympathetic nervous system. The firefighter's body releases the hormone norepinephrine and goes into fight or flight mode (Farrell, 2012). The firefighter is expected to dress rapidly in full equipment and gear that includes the self contained breathing apparatus (SCBA) which weighs approximately twenty pounds (Campbell & Langford, 1990).

During travel time to the fire scene the firefighter's sympathetic nervous system continues to be activated. The sympathetic nervous system acts to give the body increased strength, speed and alertness for the perceived or real task to come. Heart rate, blood flow, and blood pressure increase, as does muscular tension (Farrell, 2012). Once the firefighters reach the scene they are to act in a rapid and efficient manner to extinguish the fire. The hoses and tools used during firefighting are physically demanding. If the firefighter is not on "fire attack" (putting out the fire) then they are assisting in other duties such as; backing up hose lines, ventilation, search and rescue, and rapid intervention. The physical demands are extreme until the fire is extinguished.

Following the fire scene, the firefighter's body needs to adapt from the highly elevated sympathetic nervous system activation back to parasympathetic nervous system activation associated with the resting state and homeostasis (Farrell, 2012). During this transition, successful physiological adaptation depends on the physical fitness and heart health of the firefighter (Ridenour et al., 2008).

Physical Demands of Firefighting

Firefighting, in the line of duty, is a vigorous and physically demanding task. The exertion from fighting a fire is both mentally and physically stressful. On duty, firefighters are at risk of suffering musculoskeletal injuries from lifting and injuries from overexertion (Karter, Molis, 2012). It is important to understand that a higher body mass index (BMI) is related to significantly higher cardiovascular risk as well as lower exercise capacity (Tsismenakis et al., 2009). Alarmingly, studies show obesity is the correlating factor for firefighter injuries as well as cardiovascular events (Poplin, Harris & Pollack et al., 2011; Smith et al., 2012).

The physical tasks firefighters perform engage the human body in ways that far exceed a typical desk job. Firefighting stresses the cardiovascular and musculoskeletal systems both anaerobically and aerobically (Abel, Mortara, & Pettitt, 2011). Unfortunately, and all too often, the only time a firefighter is stressed physically is during a firefighting call. Typical fire department shifts consist of waiting at the fire station until a distress call comes in. During shift time, the mostly sedentary firefighters accomplish daily tasks the fire station needs accomplished. The operational definition that defines most fire stations is "sedentary."

Pre-employment fitness testing screening is utilized by fire departments in the hiring process of firefighter candidates. Fitness screenings are meant to replicate the high physical demands of firefighters. Fire performance tests were developed to test physical fitness and efficiency during fire specific tasks. The Candidate Physical Ability Test (CPAT) is a nationally recognized firefighting simulation test that fire departments use to screen applicants. Williams-Bell, Villar, Sharratt, and Hughson (2009) examined the physiological demands of the CPAT and found that the CPAT challenged the aerobic and anaerobic energy systems. In 58 participants, heart rate averaged at 90% of maximum across the entire circuit for men and women and VO_2 averaged at 70-73% of VO_{2max} (Williams-Bell, Villar, Sharratt, & Hughson, 2009). Anaerobic energy expenditure was relatively high which was shown through a high respiratory exchange ratio for the given VO_2 (Williams-Bell, Villar, Sharratt, & Hughson, 2009). This study found the energy demands to be high for the CPAT, however the sample may not have been truly representative of all firefighter candidates. Generally speaking, the CPAT has been standardized to simulate the extreme physiological demands of real fire situations.

Coupled with the use of both energy systems, power, muscular strength and endurance are all required for simulated fire tasks (Abel, Mortara, & Pettitt, 2011). Tasks include: stair climbs, entry maneuvers, hose drags and victim hauls which must be trained simultaneously for optimal results in task performance (Abel, Mortara, & Pettitt, 2011). All of these key considerations must be taken into account when designing a physical training program for firefighters. The training sessions must be developed specifically to train firefighters for the unique and taxing range of physical tasks.

Firefighter Training Studies

Several studies have experimented with different training programs for firefighters. Circuit training and periodization training were commonly used (Abel, Mortara, & Pettit, 2011). Circuit training can be defined as a sequence of resistance exercises paired with high-intensity aerobics. Circuit training targets the improvement of strength as well as muscular endurance. In a study by Chtara et al. (2008) circuit training alone was shown to produce significantly greater improvements in strength and power than when the resistance and endurance were not combined.

Abel, Mortara, and Pettit (2011) found that a bout of circuit training produced similar heart rate and blood lactate levels as fire suppression tasks. Simulating tasks and using muscle groups that are utilized in specific firefighter duties in workouts would likely increase the performance and fitness of firefighters in assessments but more importantly on the job. There has not been longitudinal research yet to support that circuit training will affect the fitness and performance of firefighters (Pawlak, Clasey, Palmer, Symons, & Abel, 2015).

Pawlak, Clasey, Palmer, Symons, and Abel (2015) studied the effects of a novel tactical training program that utilized firefighter equipment in training sessions. The results of this study showed after the twelve-week intervention, the supervised exercise group (SEG) showed there was a significantly ($p > 0.013$) greater portion of firefighters that completed the simulated fire ground test (SFGT) than the control group (CG). Before the intervention, both the SEG and the CG groups, showed no significant difference ($p=0.822$) in completion of the SFGT. The results of this study are important to both firefighters and administrators because the use of firefighting equipment is readily available at fire stations. Pawlak, Clasey, Palmer, Symons, and Abel (2015) showed that training interventions do not need significant funds or specialized training equipment to produce improvements in fire task performance. Exercise supervision was also important in this study, which demonstrates the need for exercise specialists on staff in fire departments across the nation.

Periodization training can be described as a series of phases in a training program that focuses on increasing and decreasing volume and intensity. Periodization is typically used over the course of an extended amount of time and is used to reach the best results. Roberts, O'Dea, Boyce and Mannix (2002) utilized a periodization program for firefighter recruits over a 16-week period of time. Results from this study showed that VO_{2max}, muscle endurance, strength, and flexibility increased, while body weight and body fat decreased (Roberts, O'Dea, Boyce & Mannix, 2002). The intervention consisted of one hour sessions, 3 days per week for 16 weeks, which included aerobic conditioning, upper and lower body strengthening, core work and stretching (Roberts, O'Dea, Boyce & Mannix, 2002). By using a combination of free weights, cardiovascular machines, and firefighting gear such as hoses and victim dummies, the firefighter recruits improved their overall fitness levels. This is integral to the current study because similar equipment was utilized in the present study program design.

Undulation training is another type of training that has been researched in firefighters. Peterson, Dodd, Alvar, Rhea and Farve (2008) studied the effects of a nine-week (twelve-week total including pre and post testing) nonlinear undulation-training program on hierarchical fitness and improved job performance of firefighters. Strength and power were assessed as well as the degree of transfer of training to job-specific firefighter tasks in a testing battery (Peterson, Dodd, Alvar, Rhea & Farve, 2008). The training program consisted of resistance exercises that remained the same the entire nine weeks, along with the mean training dosages to specifically determine the effects of undulation training (Peterson, Dodd, Alvar, Rhea & Farve, 2008). The group of fourteen subjects was split into the standard training control (STC) group and undulation-training (UT) group. Both groups' significantly improved from baseline ($p < 0.05$) in 1RM bench press, 1RM squat, power output, and performance test time (Peterson, Dodd, Alvar, Rhea & Farve, 2008). Although both groups improved, the undulation-training group (UT) showed significantly greater ($p > 0.05$) improvements in the performance test and greater general improvements in muscular strength, power output, and vertical jump (Peterson, Dodd, Alvar, Rhea & Farve, 2008). Utilizing various modes, frequency, intensity, and volume of exercises in a training program forces the body to adapt and possibly reduce the amount of detraining. Therefore, a training program using undulation training or training multiple systems at once may be most beneficial for the many physical demands of firefighting.

Although, research suggests that training specificity is beneficial for peak performance, firefighters are unique in that they must be able to perform optimally at any given time and throughout their entire career. Results from Peterson, Dodd, Alvar, Rhea and Farve's (2008) study suggest daily fluctuations in training could be the superior way to train firefighters who "require sustained concurrent adaptation in an array of physiological fitness and performance objectives." Determining a program protocol that firefighters will comply to could be altered with the type of training program.

A training program that is constantly varied may entice firefighters to adhere to exercise programs. Remarkably, there are an estimated 80 percent of fire departments that don't offer basic health and fitness programs (Peterson, Dodd, Alvar, Rhea & Farve's study (2008).

Circuit training produces changes in strength and power, but other physiological adaptations must be paired with strength and power for the specific fire suppression tasks (Abel, Mortara, & Pettit, 2011). If a firefighter has the strength to move an object but not the aerobic capacity to carry it, the task cannot be completed. Therefore, an intervention that includes circuit training paired with high intensity interval training will improve not only performance but fitness of the firefighter as well.

In conclusion, research clearly shows the positive effects of physical fire specific training programs on firefighters. Physical training is important to both the health and wellbeing of firefighters but also their job performance. It is important to implement fire physical training in the early stages of a firefighter's career. Hopefully, this will inherently establish a healthy foundation of fire physical training for the rest of their career and change the current health and performance statistics for the better. In particular, there is limited research on fire specific physical training of the college-aged fire science major population, which led to the need for this current study.

CHAPTER III – METHODOLOGY

Introduction

The purpose of this study was to determine the effects of a six-week functional high intensity interval-training program on fire science majors. Fire science students performed a battery of fitness tests and specific job-related performance tasks. Subjects were randomly selected to a control group or exercise group. The subjects in the exercise group underwent a six-week functional training program and were tested using the same tests for the pretest and the posttest.

Subjects

The Institutional Review Board approved this study. Subjects were recruited from the fire science department at Eastern Kentucky University (EKU). To recruit students, advertisements were handed out in fire science courses over a two-day period. Fire science professors also announced the need for participants in this study.

Subjects voluntarily signed up to participate. All subjects completed a descriptive demographic questionnaire, the Physical Activity Readiness- Questionnaire (PAR-Q), and informed consent form prior (see Appendix A). Subjects were screened for any other issues that would inhibit them from participating fully in the study. Subjects were instructed to abstain from exercise 24 hours in advance of the study as well as abstain from food or drink two hours prior to testing.

Instrumentation

Fitness Pretests/Posttests

A wide range of fitness tests were employed to assess fitness in the areas of cardiovascular endurance, muscular endurance, grip strength and body composition. Subjects met at an outdoor track at 7:00 a.m., dressed in exercise clothing and shoes. Subjects were instructed to warm-up and perform dynamic stretching prior to the one-mile run. Following the one-mile run the subjects proceeded to an adjacent gymnasium where the remaining fitness tests were conducted. The time of day that each subject completed every fitness test was recorded. This helped ensure that the test was performed at the same time of day for pre and post testing.

Cardiovascular Endurance

The one-mile run was performed to evaluate cardiovascular fitness. Subjects ran four laps (1,600 meters) around a standard track at their own pace. Time was started when the evaluator said 'go' and was assessed as each subject finished the last lap and crossed the finish line. Times were recorded for each subject.

Muscular endurance

Muscular endurance was assessed with a one-minute push-up and one-minute sit-up test. Subjects were given instructions on the proper form for each exercise. For one full minute the subject performed as many push-ups as possible with the chest touching a sponge (2” x 8”) that was placed directly under the sternum. Upon completion, the subject rested for two minutes.

The subject performed as many sit-ups as possible with their knees bent, and their arms laid across the chest. Each repetition would be counted only when the subjects' chest and arms reached the front of the legs.

Body composition

Four different methods were used to measure body dimensions. These included: weight, height, body fat percentage, and waist circumference. To measure weight, the subject stepped on a mechanical weight scale. The stadiometer that was attached to the scale was adjusted to measure height. Body fat percentage was assessed using the handheld bioelectrical impedance analysis (BIA) machine. The BIA sends a small electric signal through the body, which passes quickly through water in the muscle tissue but is 'impeded' or resisted by adipose tissue. The level of impedance was determined and body fat was estimated statistically through equations in the machine. Prior to testing there was no regulation of hydration levels of the subjects (which can impact readings on the machine).

Waist circumference was assessed using a flexible but inelastic tape measure. It was measured at the narrowest part of the torso, above the umbilicus and below the xiphoid process (Thompson, Gordon, & Pescatello, 2010). The researcher then asked the subject to find their umbilicus and then find the location two inches above it. The researcher placed one end of the tape measure at this site and asked the subject to spin 360 degrees. The tape was wrapped around the subjects' body in a horizontal plane. The tape was placed on the surface of the skin without compression of the adipose tissue (Thompson, Gordon, & Pescatello, 2010).

Subjects had one full day of rest between the completion of these fitness tests and the physical performance test. Subjects were given directions to the local Fire Department Training Center and were told to report at 8:00 a.m. the following day.

Physical Performance Test

The physical performance test (PPT) consisted of eight separate performance tasks that were performed consecutively and as fast as possible. The tasks were timed from the beginning of the first task to the completion of the final task. The tasks were completed on a running time clock. The time was also recorded for each individual task as well. Tasks included: (1) stair climb, (2) hose pull, (3) hose drag, (4) Kaiser machine, (5) ladder raise, (6) ladder extension, (7) over/under tasks, and (8) simulated victim drag. These activities were determined to be representative of tasks performed at the fire scene as well as during firefighter physical ability tests (Williams-Bell, Villar, Sharratt, & Hughson, 2009). Each station was spaced fifty feet apart. The walk between each test provided an "active recovery" (rest) between each test.

The entire test was performed in long pants, closed toed shoes, helmet and fire retardant gloves. Each subject was strapped with a fifty pound (50lb) weighted vest during the entire performance test. Prior to testing, the evaluators and subjects walked through the course for familiarization. The subjects were instructed on the guidelines for each station. Detailed instructions allowed each subject to have a clear idea of how the test would be performed prior to participation.

Stair Climb

A fifty foot (3 inch round) folded hose line (high-rise pack) with two spanner wrenches attached was carried over the shoulder while ascending and descending five flights of stairs in the fire-training tower. A proctor walked alongside the subject to make sure the subject touched every step on the way up and down as required. During the climb the subject was allowed to use the railings at their own discretion. If a step was missed, the time continued, but the subject had to start the task over. Upon completion of the stair climb the subject dropped the hose pack outside the door and moved to the next station.

Hose Pull

A five-inch uncharged (dry) fire hose was held over the subject's shoulder and pulled one hundred feet as quickly as possible. Once the line was dragged across the one hundred feet mark the subject moved to the next station.

Hose Drag

A charged (wet/full) 1 3/4" hose line was dragged under the armpit one hundred feet. The student dragged the line as fast as possible across the designated mark to complete this task.

Kaiser Machine

The subject straddled the Kaiser Machine in a standing upright position on the metal platform. An eight-pound (8 lb.) sledgehammer was used to strike the 70 lb. weight and move it along the machine. The subject did not push or pull the weight. If this happened the subject restarted the task from the beginning. Once the weight crossed the end line this station was complete.

Ladder Raise

A 14-foot ladder was raised rung by rung until the ladder was parallel to the wall and rested fully on the wall. The subject then moved to the next station.

Ladder Extension

A twenty-four foot extension ladder was raised using a rope pulley. The subject extended the ladder with control of the rope without letting the rope slip. If the rope slipped the subject restarted the task from the beginning.

Over/Under Tasks

Four obstacles or barriers were set up in succession. The subject moved over and then under each of them. Two hurdles were placed thirty-two inches above the ground and spaced eight feet apart. The subject also went through two window-like frames and then crawled under (without touching) the two hurdles and repeated this to move onto the next and final task.

Simulated Victim Drag

Subjects dragged a one hundred pound (100lb) hose manikin backwards for one hundred feet. The subject was required to use the harness attached to the manikin to drag it across the designated mark. Once the entire manikin was across the line the timer was stopped. This final task completed the fire specific physical performance test. The total time was recorded.

Experimental Procedure

This study used a randomized control trial. Upon completion of the pre-tests the subjects were randomly allocated to either the control group or the exercise group. The subjects were assigned to a group before the exercise training intervention began.

Immediately following the physical performance pretest, each subject was handed a sealed envelope with a letter describing his or her allocation. The control group subjects were instructed to continue exercise and diet regimens "as usual" and report back for post testing in seven weeks. The exercise-training group was to report outside the training facility building at 7:00 a.m. on Monday morning. There, they began the functional circuit-training sessions for (1-hr/day, 4-day/week) for the next six weeks. The sessions were performed on Monday, Tuesday, Thursday and Friday for each of the six weeks. After six-weeks of training, post-testing was carried out. The protocol was done in a manner identical to the pre-testing protocol.

Each training session consisted of three sections which included: dynamic warm-up, functional circuit-training workout, and cool-down.

* See Appendix E for six-week training program workouts.

Data Analysis

Means and standard deviations for each individual test were analyzed. Change scores from pretest to posttest means were computed. Repeated measures ANOVA was used determine if significant changes in criterion variables occurred over time (pre-training to post-training). Scatterplots were used to analyze change between individual subjects over time.

CHAPTER IV – RESULTS

This study analyzed the effects of a six-week functional training program on fitness in fire science majors. The variables assessed included body composition, which was evaluated through changes in body weight, body fat percentage, and waist and hip circumference. Other variables assessed included, one mile run test, push- up test, sit-up test, flexed arm hang and stair climb. For the purpose of this study, significance was set at $p < 0.05$.

Demographics

A total of sixteen subjects volunteered to take part in the study. Of the sixteen participants, twelve completed the fitness assessment portion of the study while nine completed the fire specific physical performance test. Of the twelve, two were female and ten were male. Demographic data for the subjects can be seen in Table 1.

Table 1 – Physical characteristics of subjects.

Variable	**Exercise Group (n = 6)**	**Control Group (n = 6)**
Age (yr)	21.8 ± 3.5	22.2 ± 4.5
Height (in)	72.0 ± 5.5	71.6 ± 3.1
Weight (lbs)		
Pre	203.8 ± 40.1	170.1± 21.8
Post	202.1 ± 40.5	171.3 ± 23.7
% Change	-0.8	0.7
Gender (M/F)		
Female	1	1
Male	5	5

All units are ± standard deviation.

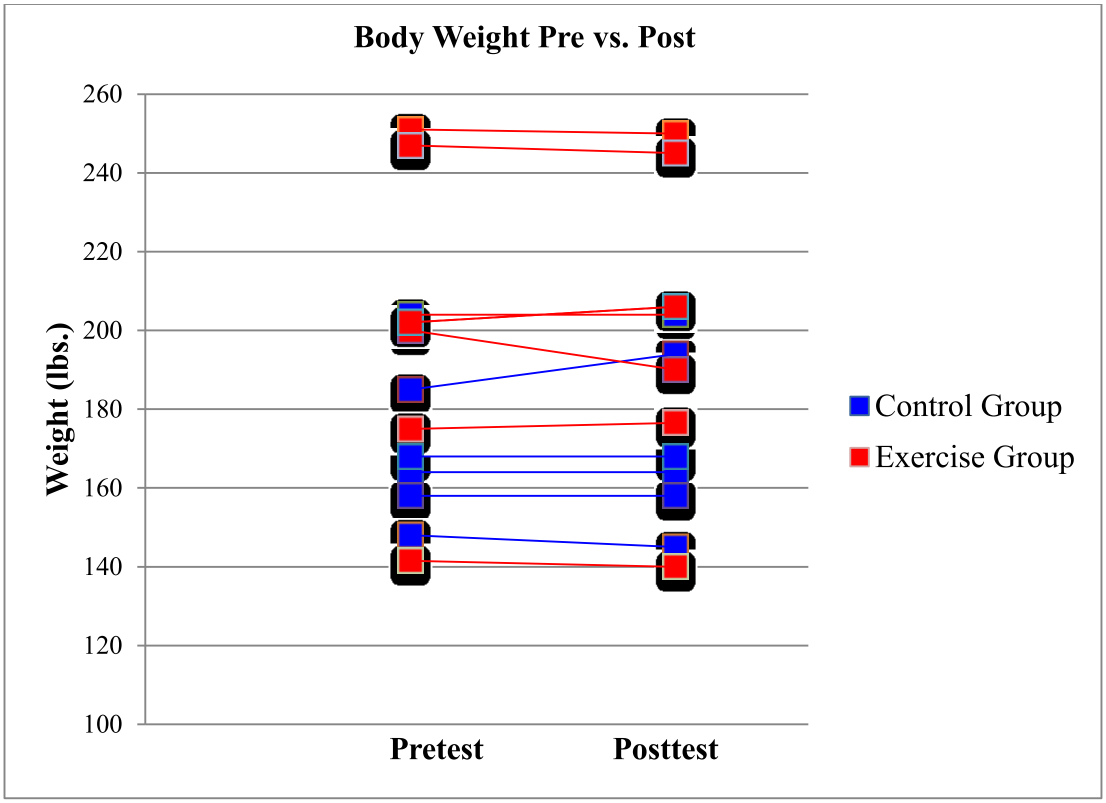

Figure 1 – Individual subjects' body weight change pre to post.

<u>Body Composition</u>

Subjects were pre-tested, one week prior to the six week training program and post-tested the week following the program. Variables of body composition tested included: body weight, body fat percentage, and waist and hip circumference. The results showed no significant difference in averages of body weight ($p = 0.258$), body fat percentage ($p = 0.262$), waist circumference ($p = 0.271$) and hip circumference ($p = 0.356$). Although there was a low sample size, Table 2 shows a trend in the percent change of the exercise group compared to the control group. The exercise group decreased their body composition variables from pretest to post-test (See Table 2).

Table 2 – Pre and posttest body composition descriptive statistics.

Group	Body Fat (%)	Waist Circumference (inches)	Hip Circumference (inches)
Exercise Group (EG)			
Pre	22.2 ± 2.3	35.9 ± 6.2	38.3 ± 2.7
Post	20.9 ± 2.0	35.6 ± 5.6	37.9 ± 2.6
% Change	-5.9	-0.8	-1.0
Control Group (CG)			
Pre	14.0 ± 5.2	31.3 ± 2.0	36.0 ± 0.6
Post	14.2 ± 4.5	31.7 ± 2.5	36.3 ± 1.7
% Change	1.4	1.3	0.8

All units are mean ± standard deviation.

Figure 2 represents the individual changes in body fat percentage, which compares the control group with the exercise group. Figure 3 shows the individual changes in waist circumference from pretest to posttest.

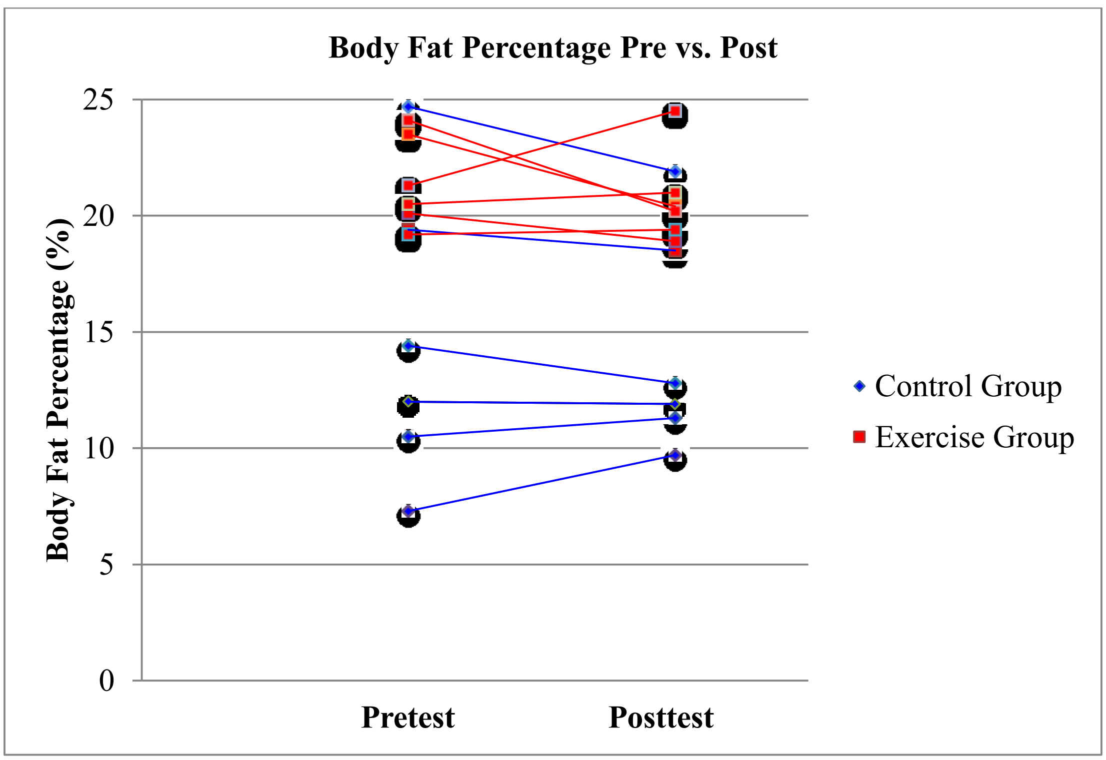

Figure 2 – Individual subjects' body fat percentage pre to post.

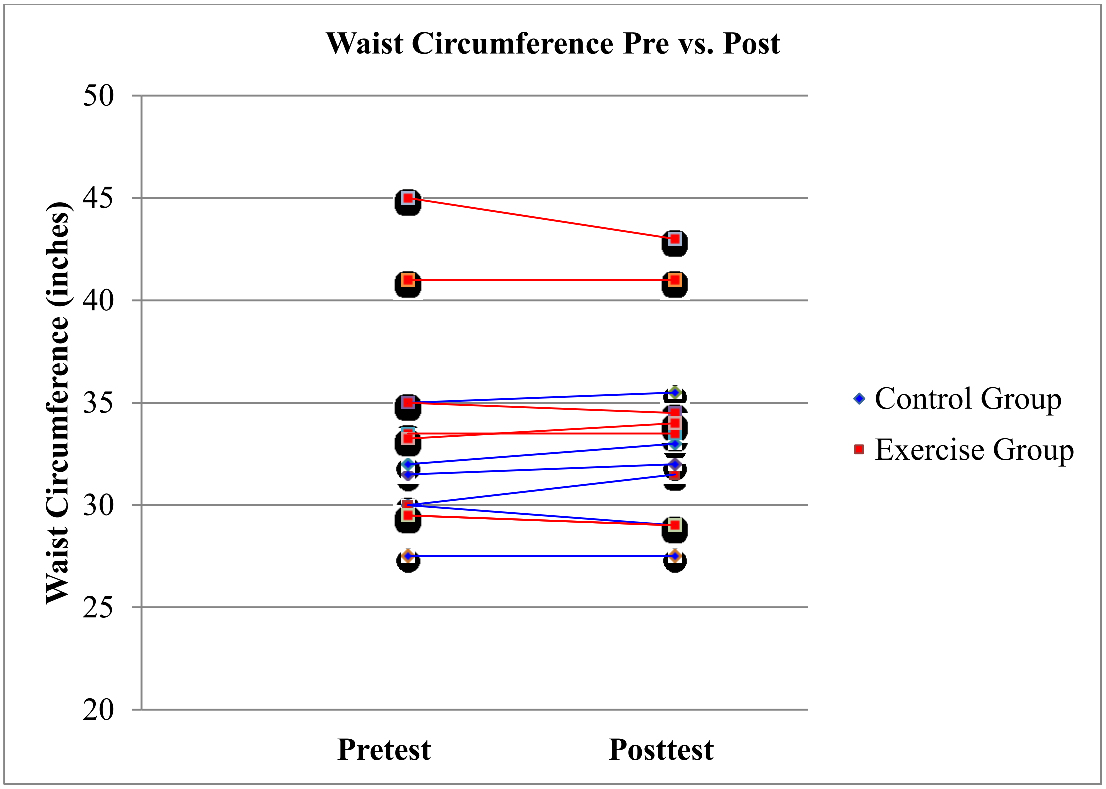

Figure 3 - Individual subjects' waist circumference pre to post.

Cardiovascular Fitness

The subjects performed two assessments (one-mile timed run and timed stair climb) that were used to measure cardiovascular fitness of the subjects. The purpose of the one-mile run was to assess a general baseline of cardiovascular fitness through running. The stair climb was the first station as part of a fire specific physical performance test. Each subject climbed five flights of stairs up and down carrying a folded hose-pack, while wearing a fifty-pound weight vest, helmet and gloves. This test was used to simulate the stair climb that is part of the nationally recognized Candidate Physical Ability Test (CPAT) for firefighters.

Table 3 shows that on average both groups decreased the time for performance of both the one-mile run and the stair climb. The exercise group showed a slightly greater improvement in the times for both tests comparing pretest to posttest. Although a trend showing improvement appears, the one mile run and stair climb showed no significant difference. The data for the cardiovascular fitness tests are shown in Table 3. The individual changes in cardiovascular fitness from pretest to posttest can be seen in Figures 4 and 5.

Table 3 – Pre and posttest cardiovascular fitness descriptive statistics.

Group	**Mile Run (seconds)**	**Stair Climb (seconds)**
Exercise Group (EG)	(n = 6)	(n = 4)
Pre	531.5 ± 107.6	155.8 ± 40.1
Post	518.0 ± 100.2	144.3 ± 23.9
% Change	-2.5	-7.4
Control Group (CG)	(n = 6)	(n = 5)
Pre	451.2 ± 44.6	123.6 ± 30.4
Post	444.0 ± 36.9	118.6 ± 22.9
% Change	-1.6	- 4.0

All units are mean ± standard deviation.

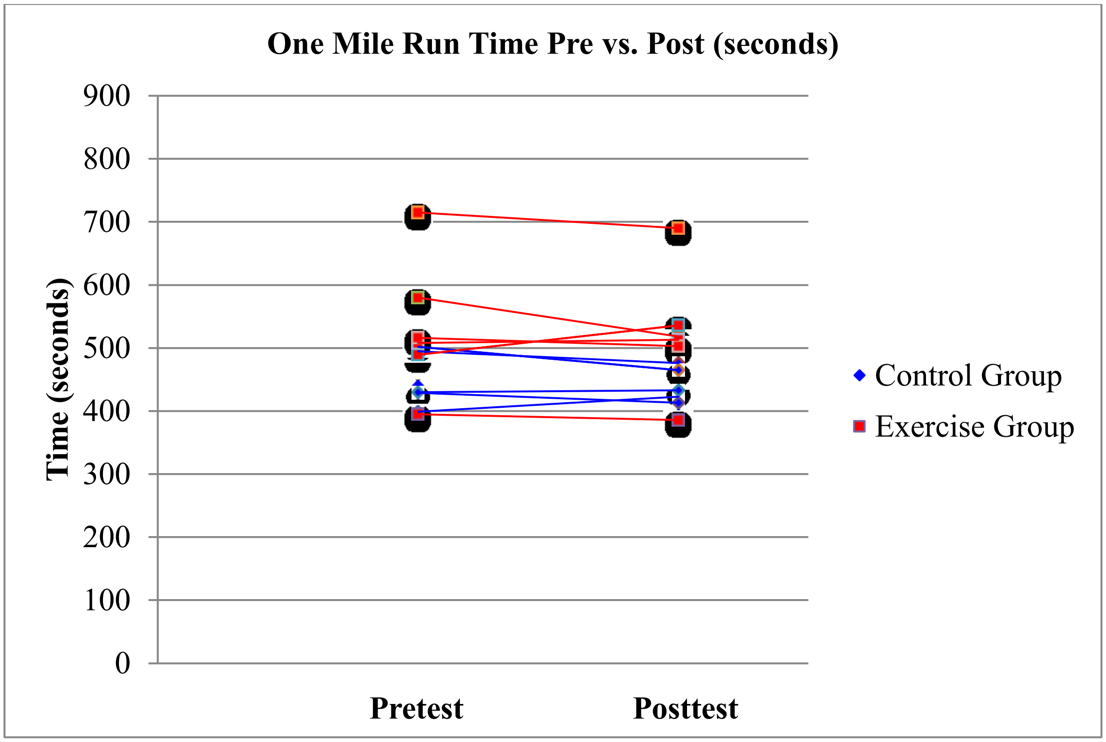

Figure 4 - Individual subjects' timed one-mile run pre to post.

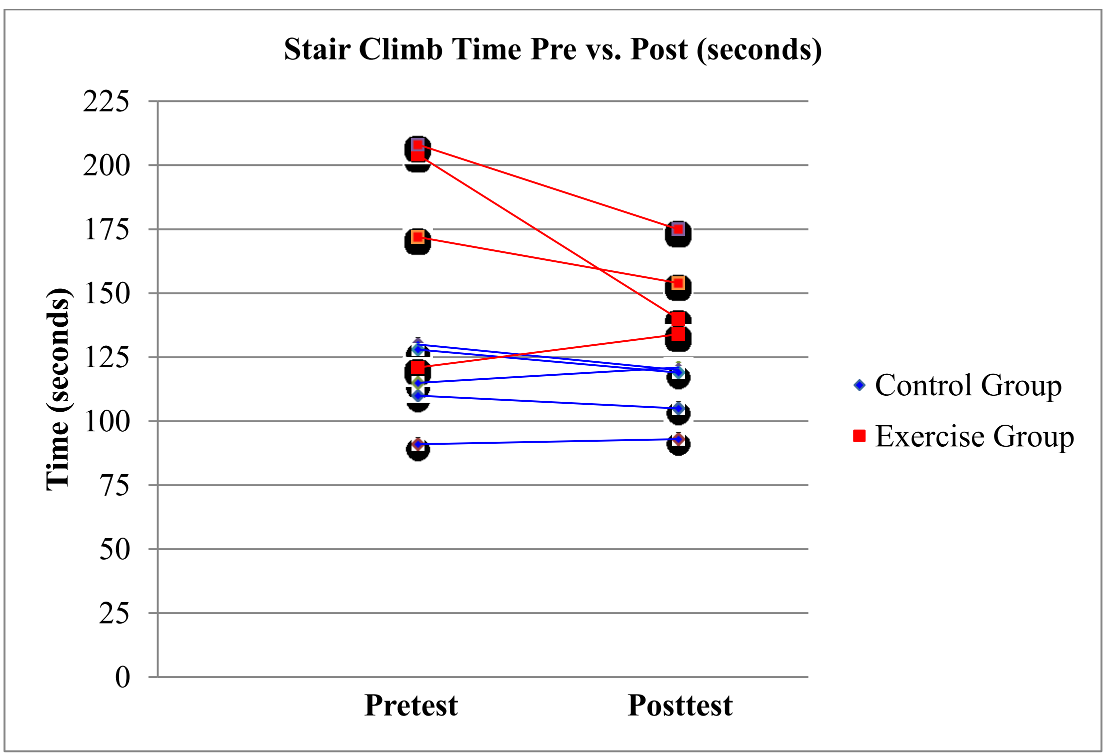

Figure 5 - Individual subjects' timed stair climb pre to post.

Muscular Fitness

Several muscular fitness tests were done as part of the battery of fitness assessments. Each subject performed the push-up, sit-up and flexed arm hang tests. The only test that showed an improvement was the push-up test, however both the exercise and the control groups showed a change over time. The averages of the push-up test for the exercise group showed the greatest improvement of repetitions from pre-test to post-test. There was a 25.8 percent change in repetitions from pretest to posttest (See Table 4) and a 14 percent change in the control group.

Table 4 – Pre and posttest muscular fitness descriptive statistics.

Group	Push-up Test (reps.)	Sit-up Test (reps.)	Flexed-arm hang (seconds)
Exercise Group			
Pre	22.5 ± 9.9	39.3 ± 9.3	31.0 ± 17.9
Post	28.3 ± 9.8	38.3 ± 7.2	25.1 ± 14.6
% change	25.8	-2.5	-19.0
Control Group			
Pre	33.5 ± 19.7	41.0 ± 10.8	41.3 ± 18.7
Post	38.2 ± 14.0	41.0 ± 8.5	44.0 ± 15.7
% change	14.0	0	6.5

All units are mean ± standard deviation.

Figures 6, 7 and 8 are scatterplot representations of the individual changes in the push-up, sit-up and flexed- arm hang tests respectively. These scatterplots show the individual responses in the exercise group compared to the control group.

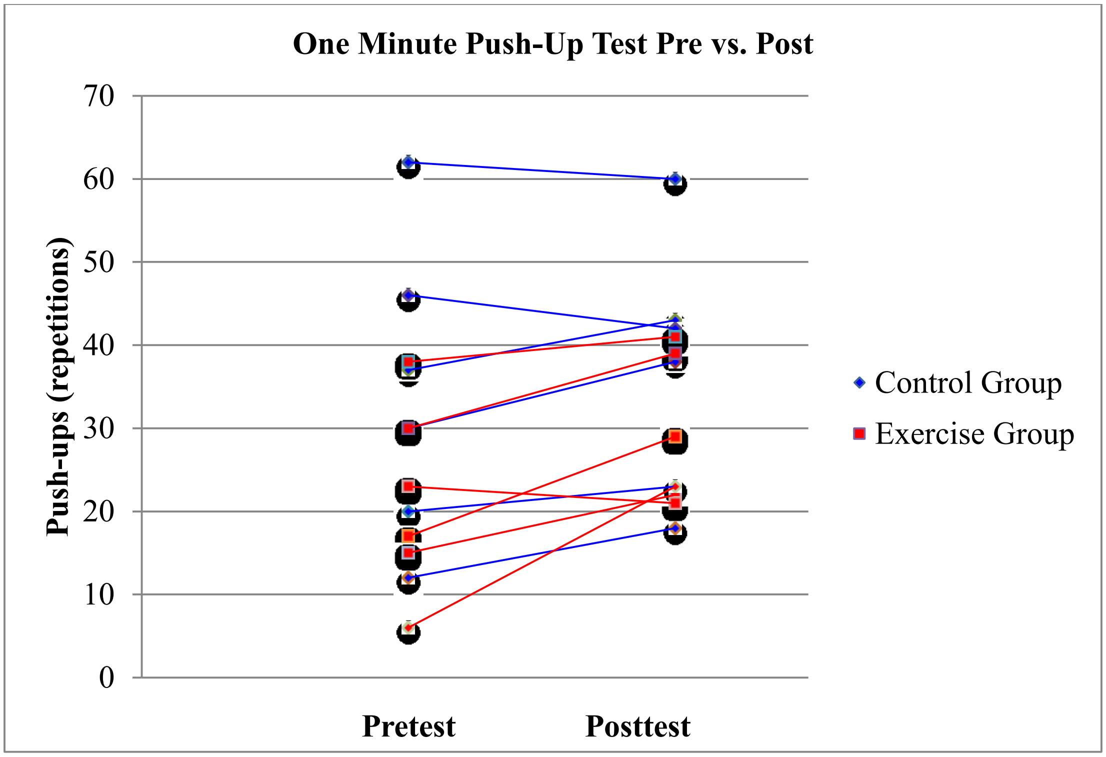

Figure 6 - Individual subjects' one-minute push-up test pre to post.

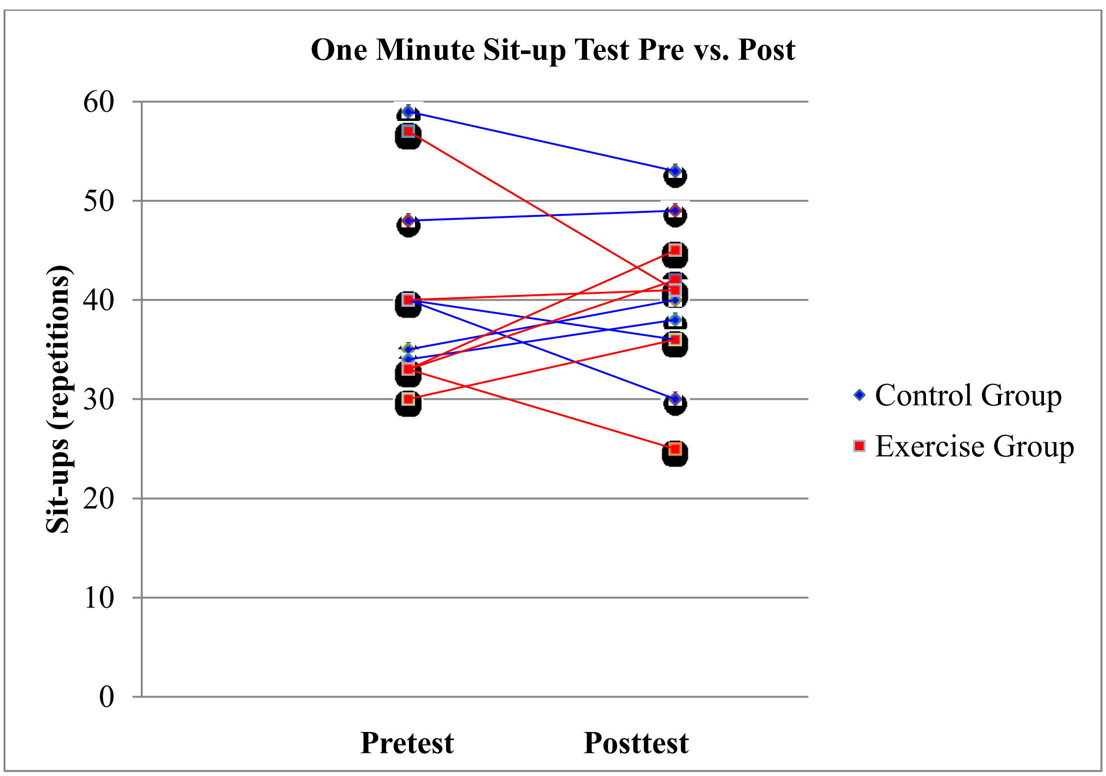

Figure 7 – Individual subjects' one-minute sit-up test pre to post.

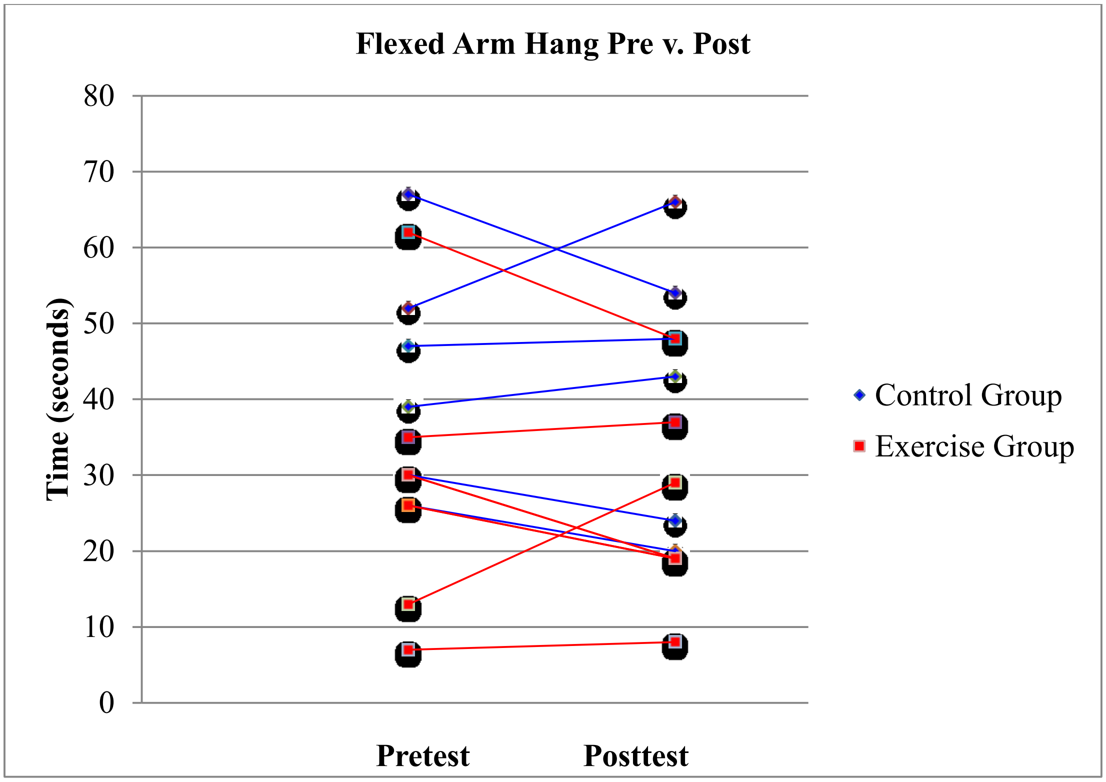

Figure 8 - Individual subjects' timed flexed-arm hang test pre to post.

CHAPTER V - DISCUSSION

The purpose of this study was to determine the effects of a six-week functional training program on body composition, cardiovascular and muscular fitness in fire science majors. This study evaluated the effects on the fire science college population.

Subject Sample

In order to show true significance in change over time, training studies should ideally have a large sample size. The sample in this study started at sixteen subjects. This small sample size could be attributed to the: (1) limited number of fire science majors, (2) limited amount of time for recruitment, (3) the lack of incentive, or (4) conflicted training schedule. Due to illness, dropout and other reasons the sample decreased from sixteen to twelve subjects for the overall fitness testing. Even fewer (nine subjects) completed both the pretest and posttest of the fire specific physical performance testing.

Human subjects and exercise adherence especially in college is something that is difficult to control. However, if this type of physical training were part of the fire science curriculum, adherence could be optimized yielding better results.

Study Design

Previous firefighter studies have investigated programs to determine the effects of physical training on firefighter fitness and performance. This study was designed for six weeks of intense physical fire specific training. In most studies, the training program duration lasted a longer amount of time, i.e. eight, nine, twelve, or sixteen weeks. It is important to recognize that firefighters must have a base level of fitness to be prepared for fire tasks. To be able to effectively complete tasks during emergency situations it is essential to the career of a firefighter (Peterson, Dodd, Alvar, Rhea & Farve, 2008). In order to do so without excessive stress, a firefighter must not only have sustained cardiovascular fitness, but joint mobility, as well as muscular endurance, strength and power (Peterson, Dodd, Alvar, Rhea & Farve, 2008). A six-week period of time may increase baseline fitness levels but may not be enough time to see significant adaptations in all of these fitness variables. The six-week time frame was perhaps not enough time to account for any random limitations that occurred unexpectedly with the subjects' adherence or university schedule.

The program design was also limited by the availability of equipment to use for the training sessions. Limited resources meant that body weight exercises paired with functional fire specific exercises using fire equipment were prescribed for training. Although the appropriate periodization was restricted due to limited equipment (weights), this study demonstrated an important point. Firefighter physical training can be achieved with the resources and firefighting equipment found at a fire station. This was similar to the study by Pawlak, Clasey, Palmer, Symons and Abel (2015) that primarily used equipment at a fire station to perform circuit training on firefighters. More research is needed to determine the longitudinal effects of this type of training.

Body Composition

The average body weight of the exercise group decreased slightly compared to the control group, which increased minimally. Body fat percentage average results were equivocal in that the exercise group decreased their percentage while the control group stayed the same. Waist and hip circumference averages showed no change over time. Body composition in general showed no significant differences. In changes with body composition it is common knowledge that both exercise and nutrition play a role in improvement. This was difficult to control for. No nutritional advice, restrictions nor recommendations were made during this study.

According to the posttest surveys for the exercise group, all but one subject self-reported no changes in diet over the six-weeks. For engagement in exercise in addition to the training four days a week, two subjects reported partaking in additional cardiovascular exercise one to two days per week for thirty to forty-five minutes per session. None of the subjects in the control group self-reported changing their eating habits. However, five of the six subjects in the control group reported engaging in exercise. Four of the five reported exercising three or more days per week for forty-five minutes to two hours. In conclusion, the post-test reports show the control group exercised at the similar frequency and duration as the exercise group sessions. Therefore, the control group did not serve as a true control to effectively compare the exercise group results with.

Cardiovascular Fitness

The mile run test was used as a baseline cardiovascular fitness test and results showed that both groups decreased their amount of time to completion. The exercise group decreased their average time close to two times that of the control group. The pretest mile run time for the exercise group did start higher than the control group. To explain this, unconditioned subjects will likely see a greater improvement than those that have baseline levels of fitness.

Other firefighter studies used estimation of VO_{2max} through the cycle ergometer or the Cooper twelve minute run tests. These tests allow for the researcher to evaluate more accurate measures of VO_{2max} particular to the unique subject. Heart rate would be an advantageous variable to assess in future studies as well.

The stair climb was the first station of the eight-station fire specific physical performance test. Similar to previous studies, a high-rise hose pack was carried while ascending and descending five flights of stairs (Rhea, Alvar & Gray, 2004; Peterson, Dodd, Alvar, Rhea & Farve, 2008; Pawlak, Clasey, Palmer, Symons & Abel, 2015). Time was recorded after the hose pack was placed back on the ground where the subject began the station. The exercise group showed greater improvement (7.4 %) from pretest to posttest, but the difference was not significant.

Muscular Fitness

Results from the muscular fitness tests were inconclusive. For the push up test, both groups improved their repetitions from pretest to posttest. The exercise group showed a greater percent change (25.8%) compared to the control group (14.0%) in improvement of repetitions of pushups. The training program utilized this specific movement on a weekly basis. The sit up tests showed relatively no change in repetitions from pretest to posttest. Flexed-arm hang results showed decreased performance on the length of the flexed-arm hang. This particular movement was not directly trained as there was no access to a pull up bar or anything similar to it. Overall, the results of both groups were similar which leads to the previous conclusion that the control group exercised regularly during the six-week training period and therefore the results were equivocal.

Further research would benefit from other tests of muscle fitness, which include tests of muscular strength through one-repetition maximum barbell back squat, deadlift and bench press exercises. Another measure of muscular fitness for future research that is specific to firefighter tasks would be handgrip strength assessed through the handgrip dynamometer.

Practical Applications

This study laid the necessary foundation for various future studies for fire science majors. Fire science majors need to be prepared not only intellectually for the fire service but also physically. To prepare for their future as a firefighter, undergraduate and graduate students must take the nationally recognized CPAT. In this study, five of the subjects had taken the CPAT previously. Proper physical and mental preparations are needed to pass the CPAT test. This study utilized a six-week program, which is similar to the eight-week period of time given to someone who signs up for the CPAT to the time they take the actual test (“CPAT at NTN”, 2012). This study offered exposure to a training program for the subjects that simulated fire tasks and how to train for these tasks.

Nationally, most fire specific physical training programs are not offered as part of the curriculum at the university. In particular, the university in this study was a nationally recognized and ranked fire science program in the United States and it offered no fire specific physical fitness courses. The students were required to take a general physical and health education course. Making a physical education course specific to the demands of firefighting would better prepare students to pass physical performance tests in order to get hired at fire departments.

More profound, is that the course should provide background information to promote the tools and foundation for physical training that fire science students need throughout their entire career. Given the nature of the job, high demands are placed on the body physically and reoccur over time as part of the career of a firefighter. This physically demanding job is however, countered by varying shift time with irregular sleep, diet and physical activity patterns. Therefore, as with the public as a whole, the recommendation of thirty minutes a day five times a week for physical activity is not being met. This has resulted in high rates of obesity and sadly, heart disease. Unfortunately, cardiovascular events account for forty-five percent of deaths of firefighters on duty (Soteriades, Smith, Tsismenakis, Baur, & Kales, 2011). Positive changes need to be made for the sake of the health of firefighters as well as public safety.

Fire departments vary in their governance of regulations regarding physical fitness. A problem lies in that after firefighters are hired onto departments (depending on the department), there may or may not be yearly physical performance tests. The National Fire Protection Association (NFPA) has recommended that all firefighters take part in physical fitness training (Findley, Brown, Whitehurst, Gilbert & Apold, 1995). The crucial point in this statement is that the NFPA has 'recommended' rather than 'required' physical fitness training.

Conclusion

The purpose of this study was to determine the effects of six weeks of functional training on fitness and body composition in fire science majors. The firefighting career is one that benefits the common public. Often the public is not aware of the sacrifices firefighters make throughout their career. Firefighting is acknowledged to be "one of the most physically demanding and dangerous nonathletic, civilian occupations" (Peterson, Dodd, Alvar, Rhea & Farve, 2008). With that being said, the health of firefighters should be emphasized. A good place to start is with fire science majors. In this study many fitness-related topics were addressed. Although the results provided no statistical significance due to a low sample size, improvement trends were revealed. The improvements in body composition and fitness were small. With a greater sample size, and a prolonged training duration greater improvements could be revealed. This study laid the foundation for future studies in the fire science population.

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APPENDIX A:

PAR-Q

PAR-Q & YOU

Physical Activity Readiness Questionnaire

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age and not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly.

YES NO 1. Has you doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

YES NO 2. Do you feel pain in your chest when you do physical activity?

YES NO 3. In the past month, have you had chest pain when you were not doing physical activity?

YES NO 4. Do you lose your balance because of dizziness or do you ever lose consciousness?

YES NO 5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?

YES NO 6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

YES NO 7. Do you know of any other reason why you should not do physical activity?

If you answered YES to one or more questions, talk with your doctor before you start becoming much more physically active.

If you answered NO to all questions, you can be reasonably sure that you can:

- Start becoming much more physically active—begin slowly and build up gradually.
- Take part in a fitness appraisal—this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively.

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

NAME_________________________________

DATE_____________________________

SIGNATURE_____________________________

WITNESS__________________________

SIGNATURE OF PARENT OR

GUARDIAN______________________________________

(for participants under the age of majority)

APPENDIX B:

Deposit Form

Please be aware that numerous technicians, equipment, etc., are required to administer the tests outlined above. In order to demonstrate your commitment to the above study, a fully refundable $20.00 deposit will be required prior to any testing occurring. This deposit will be totally refunded upon completion of the post-test.

Note: Your deposit will be refunded if any medical situation results in your inability to physically complete the study.

Amount:________________________ Date:_________________________________

Received By:____

APPENDIX C:

Recruitment Flyer

Recruitment for Firefighter Fitness Study

Informational Meeting Monday, August 24th & Tuesday, August 25th. Ashland Building 6:00 PM
Meant to help prepare students for physical performance tests they might encounter.

Requirements:

- Must be a full-time Fire Science Student at EKU
- Must be willing to participate in all Pre-testing & Post-testing
- Pre-test – August 27th & August 29th - Must be at both days
- Post-test – October 15th & October 17th – Must be at both days
- Study group workouts will be at 7AM Monday, Tuesday, Thursday, Friday – Must be at all workouts for 6 weeks.

For additional information contact: Jessica Moody or Kristen LeBrun at jessica_wood25@mymail.eku.edu; kristen_lebrun1@mymail.eku.edu subject line FF Study

APPENDIX D:

Physical Performance Proctor Statement

Physical Performance Statement

The physical performance testing will consist of multiple stations that will assess job-related firefighter skills in a fitness test. There is no pass/fail on this test. It is a timed test that is meant to show physical improvement through better times. Throughout the test you must wear a 50lbs. short vest, a helmet, and gloves, which will be provided to you. You must wear long pants, and closed toe shoes, preferably athletic shoes, to reduce your risk of injury. During this test, you are not allowed to run in between obstacles for safety reasons. If at any time you feel you are unable to finish the performance test, you can stop the test. It will be noted where you stopped and what your time is, to use to compare to the post-test 8 weeks from now.

When you are ready we can start. You will start with the high-rise pack on the ground. You will lift it out of the area and place it on your shoulder. You will carry the high-rise pack up 3 flights of stairs. You will come down 2 flights or stairs, go back up the 2 flights of stairs and finally come all the way down. You must touch every step on the way up and down or you will be warned once and on the second warning you will have to start the task over and time does not stop. Once you get to the bottom of the stairwell, you will place the high-rise pack back in the square on the ground where you first picked up the high-rise pack.

You will now follow the __________ line for 50’ to the next station.

At this station you will drag a 5” supply line for 100’. It is uncharged and you must carry the line over your shoulder. Once the hose has been pulled past the 100’ mark I will inform you that you have completed the task and we will move on to the next task.

Follow the _________ line for 50’ to the next station.

At this station you will advance an attack line 100'. The hose line is to be carried under your arm and is to remain in the off position. Once you have dragged the line past the 100' mark I will inform you that you have completed the task and we will move on.

Follow the _________ line 50' to the next task.

You are now onto the Kaiser Machine. You will straddle the machine standing on the top side. You will take the hammer and strike the weight until you have moved it from one end to the other. I will inform you when you have striked the object enough times to move the weight past the mark. You are to strike the object and not push the object with the hammer. If at any time you are observed to push the weight with the hammer you will be warned, a second warning will cause this station to be started over.

Next, follow the ___________ line 50' to the next station.

You are now on to the ladder station. You will raise a 14' ladder rung over rung until it is leaned up against the building. Once it is against the building, you can move on to the next station.

Follow the _________ line 50' to the next station.

This ladder is to be raised by the rope in front of you. You are not to wrap the rope at any time around your hand. If you lose control of the ladder and the rope slips, you will be told to restart the task. You are not to let the rope slide at any point during this exercise. Once you have raised the ladder to full extension and back down in a controlled manner, you can move on to the next station.

Follow the _________ line 50' to the next station.

On this station you will be going over and under the following obstacles. You must be low enough to not bump the under obstacles or you will be told to repeat the entire obstacle. Once you have completed this task you will move on.

Follow the _________ line to the final task.

You will lift the manikin using the harness on the manikin. You must drag the manikin 100’. Once the entire manikin is past the 100’ mark, you will be told to stop and the performance test will be complete.

APPENDIX E:

Physical Training Program

Week 1	Aug. 31 - Sept. 4th			
	Monday	**Tuesday**	**Thursday**	**Friday**
Warm Up	Jog 200 M 20 Jumping Jacks 20 Mountain Climbers Jump Rope 1 Min	Jog 400 M + dynamic stretches	Jog 200 M 20 Jumping Jacks 20 Mountain Climbers	Jog 200 M 20 M High Knees 20 M Butt Kicks 20 M Side Lunge Right Side 20 M Side Lunge Left Side Jump Rope 1 Min
Met-Con	CIRCUIT 3 Rounds + 2 Hill sprints between each; rest 1 min. ; 30 sec-15 sec 1) body wt. squats 2) plank shoulder taps 3) walking lunges 4) jumping jacks	15 Min. AMRAP 10 burpees 12step-ups w/ wt OH 14 sit-ups 100m weighted carry TABATA -side step ups -side plank hugs -up downs -hop scotch	CIRCUIT 3 rounds + 10 jumping jacks btw. Each exercise 1 min. ; 30 sec-15 1)squat jumps 2)tire drag-line to line 3) plank rows 4) goblet squats wt 5) push press w/ wt	BURN BABY 4x *0.5 mi. RUN *10 push-ups *10 DL's *10 dead bugs …10,12,14 ,16 increase each round
Cool down	30 seconds of each -crunches w/wt -russian twists w/wt -toes to sky -flutter kicks -bridge static stretch	Stretch	30 seconds of each -crunches w/wt -russian twists w/wt -toes to sky -flutter kicks -bridge static stretch	

Week 2	Sept. 7 - Sept. 11			
	Monday	**Tuesday**	**Thursday**	**Friday**
Warm Up	Jog 200 M 20 Jumping Jacks 20 Mountain Climbers Jump Rope 1 Min	Jog 200 M 20 M High Knees 20 M Butt Kicks 20 M Side Lunge Right Side 20 M Side Lunge Left Side Jump Rope 1 Min	Jog 200 M 20 Jumping Jacks 20 Mountain Climbers	Jog 400 M 15 Air Squats Jog 200 M
Met-Con	3 mile buddy run	Tabata 20:10sec * lunges w/ wt twist * box jumps * v-incline superhero push ups * line sprints * tire flips * tricep dips * G2OH presses w/ box * football quick feet 10minute run in between tabatas (26 min total)	400m BUY IN 21-15-9-5 1) woodchops w/ wt 2) walk the plank push ups 3) sit up get ups w/ wt 400m buy out	14 minute Even min : 10 deadlifts odd min : 3 crawl up hill; walk backwards down 12 minute Indian Run
Cool down	5 min cool down stretch 3 rounds ABS 50 crunches 50 leg lifts 50 supermans		* plank hold 45 sec * side planks 30 sec/each * plank claps w/ partner 20x * single arm and leg hold plank for 20 sec and switch	

Week 3	Sept. 14- Sept. 18			
	Monday	**Tuesday**	**Thursday**	**Friday**
Warm Up	Jog 200 M 20 Step Ups Jog 200 M Jog200 M 10 Star Jumps	Jog 200 M 10 plank jacks Jog 200 M 10 plank jacks Jump Rope 1 Min 10 plank jacks	Jog 200 M 20 M High Knees 20 M Butt Kicks 20 M Side Lunge Right Side 20 M Side Lunge Left Side Jump Rope 1 Min	Jog 200 M 10 Turkish Get-Ups (R) 10 Turkish Get-Ups (L) Jump Rope 1 Min
Met-Con	2 Rounds For Time - Run 1 Mile - 50 Box jumps - 30 burpees -20 plank up downs	Circuit 45sec;15 sec 3 rounds -tire drags - hose carry - push presses - squats * at least 1 round with wtd. Vest	Circuit 45sec;15 sec 3 rounds - tire flips -5'' battling ropes - hammer hits - tire drag - farmer carry w/ box - burpee tire stepovers - RUN 100m	MOD: (M/G) For Time: 18,15,12,9,6,3 -bent Rows -decline Push Ups -hill sprint 400m
Cool down	5 min cool down stretch 3 rounds ABS 50 crunches 50 leg lifts 50 supermans		* plank hold 45 sec * side planks 30 sec/each * plank claps w/ partner 20x * single arm and leg hold plank for 20 sec and switch	

Week 4	Sept. 21- Sept. 23			
	Monday	Tuesday	Thursday	Friday
Warm Up	Jog 200 M 20 Step Ups Jog 200 M Jog200 M 10 Star Jumps	Jog 200 M 10 plank jacks Jog 200 M 10 plank jacks Jump Rope 1 Min 10 plank jacks	Jog 200 M 20 M High Knees 20 M Butt Kicks 20 M Side Lunge Right Side 20 M Side Lunge Left Side Jump Rope 1 Min	Jog 200 M 10 Turkish Get-Ups (R) 10 Turkish Get-Ups (L) Jump Rope 1 Min
Met-Con	<u>SIZZLE 3 groups</u> • 10min. Stair stepper at level 7 • 5x5 deadlifts @ 65% •3 sets of 20x each - plank rows, - wted OH lunges, - sit ups	<u>20 Min AMRAP</u> 200 M Run 6,7,9,12,16,21,27 - tire flips - push ups - Russian DB swings or sledge hammer	<u>5 Rounds; 45 sec. work; 15 sec break</u> - tire side step ups - drag and flip tire from cone to cone - crawl on ground from cone to cone - rope pulls around the hydrant - both ways - clean and presses	<u>3 minute steps w/wt vest + box carry up the hill</u> Rest of group : jogging on mulch track + 10 tire flips 20minutes of running/ stepping total
Cool down	5 min cool down stretch <u>3 rounds</u> ABS 25 decline sit ups 25 leg lifts 15 back extensions	**Note: perform 6 of each exercise, then run 200m, then 7 of each and so forth…**	3x 30 sec. plank hold 15 sec side plank each side 20x supermans	

Week 5	Sept. 28- Oct. 2			
	Monday	**Tuesday**	**Thursday**	**Friday**
Warm Up	3x {zig zag run … 15 jumping jacks} 'Bring Sally Up'- song withbody weight squats	jog 5 minutes + dynamic stretches	4x's 10 walking lunges 3 up downs 1 box jog	Jog 200 M 10 Push Ups 15 Air Squats 20 Sit Ups Jump Rope 1 Min
Met-Con	REC CENTER * 5x5 Deadlifts @65% +10lbs * 5x5 Back squats 3 sets : Row 10cal + 15 KB swings + sit ups Stairstepper 10 min w/5-10 lbs	Circuit 1minute work 30 sec rest 4 x *sledge hammer hits *tire drags *battling ropes *box jumps *sprint cone to cone with high pack * sit up get ups w/ wt	20 MIN AMRAP 800m wted run 20 sledge hammers 10 air squats 5 burpees with weight and press 3/3 single leg dips	Circuit 1minute work 30 sec rest 4 rounds * box jumps * tricep dips w/ wt * tire drag * farmer carry *OH lunges 1 burpee between each exercise
Cool down	5 min cool down stretch 3 rounds ABS 25 decline sit ups 25 leg lifts 15 back extensions		4x 30 sec. plank hold 15 sec side plank each side 20x supermans	

Week 6	Oct. 5th- Oct. 9th			
	Monday	Tuesday	Thursday	Friday
Warm Up	3x {zig zag run … 15 jumping jacks} 'Bring Sally Up'- song withbody weight squats	jog 5 minutes + dynamic stretches	4x's 10 walking lunges 3 up downs 1 box jog	Jog 200 M 10 Push Ups 15 Air Squats 20 Sit Ups Jump Rope 1 Min
Met-Con	EMOM 12min; 5x -back squats -deadlifts 3 rounds -15 KB swings - 12 lunges w/ KB - 12 push ups Stairmaster 10min -level 7	Circuit 1min. work 30 sec rest for 4x *sledge hammer hits *tire drags *hose carry with tire *box jumps + burpees *push presses 2 rounds with wt. vest 30lbs	Circuit 1min. work 30 sec rest for 4x * plank row + push ups * tire flips * battling ropes * DB deadlifts * box jump ladder	25 minute CAP to complete 5 rounds + 12 step ups w/ wts + 12walking OH lunges + 12 bent rows + 200m run + 12 chest press
Cool down	5 min cool down stretch 3 rounds ABS 25 decline sit ups 25 leg lifts 15 back extensions	5 min cool down jog	5 min cool down stretch 3 rounds ABS 25 decline sit ups 25 leg lifts 15 back extensions	cool down jog 1 mile

APPENDIX F:

Self-Report Questionnaire

Questionnaire for Study

Name____ Date______________

Richmond Address____

Home Address____

Phone Number__________________ Birthday________________ Sex: Male / Female
E-Mail____

Are you available for Pre-test, Post-test, and Practice August – October 2015? Yes / No

Are you willing to train Monday, Tuesday, Thursday, and Friday each week during the study at 7:00 AM? All trainings will be supervised and have specified workouts each day. Yes / No

Will you agree to participate regardless of whether you are in the control group or the study group? Yes / No

Do you consider yourself to be an inactive person? Yes / No If yes, why?_____________

____

____

____

Will you agree not to engage in additional exercise during the course of this study? (i.e. – if you get the control group, abstain from additional exercise that you are not already doing, or if in the study group only do the specified training.) Yes / No

Will you agree not to change your normal diet or go on a restricted calorie diet during the study? Yes / No

APPENDIX G:

Post-test Survey

Name________________________________ Date_____________________

Physical Performance Test

Post-test Survey for Control Group

Did you change your lifestyle during the past 8 weeks? Yes No

If yes, please explain.____

____

Did you engage in exercise? Yes No

If yes:

How many times a week on average did you workout?_________________

How long on average was each workout?______________________

What was your typical workout? (Please explain in detail)___________________

____

Did you change your eating habits? Yes No

If yes, please explain.____

____

Have you ever taken the CPAT? Yes No

If yes, when?(Please list all times you have attempted.)_______________________

Did you pass? Yes No

If this was offered as a class would you be interested in it? Yes No

Please explain why?____

____

____

Name________________________________ Date_____________________

Physical Performance Test

Post-test Survey for Workout Group

Did you change your lifestyle during the past 8 weeks? Yes No

If yes, please explain.____

____

Did you engage in exercise in addition to the workouts provided? Yes No

If yes:

How many times a week on average did you workout additionally?_______

How long on average was each additional workout?_____________

What was your typical additional workout? (Please explain in detail)___________

____

____

Did you change your eating habits? Yes No

If yes, please explain.____

____

Have you ever taken the CPAT? Yes No

If yes, when?(Please list all times you have attempted.)_______________________

Did you pass? Yes No

Do you think after following the 6 week workout period that you would be better prepared to take the CPAT or something similar to it? (Please explain.)_______________

____

If this was offered as a class would you be interested in it? Yes No

Please explain why?

How do you think this could be better?