Title: In-Training Improvement: A Tactical Athletic Approach to Enhance the Performance and Wellness of Law Enforcement Officers

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ABSTRACT
Fitness and musculoskeletal injuries are a major health concern among United States law enforcement personnel. The objectives of this study were twofold: 1) to compare the effects of wearing work gear and not wearing work gear during job related specific activities; and 2) identify the negative effects of the required work equipment on law officials and exploring methods to decrease the negative effects. There is an undeniable prevalence of law officials and back issues and other musculoskeletal complications which presents an interrelated research and field test environment. This study leverages research to help advance the knowledge of law enforcement performance, and injury prevention to provide a solution to alleviate or diminish the prevalence of numerous musculoskeletal injuries. A study had shown 62 % of law enforcement officials suffered from low back pain as a result of the duty belts worn (25). The purpose of this current study was to compare the Academy cadets' fitness scores absent of equipment and wearing the fully equipped duty belts in relations to job performance. Police Officers and Sheriff's Deputies in training completed a Regional Law Enforcement Academy that consisted of 33 participants (24 Males and 9 Females). Descriptive statistics (age, height, weight) for all cadets were (29.5 ±7.5 years, 174.3 ± 7.0 cm, and 97.7 ± 25.5 kg), males (28 6.4 ± 6.5 years, 1775.8 ± 5.9 cm, and 99 ± 27.8 kg), and females (33.6 ± 8.8 years, 167.2 ± 4.3 cm, and 94.4 ± 19.4 kg). All cadets completed the Academy's standardized fitness protocols, the outdoor tactical obstacle course, and 5-10-5 Pro Agility while wearing a fully equipped duty belt or no duty belt. Results of the study had revealed no huge significant impact of the duty equipment on human anatomy and job performance skills. Both the Loaded groups of Males and Females were greater than the alpha ($p>0.05$). However, various studies had gathered a large data pool of Police Officers and Sheriff Deputies suffering from back complications from their work equipment and the recurring continuous effect of it.
KEY WORDS: functional movement, low back pain, physical ability test

INTRODUCTION
'Tactical athlete' describes individuals in service professions (e.g. military, firefighters, law enforcement, and emergency responders) who typically have significant physical fitness requirements associated with their work (1). Law Enforcement Officers (LEOs) should be trained and conditioned in a manner that promotes holistic health and wellness that has been shown to minimize injury rates (1). In 2018, the International Association of Chiefs of Police (IACP) conducted an assessment involving 18 Law Enforcement Agencies that reported a total of 1,295 injuries. On top of those injuries, it was reported that an average of 4.5 days of shift work was lost with an average additional 3.5 days for rehabilitation (2). These findings indicated that agencies should focus on injury-reduction by increasing the health and fitness of its employees. The purpose of this research was to determine if wearing a fully-equipped duty belt significantly impacted a LEO's ability to perform simulated job-related tasks such as an obstacle course simulating a foot pursuit. It's hypothesized that the loaded group who wore their duty belts during the 5-10-5 Pro Agility and Outdoor Tactical Obstacle Course would have a slower time of completion than those who did not wear their duty belts.

METHODS
Participants

Descriptive statistics (age, height, weight) for 33 study participants (24 Males and 9 Females) was 29.5 ±7.5 years; 174.3 ± 7.0 cm and 97.76 ± 25.5 kg. The St. Charles Parish, Peace Officer Standards and Training (POST) Regional Law Enforcement Academy, located in Hahnville, Louisiana provided written informed consent and granted permission for the use of de-identified data for the 33 cadets and Liberty University's Institutional Review Board approved this study (IRB-FY20-21-31). Descriptive statistics for the male cadets were 28± 6.4 years, 177±5.8 cm, and 99.3±27.7 kg, and 33.6 ± 8.8 years, 167.2 ± 4.3 cm, and 94.4 ± 19.4 kg for the female cadets.

Protocol

Cadets attended the Academy for 12-16 weeks on Monday-Friday from 0800-1600. Physical training (PT) was performed by cadets each week. The initial fitness assessment was held on the grounds of the training academy's facilities outdoor tactical obstacle course, within the gymnasium, and the community park.

All 33 cadets were required to wear a standard duty belt throughout the Academy classroom times and during defensive tactics. Then for the 5-10-5 Pro Agility and Outdoor Tactical Obstacle Course the cadets were divided into loaded (wore duty belts) or unloaded (did not wear duty belts) groups for testing measurement. The cadet's duty belt consisted of their gun holster, an orange plastic handgun within the holster, handcuffs, a flashlight w/a holster, magazine holsters, a baton w/a holster, a tourniquet w/a holster, and a peppery spray holster. The overall weight of the cadets' duty belts was 6.80kg.

The events of the physical assessment were: 1.5-mile run, sit-ups, push-ups, 5-10-5 Pro Agility shuttle, and outdoor tactical obstacle course. The procedures for those events are as follows.

The 1.5-mile run was performed to assess cadets' aerobic fitness. The cadets' run was conducted at the community park across from the Academy. The 1.5-mile run was not based on a pre-set time limit but instead the cadets' completed run time was recorded and logged.

A sit-up test was administered to assess the cadets' abdominal muscular endurance. The cadets were instructed to do as many sit-ups as possible on a gym floor within 60 seconds. Each cadet was paired up with another cadet; with one seated on the floor, the other cadet placed their hand on the exercising cadet's feet. The cadet holding the feet was responsible for keeping count for the other cadet's sit-ups. The starting position had cadets with their shoulders and hips in contact with the ground; knees bent at a 90° angle and their arms were crossed in contact across their chest. Each repetition required cadets to lift their torso until both elbows contacted their thighs and then return to the floor in a controlled motion.

To assess upper-body endurance, cadets were required to perform as many push-ups as possible on a gym floor in 60 seconds with proper technique. Each cadet had another cadet as a grader who would keep count of the repetitions. Cadets were instructed for their hands to be shoulder-width apart and their feet no more than 6 inches or shoulder-width apart. Once instructed to start, cadets begin in the starting position, with their elbows slightly locked. While descending, cadets maintained a level spine and then allowed their breast bone to make contact with the noted indicator on the floor. The 'up position' could be used to rest.

With the application of the National Strength and Conditioning Association (NSCA), the shuttle time norms were referenced as guidance, and a 5-10-5 Pro Agility test was administered (25, 27, and 28). Dividing the cadets into two randomized groups: one group wore their fully loaded duty belts, and the other group was identified as unloaded, or no duty belts.

To assess stamina, strength, and challenge of an officer's physical fitness, an outdoor tactical obstacle course designed by the St. Charles Parish Sheriff's Training Staff was developed. The outdoor tactical obstacle course consisted of a 20-meter sprint to simulate a foot pursuit. The cadet sprinted 20 meters from a standing position. Then culvert jumping to simulate jumping over a creek bed or ditch during a foot pursuit. The cadet then sprinted from the 20-meter foot sprint and jumped over a 4x2 plywood squared outline. From there a staged window (44"x72" window frame) was placed to simulate a chase through a building's window during a pursuit. Once clearing the window, the cadet would scale a 5 ft. (1.524 meter) wooden wall to simulate that aspect of a pursuit. After scaling the wall, the cadet would perform a ditch crawl through a 5-foot tunnel to simulate crawling through small spaces during a pursuit. Following the ditch crawl was a stair climb where the cadet ran up and down five stairs two times (equivalent to two floors). Afterward a 150-foot sprint and the subject had to sprint 150 feet to man down simulating either partner or bystander is down or wounded. The subject had to lift and drag the weighted 125lbs to 165lbs rescue dummy across 5 meters to safety. Once the 'man down is recovered,' cadets run over to a balance beam (simulating a foot pursuit over a narrow high path). The cadet had to walk across a 10-meter beam without falling off. After crossing the beam, a takedown occurred. A simulation of brawling with and handcuffing the suspect from the foot pursuit. The subject took down the handcuff-dummy and positioned it into the rear handcuff position.

Before the cadets were signaled to begin the outdoor tactical obstacle course, each cadet was given a description of a suspect that coincided with a designated number to identify. That they would pursue during their "simulated foot pursuit." At any point during the cadet's pursuit, a training instructor would call out to ask which number suspect the cadet was pursuing. This method helped to assess the cognitive function of each individual throughout the outdoor tactical obstacle course.

The Academy's 16-week Tactical Physical Fitness Training Program of the POST Academy curriculum required the cadets to partake in some form of a physical training program for 2 hours a day, 2-3 days per week. The training sessions were held on a rotating schedule depending on the schedule of the day with PT being between 1500-1700 hours (3pm-5 pm). The PT instructor and the researcher drafted various sports and wellness related conditioning programs suitable for the tactical athletes. Which were guided along with the American College of Sports Medicine (ACSM) recommendation for physical activity (10). The target components were designed in the program that had included cardiovascular endurance, muscular core endurance, upper body endurance, agility, entire body strength, and stamina to address the specific job environment of a tactical athlete. Also, it was designed to prepare the cadets in improving their fitness and wellness baseline to pass the mid assessment and the final PT test at the end of the Academy. Each session started with dynamic warm-up, static stretching, and calisthenics the cadets engaged in as a part of their designed daily workouts. At the end of a PT session, the cadets would perform a cool-down of either more static stretching or a light form of gentle yoga.

Statistical Analysis

The alpha level was set at 0.05. An Independent t-test was performed on the Outdoor Tactical Obstacle Course and Pro Agility Test for both duty belt groups vs. non-duty belt groups. As well an Independent t-test was conducted on sit-ups, push-ups, 1.5-mile run for both males and females. All collected data were transferred and analyzed with the use of Microsoft Excel®

(Microsoft Corp., Spreadsheets for Windows, Version 2016, Albuquerque, NM. The statistical software package IBM® Statistical Package for the Social Sciences (SPSS®) Statistics 20.0 (IBM Corp. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY) was used to analyze all quantitative data.

RESULTS

Physical characteristics of cadets broken down by sexes are in Table 1. The average values of the Outdoor Tactical Obstacle Course between groups are in Table 2. The values of the 5-10-5 Pro Agility between groups are in Table 3. During the 5-10-5 Pro Agility the Loaded group was 00:03.5±00:10.21 slower in comparison to the Unloaded group as it was predicted. See Table 3 in reference to Loaded vs. Unloaded time completion. For the breakdown by sexes for the 5-10-5 Pro Agility times the National Strength and Conditioning Association (NSCA) (APPX. E) average time standards for Males and Females Soccer were used to classify the cadets' Agility times. The cadets as a single group were classified in the poor ranking. Males and females in the loaded group were classified in the poor ranking also.

Table 1. Participant Physical Characteristics

	Males	Females	Combined
Age (yrs.)	28±6.4	33.6±8.8	29.5±7.5
Height (cm.)	177±5.8	167.2±4.3	174.3±7.0
Bodyweight (kg.)	99.3±27.7	94.4±19.4	97.76±25.5

Table 2. Outdoor Tactical Obstacle Course Males vs. Females, Loaded vs. Unloaded

	Loaded	Unloaded
Males (mins.)	01:45 ± 03:47	01:36 ± 03:23
Females (mins.)	02:41 ± 04:38	02:33 ± 04:35

Table 3. 5-10-5 Pro Agility Shuttle Times Males vs. Females, Loaded vs. Unloaded

	Mean	SD

Loaded vs. Unloaded(secs.)	00:03.5	±	00:10.21
Males Loaded (secs.)	00:09.8	±	00:02.11
Males Unloaded (secs.)	00:08.4	±	00:04.37
Females Loaded (secs.)	00:08.9	±	00:05.83
Females Unloaded (secs.)	00:10.8	±	00:01.56

DISCUSSION

First responders, especially law enforcement officials are affected by numerous work specific injuries. With the requirements of mandatory work gear contributing to the work specific stress. This study investigated cadets' performance on a 5-10-5 Pro Agility and the Outdoor Tactical Obstacle Course when wearing a duty belt versus not wearing a duty belt.

It was hypothesized, of those cadets wearing the duty belt would complete the 5-10-5 Pro Agility and the Outdoor Tactical Obstacle Course statistically slower than those not wearing a duty belt. In comparison to those cadets who did not wear their equipment during their time trials; not violating the p-value ($p>0.05$). The loaded groups of the females ($p>0.43$) and the males ($p>0.23$) that wore their equipment during the 5-10-5 Pro Agility run times were higher as predicted. However, the results had given no statistically significance between the Loaded vs. Unloaded groups. Unlike the 5-10-5 Pro Agility the loaded groups of the females ($p>0.01$) and the males ($p>0.02$) Outdoor Tactical Obstacle Course were course times given statistically significance.

The IACP reported 1,295 injuries in 2018, listed common on the job injuries and frequency of occurrences. Sprains, strains, and soft tissue tears occurred 610 times in comparison to gunshot wounds with an occurrence frequency rate of one (12,24,25). Academy physical training and agencies in-service training was also significant to police officers' injuries with 175 recorded injuries that occurred during these training events (12, 24, and 25). Many of these on-the-job incidents or training incidents are problematic occurrences simply due to the work equipment worn and the stress the equipment placed on the human anatomy, such as the lower back and hips. The Eau Claire Police Department partook in a research team's study that had determined load-bearing vests were safer and a healthier alternative to the traditional duty belt. The six month study had discovered that although the loaded bearing vest had weighed more than the duty belts, the 30lbs weight normally from the duty belt was evenly distributed throughout the wear of a load bearing vest instead and the participating officers had experienced less strain on the hips and the lower back (21). Research on Canadian police officers indicated that 33%-75% of officers had lower back complications (29). Law officials can wear body armor that can be quite heavy, weighing up to 18.8 pounds (8.5 kg) and on top of wearing the armor the additional weight of a duty belt (28) which can significantly impact movement and physical performance. A duty belt can weigh anywhere from 10 to 20 more pounds depending on its configuration. Not only is a duty belt pressing downward on the law officials hips but the addition of the Body armor covering the torso decreases their mobility. With the interference it decreases balance recovery, which will result in an increased risk for low back strains due to rapid, twisting motions to correct balance or due to job tasks (28).

This twisting motions to correct balance was present in those cadets who had worn their duty belts during the 5-10-5 Pro Agility Shuttle. Many cadets that were favoring one side, the right or

the left, while they stood with their fully equipped duty belt were displaying physical observation; they were experiencing a pinch or a burning like symptom, which was more than likely significant they had weak gluteus medius and maximus muscles (15).

Agility is an important physical trait because officers have to make instinctively rapid changes in direction while in pursuit. Proficiency in agility requires the officer to rapidly change direction within a relatively short time in contact with the ground while generating enough force to pursue a suspect (26). LEO's health and safety are the main priority for every Agency, with the progressive strides towards effective LEOs performance and wellness inclusion. This would be a beneficiary progression in prolonging LEO's life spans such as lowering back pain, which in term this study had presented that those cadets who had worn their fully equipped duty belts were less efficient executing their job specific tasks. Not only were they less efficient at their jobs but expressed the pain and discomfort performing these tasks while wearing their required work gear.

Limitations of the Study

The sampling size could have been spread across numerous days with the cadets assigned appropriately to a routine schedule. The most notable limitation was the small collection of data to compare the first set of collected data because of COVID-19. Continued sample collections were unable to be obtained because of the unpredictable and volatile environment presented by COVID-19 which led to significant changes and adjustments in the conduct of this study.

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