

The effects of aerobic fitness on day one physical training session completion in law enforcement recruits

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Objectives: The aim of this study was to determine if there were differences in aerobic fitness between recruits who completed or failed a physical training (PT) session on day one of law enforcement agency (LEA) academy training.

Design and Methods: Retrospective data from one class comprising 101 LEA recruits ($\text{♂} = 78$; $\text{♀} = 23$) were analyzed. Recruits completed the multistage fitness test (MSFT) three days prior to academy. The number of completed shuttles and estimated maximal aerobic capacity ($\dot{V}O_{2\text{max}}$) derived from this test provided measures of aerobic fitness. LEA staff ran the PT session on day one, which incorporated psychological stress, calisthenics, and a 2-mile (3.22-km) formation run completed at a 10 minute·mile⁻¹ pace. Failure to complete the run resulted in PT failure. A one-way ANOVA ($p < 0.05$) calculated between-sex differences; univariate repeated measures ANCOVA (sex was a covariate) derived differences between those that completed or failed the PT session.

Results: Males completed more MSFT shuttles and had a higher $\dot{V}O_{2\text{max}}$ than females ($p < 0.01$). Eighty-six recruits ($\text{♂} = 70$; $\text{♀} = 16$) completed the PT session; 15 ($\text{♂} = 8$; $\text{♀} = 7$) did not. Recruits that completed the PT session were younger, lighter, completed 57% more MSFT shuttles, and had a 25% greater estimated $\dot{V}O_{2\text{max}}$ ($p \leq 0.03$).

Conclusions: Higher aerobic fitness, measured via the MSFT, likely contributed to law enforcement recruits successfully completing a PT session conducted on day one of academy training. The PT session intensity affected older recruits and females more. These recruits in particular should enhance aerobic fitness prior to academy to successfully complete this, and potentially future, PT.

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Key words: cardiovascular fitness ■ multistage fitness test ■ maximal aerobic capacity ■ police ■ tactical

INTRODUCTION

Law enforcement can be a demanding occupation where officers may need to exert force and pursue suspects, sustaining these actions for periods of time.⁷ As a result, law enforcement agencies (LEA) conduct training academies to prepare recruits for the profession. Academy is used to socialize recruits by establishing expected behaviors,² and physically developing recruits for the job demands.⁵ This often appears similar to a military-style boot camp, where training staff expose recruits to physical and psychological stressors.¹⁰ Day one is particularly challenging, as staff aim to elicit stress responses comparable to that experienced in daily job tasks, and to assess each recruit's tolerance and demeanor under these stressors.¹⁰

Physical training (PT) will typically form part of the requirements for day one of academy. Due to large class numbers and limited equipment and space, most academies focus on muscular endurance or calisthenics, and aerobic training (e.g., formation runs).^{4, 11, 14} A formation run involves recruits running in an organized formation along a set route, with the distance and pace typically dependent on the overall fitness of the unit.⁴ However, if staff are using a formation run as a physical and

mental challenge, the pacing may be set above the capabilities of certain recruits. This could result in them failing to complete the run. Depending on the LEA, this could equate to a PT session failure, and generally a recruit has to complete a set number of PT sessions in order to graduate academy. For example, in a Californian (USA) LEA, recruits must successfully complete at least 30 of 36 PT sessions.¹⁶

Higher aerobic fitness should aid a recruit in successfully completing a PT session on day one of academy, especially if a formation run is a large component. Successfully completing all the first day requirements could be important for recruits, as it ensures they do not fall behind in PT session completion, while also potentially avoiding a negative experience that could encourage voluntary separation from academy.⁹ Additionally, female and older recruits tend to have lower aerobic fitness,^{3, 6, 12} which means they could be more adversely affected by day one training intensities. This could place these recruits at a disadvantage with regards to PT completion, although this requires research confirmation. The aim of this study was to investigate the differences in aerobic fitness, as measured by the multistage fitness test (MSFT) between law enforcement recruits that completed or failed a PT session on day one of academy.

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METHODS

Experimental Approach to the Problem

A retrospective analysis of existing data from one class was performed to investigate the effects of aerobic fitness, as measured by the MSFT, on the ability of recruits to complete the academy day one PT session. Data were analyzed by sex, and by recruits that completed or failed the PT sessions, as determined by the training staff.

Participants

Data were collected by one USA-based LEA three days prior to, and on the first day of, academy, and was released with consent from that organization. This sample comprised 101 recruits (age: 27.38 ± 7.01 years; height: 1.72 ± 0.09 m; body mass: 79.56 ± 13.63 kg) from one class that started training in Fall/Autumn of 2018, and included 78 males and 23 females. The institutional ethics committee approved the analysis of pre-existing data.

Procedures

The data were collected by LEA staff who were all trained by a certified Tactical Strength and Conditioning Facilitator, who also verified the proficiency of the staff.¹² The MSFT test was completed outdoors on a concrete surface between 0700-0800 three days prior to day one of academy. The day one PT session commenced on an outdoor concrete area, before a formation run was completed on neighboring roads. Although conducting testing outdoors is not ideal, these procedures were typical for this LEA.^{11,13}

Multi-Stage Fitness Test (MSFT)

For the MSFT, recruits ran back and forth between two lines spaced 20 m apart indicated by markers.^{9,13} The running speed for this test was standardized by pre-recorded auditory cues played from an iPad handheld device (Apple Inc., Cupertino, California) connected to a portable speaker (ION Block Rocker, Cumberland, Rhode Island). The speaker was located in the center of the running area, and positioned such that it would not interfere with the recruits. The test was terminated when the recruit was unable to reach the lines twice in a row in accordance with the auditory cues, or via voluntary cessation, and was scored according to the final stage the recruit was able to achieve. The stage was used to calculate the number of completed shuttles. $\dot{V}O_{2max}$, measured in milliliters per kg

body mass per minute ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), was estimated for each recruit.¹⁷

Day One Physical Training

The general structure of the PT session on day one of academy for recruits from this agency has been described.¹⁰ Day one started in the classroom, where recruits viewed educational videos, were given agency-specific information, and split into their platoons. Recruits then assembled in formation in a large open concrete space. Over an approximate 2-hour period, recruits followed the commands of staff, completed certain tasks (e.g., holding push-up or squat positions), and changed in and out of different uniforms to repeat these tasks. The recruits then completed a formation run over a distance of 2 miles (3.22 km), at an approximate 10 minute-mile⁻¹ pace. Recruits were organized in height from shortest to tallest in rows of 5-6 recruits, and were expected to stay in this formation for the duration of the run. Other staff followed the group in vehicles, and if recruits fell behind more than ~400 m behind the last person in the class and were picked up, they were deemed to have failed the PT session.

Statistical Analysis

All statistics were computed using the SPSS Version 25.0 (IBM, Armonk, United States of America). Descriptive statistics (mean \pm SD) profiled all variables. A one-way ANOVA was used to compare the sexes, with significance set at $p < 0.05$. To compare any differences between recruits who completed or failed the day one PT session, univariate repeated measures ANCOVA (sex was a covariate) was utilized ($p < 0.05$). Sexes were combined within the two groups for this analysis.

RESULTS

Males were taller, heavier, completed more MSFT shuttles, and had a higher estimated $\dot{V}O_{2max}$ than females (Table 1). The data for recruits that completed or failed the PT sessions are shown in Table 2. Eighty-six recruits (70 males, 16 females) completed the PT session, while 15 (8 males, 7 females) did not. When controlling for sex, the recruits that completed the PT session were significantly younger, and lighter in body mass. These recruits also completed 57% more MSFT shuttles compared to those that failed the PT session, and had a 25% greater $\dot{V}O_{2max}$.

Table 1 Descriptive data (mean \pm SD) for age, height, body mass, MSFT shuttles, and estimated $\dot{V}O_{2max}$ for male and female recruits.

	Males (n = 78)	Females (n = 23)	<i>p</i> value
Age (years)	27.62 ± 7.78	26.65 ± 3.84	0.57
Height (m)	1.76 ± 0.06	1.60 ± 0.05	< 0.01
Body Mass (kg)	84.16 ± 11.40	63.94 ± 7.72	< 0.01
MSFT shuttles (no.)	68 ± 17	56 ± 17	< 0.01
$\dot{V}O_{2max}$ ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$)	38.36 ± 5.26	34.47 ± 5.44	< 0.01

* Significantly ($p < 0.05$) different from the male recruits.

Table 2 Descriptive data (mean \pm SD) for age, height, body mass, MSFT shuttles, and estimated $\dot{V}O_{2\max}$ for recruits who completed or failed the Day One PT session (sexes were combined).

	Completed (n = 86)	Failed (n = 15)	<i>p</i> value
Age (years)	26.72 \pm 6.55	30.87 \pm 8.52*	0.02
Height (m)	1.73 \pm 0.09	1.68 \pm 0.11	0.77
Body Mass (kg)	79.13 \pm 12.72	81.99 \pm 18.38*	0.03
MSFT shuttles (no.)	69 \pm 16	44 \pm 10*	< 0.01
$\dot{V}O_{2\max}$ (ml·kg ⁻¹ ·min ⁻¹)	38.64 \pm 4.98	30.81 \pm 3.39*	< 0.01

* Significantly (*p* < 0.05) different from recruits who completed the day one PT session.

DISCUSSION

The aim of this study was to investigate whether aerobic fitness contributed to a law enforcement recruit's ability to complete a PT session on day one of academy. The results indicated that this was the case; recruits that failed the PT session tended to have a lower level of aerobic fitness, as measured by the MSFT. Although not unexpected, further discussion of these results are warranted; the 15 recruits that did not complete the PT session were not the bottom 15 in the MSFT. Additionally, there appeared to be a greater impact of this PT session on older and female recruits, both of whom (as a population group) tend to have a lower $\dot{V}O_{2\max}$.

Aerobic fitness is valuable quality for law enforcement officers.¹⁸ The current results provide further support to this notion; those recruits who completed the day one PT session had significantly superior aerobic fitness. Additionally, recruits from this study demonstrated a MSFT performance^{6, 9, 13} and estimated $\dot{V}O_{2\max}$ ²⁰ comparable to other law enforcement populations. Successful completion of the day one PT session specific to this agency meant that recruits had not fallen behind in the PT requirements,¹⁶ and may have also experienced a more positive first day. This positive experience is important given that negative experiences from the PT sessions could contribute to a recruit voluntarily separating from academy.⁹

The recruits that completed the PT session were younger and lighter than those recruits that failed the session. Older law enforcement officers tend to demonstrate poorer fitness and have a greater body mass when compared to their younger counterparts.⁶ While this study did not feature a detailed analysis of body composition, lower $\dot{V}O_{2\max}$ and greater body mass could negatively influence PT performance, especially if a formation run is part of the session. Older recruits should ensure they develop fitness qualities, such as aerobic capacity, that could influence the ability to complete the PT requirements. Additionally, ensuring an appropriate ratio between lean and fat mass could also positively influence PT completion.^{7, 13}

It is likely that aerobic fitness was not the sole contributor to day one PT session completion. When ranking the recruits in the MSFT, the bottom 15 did not all fail the PT session (five of the bottom 15 completed the session). A large component of day one is not just the physical stress, but psychological stress as well.¹⁰ Psychological stress will induce a physiological response; when analyzing custody assistant recruits on day one of academy in the period prior to the formation run, Lockie et

al.¹⁰ found that recruits had a mean heart rate equivalent to 80.92 \pm 5.64% of their age-predicted maximum. This meant the custody assistant recruits spent approximately 70% of the PT session prior to the formation run in the vigorous-to-very vigorous heart rate training zone.⁸ It could be expected that the recruits from this study would have similar responses as their day one followed the same general structure. Accordingly, even though a recruit could have an acceptable level of aerobic fitness, the combined stress of psychological and physical exertion could negatively impact their ability to complete PT. This could be more closely related to the recruit's mental resilience and ability to manage stress.

Furthermore, vigorous exercise, which occurred in this PT session,¹⁰ can be more challenging for less-trained individuals.¹ Vigorous exercise will place greater demands on an individual's anaerobic capacity, which could also be a limiting factor in exercise performance. Anaerobic capacity is not directly measured by the MSFT,¹⁹ and this could have impacted those recruits who did not complete the PT session but ranked higher in the MSFT.

The male recruits, in general, had superior aerobic fitness compared to the females. Furthermore, the mean MSFT shuttles and $\dot{V}O_{2\max}$ for those recruits that completed the PT session was similar to that for the males. While this could be expected given the greater number of males, this is still notable. Aerobic fitness, rather than sex, may be a key factor in ability to complete PT. The higher percentage of female PT failures (30% of females failed, versus 10% of males), could be due to females generally having a lower aerobic fitness than males.^{3, 6, 12} Given that the formation run intensity was likely closer to the capacity of most male recruits, the run could have impacted the females to a greater extent. Although it is generally considered that occupational standards should not differ between the sexes as all officers have same job requirements once they graduate,^{15, 16} LEAs should consider the intensities set during PT sessions. While there are other goals for academy day one of (i.e., assessing adversity tolerance to physical and psychological stressors),¹⁰ staff should take note of the inherent differences that will influence the PT performance of male and female recruits. Ability-based training practices should be introduced to enhance overall recruit fitness and job performance,^{4, 14} which is especially true if an agency wishes to retain more female officers.

CONCLUSION

Higher aerobic fitness, as measured via the MSFT, likely contributed to law enforcement recruits successful completion of the PT session on day one of academy. In addition to aerobic fitness, and due to the psychological stress imposed by officers on this day and throughout academy, recruits may also benefit from mental resilience and stress management training. Lastly, older and female recruits may be at a greater disadvantage and should focus on developing aerobic fitness prior to academy.

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