Between-Sex Differences in the Work Sample Test Battery Performed by Law Enforcement Recruits: Implications for Training and Potential Job Performance

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ABSTRACT

Law enforcement officers perform a range of demanding job-specific tasks, and these tasks are the same for all officers regardless of sex. Female officers tend to be at a physical disadvantage compared to males, and this could affect their performance in job-specific tasks. This study investigated the between-sex differences in the Work Sample Test Battery (WSTB; duplicates what an officer encounters on-duty) in law enforcement recruits. A retrospective analysis was performed on 308 recruits (259 males, 49 females) from five training academy classes. The WSTB incorporated five tests: a 99-yard obstacle course (99OC), 165-pound body drag (BD), 6-foot chain link fence (CLF) and solid wall (SW) climb; and a 500-yard run (500R). These tests were typically performed in the last weeks of academy and must be completed to a state-mandated minimum standard for recruits to graduate. Independent samples t-tests ($p < 0.05$) and effect sizes (d) calculated between-sex differences. Noting that when individual data were considered, there were male recruits who were outperformed by females. However, on average, female recruits were slower on all WSTB tasks compared to male recruits ($p < 0.01$). Large effects were present for the 99OC, CLF, and 500R differences (d = 1.26-1.69), a moderate effect for the BD (d = 0.85), and small effect for the SW (d = 0.56). Slower performance in job-specific tests could translate to slower performance in tasks required on-duty. Training staff should develop the qualities important for WSTB performance in female and underperforming male recruits to enhance future job performance.

Key words: academy training; body drag; fence climb; job-specific tasks; foot pursuit; police; tactical

INTRODUCTION

Law enforcement can be a physically challenging profession, with a variety of tasks required from officers. Some of the job-specific tasks include: driving vehicles (19); using firearms and administering defensive tactics (37); rescuing civilians or partners, vaulting obstacles, and pursuing and apprehending suspects (7). Due to these demands, law enforcement recruits undergo academy training before they become sworn officers. During academy, recruits learn the necessary procedures required for their job and agency, and complete training designed to mentally and physically prepare them for their profession (5,18,24,38). Towards the end of academy, most agencies will use task simulations as surrogate tests to demonstrate and assess a recruit's preparedness for job-specific tasks (7,18,27).

Physical training is a major component of academy, and there are numerous challenges for staff in implementing effective programs. Recruit classes typically feature individuals with a wide range of physical capacities, with a mixture of men and women of different body sizes and ages (22,23). Notably, numerous studies have documented differences between the sexes in physical fitness (1,4,28,29). In the initial hiring process for a law enforcement agency (LEA), Bloodgood et al. (1) found that male candidates outperformed female candidates in all fitness tests. This included: push-ups and sit-ups completed in 60 s to measure muscular endurance; arm ergometer revolutions completed in 60 s to quantify upper-body endurance; 75-yard pursuit run (75PR) to assess change-of-direction speed; and the 2.4-km (1.5-mile run) as an aerobic capacity metric. Cesario et al. (4) found similar results for the same battery of tests in a different pool of recruits. Lockie et al. (29) documented superior aerobic capacity in male recruits compared to female recruits prior to academy, measured by the 2.4-km run and 20-m multistage fitness test. In measures of upper- and lower-body power, Lockie et al. (20) found that male recruits outperformed females in the 2-kg medicine ball throw and vertical jump prior to the start of academy. Differences in skeletal muscle mass (13), fat mass (10), and power and

work efficiency in aerobic activities (39) would contribute to these between-sex differences. However, it should also be noted that female recruits can outperform males in fitness test performance (22,26,30), so sex may not always be the sole influencing factor when considering performance outcomes. Accordingly, it is important to document the performance recruits, regardless of sex, not just in terms of general fitness, but job-specific performance as well.

Despite any inherent sex differences between male and female recruits, or recruits of different body sizes, ages, or fitness capabilities, the job tasks of all officers are the same once they graduate academy. In line with this, LEA staff often adopt a 'one-size-fits-all' model of training (3,24,30,34,38). This model has the expectation that all recruits complete the same training, with limited individual modifications relative to exercise type, work-to-rest ratio, volume, intensity, and load. Given that many female law enforcement recruits may typically enter academy with a lower level of fitness (1,4,21,28,29), this type of training could be problematic. Female recruits may be working at a relatively higher intensity for the same exercise when compared to males, which could then increase their risk of injury (14). Furthermore, if the training load being experienced by the individual is not carefully monitored (and this is challenging within law enforcement training academies) (33), greater fatigue and physical performance decrements may occur (15). This could be an issue for recruits with lower levels of fitness, as even though they may be on track to graduate academy, their ability to complete physically demanding tasks may be less than effective. This could be true not just for female recruits, but certain male recruits as well. As a result, the physical performance of the individual recruit should be considered, in addition to analyzing sex differences.

This is pertinent, as recruits are often tested in job-specific tasks in order to ensure they have the necessary skills for the profession. In California, recruits from all law enforcement training academies must complete the Work Sample Test Battery (WSTB) before they can graduate (40). The WSTB has been described in the literature (18,27), and consists of five tests

completed for time: a 99-yard (90.53-m) obstacle course (99OC); a body drag (BD) with a 165-pound (74.84-kg) dummy; a climb over a 6-foot (1.83-m) chain link fence (CLF); a climb over a 6-foot solid wall (SW); and a 500-yard (457.2-m) run (500R). The WSTB does not operate via a pass/fail system per se. Rather, these tasks must be completed within a certain time which allows for each test to be scored; the faster the time, the greater the score (18,40). To attain WSTB points, the 99OC must be completed within 33.5 s; the BD within 27.9 s; the CLF within 15.1 s; the SW within 19.6 s; and the 500R within 199.9 s (18,40). Lockie et al. (18) documented general fitness characteristics related to the WSTB, including upper-body muscular endurance and strength, and aerobic fitness. Female recruits were typically poorer in these fitness characteristics compared to males (1,4,21,28,29), which could translate to lesser WSTB performance. As the WSTB was designed to be representative of the job duties of the profession, this could be an issue for female recruits, the agency in general, and the communities they serve. Even if it is expected that female recruits will generally not perform as well in the WSTB due to inherent physiological differences compared to males (13,39), it would be beneficial for LEA training staff to attempt to minimize any between-sex disparities. This could ensure female recruits are better positioned for job success and afforded equal opportunity, which is important given that many LEAs want to hire and retain more women (8,9,45). However, it is currently not known if there are between-sex differences in the WSTB, and what any magnitudes of difference may be. In addition to this, the profiling of individual recruit data would illustrate whether females, in general, perform the WSTB tasks slower than males, or if there are also male recruits who are towards the bottom end of the WSTB spectrum are outperformed by fitter female recruits.

This is important information, given that the WSTB is used as a surrogate for law enforcement specific tasks. If recruits are slower in the WSTB, the downstream effect would potentially be slower performance of similar tasks when on-duty. This could have safety

impacts on not just the officer and their colleagues, but the general public as well. Therefore, the purpose of this study was to compare WSTB performance between male and female law enforcement recruits. The goal of this study was not just to determine whether there was a difference, but rather the magnitude of difference between the sexes. Additionally, individual recruits would be profiled in all the WSTB tasks. This would illustrate whether there were female recruits that outperformed males, which would illustrate the need for specific training interventions for certain males in job-specific tasks. In line with previous research on law enforcement recruits (1,4,21,28,29), it was hypothesized that male recruits would be superior in all WSTB tasks. It was further hypothesized that the magnitude of difference as measured by effect sizes between the sexes would be large-to-very large (12). Lastly, it was hypothesized that profiling of individual recruits would illustrate that there were some male recruits that were outperformed by female recruits in the WSTB (22,26,30).

METHODS

Experimental Approach to the Problem

Retrospective analysis of pre-existing data for recruits belonging to five classes from one LEA was conducted. Recruits were stratified by sex, and differences between the WSTB tasks were analyzed by independent sample t-tests and effect sizes. Scatter plots were also produced to detail individual male and female recruit performance on each WSTB task. The dependent variables for this study were times for all the WSTB tasks (99OC, BD, CLF, SW, and 500R).

Subjects

As stated, a retrospective analysis of recruits from five academy classes from one agency was conducted. This sample comprised 308 recruits (26.29 ± 4.63 years; height: 1.73 ± 0.08 m; body mass: 79.67 ± 14.54 kg), including 259 males (26.25 ± 4.76 years; height: 1.76 ± 0.07 m;

body mass: 82.01 ± 13.24 kg) and 49 females (26.46 ± 3.91 years; height: 1.63 ± 0.07 m; body mass: 67.57 ± 14.99 kg). The characteristics of the subjects in this study, in addition to the ratio between the sexes, was typical of law enforcement populations (1,4,18,23,24,26,27,30,31). The five training cohorts completed their academy within a calendar year in southern California. All recruits in this study completed all tasks in the WSTB and graduated to become sworn officers. Based on the archival nature of this analysis, the institutional ethics committee approved the use of pre-existing data (HSR-17-18-370).

Procedures

The data were collected by staff working for one LEA. Across the five classes, the training and testing schedules varied between classes due to logistical arrangements. Nonetheless, all classes adhered to the standards expected by the state's governing body (Peace Officers Standards and Training) (41). Depending on the class, recruits may complete one or two 'pre-test' sessions where they will practice the WSTB tasks in a similar fashion as they will perform them during the final examination. As for the final WSTB, the timing of any practice sessions can vary from class-to-class because of the logistics of timetabling all the other requirements of the training academy. Training staff provide some coaching of the technique required for the WSTB tasks, relative to the guidelines provided by Peace Officers Standards and Training (41). The degree of coaching can differ between classes within the agency as the training staff can be different across the classes. The WSTB is mandatory for LEAs in California, and recruits must attain a minimum score of 384 to graduate from academy (18,40). The procedures for each test have been presented by Peace Officer Standards and Training (40) and Lockie et al. (18,27). Nonetheless, each test will be described. The WSTB was performed outdoors on specifically designed structures at the LEA training facility. The tests could be completed in any order, except for the 500R which was completed last. Recruits were provided the

opportunity for two attempts for each test, with a minimum of 120 s rest between attempts. Although failing a first attempt could lead to some fatigue on the recruit, the provision of the 120-s recovery period was designed to alleviate the impacts of fatigue on WSTB task performance. Time for each test was recorded to the nearest 0.1 sec by a staff member with stopwatch for each attempt. Testers trained in the use of stopwatch timing procedures for athletic performance tests can record reliable data (11). For all WSTB tasks, the fastest time was analyzed.

99-yard (90.53-m) Obstacle Course (99OC)

This test was designed to simulate a foot pursuit in an urban area and is shown in Figure 1. Recruits completed the 99-yard (90.53-m) course as quickly as possible, while remaining on the concrete track. During the run, they also stepped over three 6-inch x 6-inch (0.15-m x 0.15-m) simulated curbs, and one 34-inch (0.86-m) high obstacle.

INSERT FIGURE 1 ABOUT HERE

165-pound (74.84-kg) Body Drag (BD)

For the BD, recruits dragged a 165-pound (74.84 kg) dummy 32 feet (9.75 m). Recruits lifted the dummy by wrapping their arms underneath the arms of the dummy and moved into a standing position by extending the hips and knees. Once standing, the recruit informed the tester they were ready and timing was initiated. The recruit dragged the dummy by walking backwards over the required distance as quickly as possible. Timing stopped when the dummy's feet passed the finish line.

6-foot (1.83-m) Chain Link Fence (CLF) Climb

Recruits started 5 yards (4.57 m) away from the fence and ran up to and scaled the 6-foot (1.83-m) fence with whatever technique they chose (without using the side supports on the fence). If the recruit did not initially climb the fence in their first attempt within a trial, they could continue their attempt (recruits had to scale the fence for the trial to be successful), but the time continued to run. Once the recruit cleared the fence, they were to land and run 25 yards (22.86 m) as fast as possible to complete the test.

6-foot (1.83-m) Solid Wall (SW) Climb

The same instructions and procedures for the CLF were provided for the SW, with the difference being the type of wall that was climbed (which was a solid, wooden wall).

500-yard (457.2-m) Run (500R)

The 500R was designed to simulate a long-distance foot pursuit. The running distance was marked on the track, and recruits ran the 500-yard (457-m) distance as quickly as possible**.**

Statistical Analysis

Statistical analyses were processed using the Statistics Package for Social Sciences (SPSS) Version 26.0 (IBM Corporation, New York, USA). Descriptive statistics (mean ± standard deviation [SD]) were calculated for each variable. Independent samples t-tests ($p < 0.05$) were used to calculate any differences between the sexes in the WSTB tasks. Effect sizes (d) were also derived for the between-sex comparison, where the difference between the means was divided by the pooled SD (6). A d less than 0.2 was considered a trivial effect; 0.2 to 0.6 a small effect; 0.6 to 1.2 a moderate effect; 1.2 to 2.0 a large effect; 2.0 to 4.0 a very large effect; and 4.0 and above an extremely large effect (12). Effect sizes were included in this study to

ascertain the magnitude of difference between the sexes in the WSTB tasks irrespective of the *p* value, and to provide additional information for the practitioner (17). Scatter plots were produced in Microsoft Excel (Microsoft Corporation™, Redmond, Washington, USA) for each WSTB task to visualize the performance of each individual recruit. This allowed for the profiling of all recruits in the WSTB tasks regardless of sex.

RESULTS

The WSTB data for male and female recruits are shown in Table 1. Males were significantly faster than the females in all WSTB tasks. The between-sex differences for the 99OC, CLF, and 500R all had large effects. The BD difference had a moderate effect, while there was a small effect for the SW. The individual scores for each recruit in the WSTB were charted in Figures 1-5. Of note, while female recruits tended to have slower times in the WSTB, there were still male recruits who were similar to, or slower than, some of the females.

INSERT TABLE 1 ABOUT HERE

INSERT FIGURES 1-5 ABOUT HERE

DISCUSSION

This study investigated the differences between the sexes in WSTB performance by law enforcement recruits. Furthermore, individual recruits were profiled in each of the WSTB tasks. The WSTB was designed to assess job-specific task performance of recruits prior to academy graduation (40). This study is important, as many LEAs make a concerted effort to hire and retain females (8,9,45), so analysis of any potential physical boundaries towards successful job performance should be investigated. All recruits analyzed in this study performed the WSTB tasks to a level that allowed them to graduate academy. It is important to note, however, that

the WSTB was designed to simulate essential law enforcement-specific tasks. Accordingly, even though a recruit may pass the expected standards to graduate, slower performance in the WSTB could provide some indication of performance limitations in tasks that are essential to public safety (e.g. a slow fence climb could indicate a recruit would struggle to perform this tasks efficiently in the field, which would then inhibit their ability to pursue a dangerous offender). Given these potential downstream effects, it is important to analyze between-sex differences in the WSTB as numerous studies have demonstrated lesser physical fitness of female candidates or recruits relative to males (1,4,21,26,28-30). The data from this study could be used in providing training recommendations for female recruits and officers to enhance their performance in job-specific tasks that would ultimately benefit public safety. From the current results, it was clear that male recruit performance was generally superior to female recruit performance in all WSTB tasks. However, it should be noted that there were a number of individual male recruits whose performance in the WSTB was similar to, or lesser than, female recruits. As a result, LEA training staff should not only focus on the physical development of female recruits during and after academy, but also males that may have physical limitations relative to job tasks.

The 99OC and 500R provide measures of foot pursuit ability; the 99OC recreates a pursuit in an urban area, while the 500R provides a measure of extended foot pursuit ability (18,27,40). For both tests, there were large effects for the differences between male and female recruits. Previous research has shown that a different foot pursuit simulation, the 75PR, was generally performed faster by male candidates (1), recruits (4), and civilians (42) when compared to their female counterparts. Post et al. (42) documented that lower-body strength, multidirectional power, and linear and change-of-direction speed were important foundations for faster 75PR performance. Lockie et al. (18) noted a range of physiological characteristics that correlated to faster performance in the 99OC and 500R. These included muscular

endurance (sit-ups completed in 60 s), and anaerobic (201-m run) and aerobic capacity (2.4-km run). Previous research has shown that females from law enforcement populations tend to perform worse in these fitness tests compared to males (1,4,21,26,28-30). Clearly, there are a range of physiological qualities that could be targeted for improvement in female recruits during and following academy to enhance their ability to perform a foot pursuit.

The BD provides a metric for the essential task of rescuing a civilian or partner from a hazardous environment (18,25,27,40). Lower-body strength measured by a one-repetition maximum hexagonal bar deadlift related to a faster BD in male and female civilians (25). As males generally display greater strength than females (13), it was expected that male recruits would outperform females in this strength-based task. There was a moderate effect for the faster times recorded by male recruits; female recruits performed the task 38% slower. Given the potential importance of this task when on-duty, female recruits may benefit from targeted strength training to improve their ability in a BD. As this task requires moving a set load, absolute strength is important to develop (25). This is especially pertinent given that this type of strength training is not often a focus of law enforcement academy training (3,24,34).

The CLF and SW provide measures of climbing ability in a task that may be performed in an urban environment. Upper-body pulling strength and abdominal endurance related to faster performance in these tasks for law enforcement recruits (18). Additionally, the manner in which this test is administered by Peace Officers Standards and Training would also stress maximal running speed, as recruits must complete a 25-yard sprint following the climb (18,27,40). Females were 23% slower in the CLF (small effect), and 34% slower in the SW (small effect). Although officers will make tactical decisions as to whether they should climb an obstacle when on-duty (i.e. it is not advisable to climb a wall when you cannot see what is on the other side), it would still be beneficial for an officer to be effective at this task. Upper-body strength should be beneficial for climbing tasks (18), and females tend to display lesser

upper-body pulling strength compared to males (36). This may mean some females may need to make tactical decisions to not climb when confronted by a climbing task, which could have further downstream effects (e.g. losing a suspect when in pursuit). Muscular strength and endurance may need dedicated attention in female recruits, even for those who graduate academy. Given the collective limitations for females relative to males across the WSTB tasks, this leads to certain recommendations. The data in this study suggests that, particularly for female recruits; 1) more individualized training during academy should be administered to target specific limitations and those of poorer fitness, and 2) access to strength and conditioning programs following academy should be provided to ensure further physical development. However, it is important to recognize that universal standards, such as that provided by the WSTB (40), will typically favor males due to generally greater measures of fitness. This is because for the same tasks, they will generally be working at a lower capacity than female recruits (14). Nonetheless, this would suggest that for the female law enforcement recruit or officer, they should maximize their physical potential in order to enhance their ability to perform the specific tasks required when on-duty. Further, the results of this study, which found that there were instances where female recruits outperformed male recruits, would suggest that being of the female sex is not a deterrent to meeting WSTB standards.

These recommendations, however, do not just apply to female recruits. What can be observed in Figures 1-5 is that even though there was a tendency for female recruits to be slower in the WSTB tasks, there were still a number of male recruits that were similar to or slower than female recruits. Previous research has also documented that male recruits may be outperformed by females in a range of different fitness tests (26,30). This could be related to anthropometrical and physiological characteristics. Although anthropometry was not considered in this study, recent research has indicated that taller and heavier female trainees and soldiers performed better in military-specific tasks such as the road march, casualty drag,

casualty evacuation, and sandbag carry (43). Smaller males may experience greater challenges in tasks where absolute (i.e. the BD) and relative (the fence climbs) strength is important. Additionally, given that previous research has shown relationships between muscular endurance, strength, and aerobic capacity with the 99OC, CLF, SW, and 500R (18), and lower-body strength with the BD (25), it is likely the poorer performing male recruits were lacking in these qualities. As a result, males that perform more poorly in the WSTB may also benefit from specific training in the qualities needed for these tasks. Even though a recruit may graduate from academy, and inability to perform a pursuit, obstacle climb, or drag quickly and efficiently could effect on-duty task performance and public safety.

It is important to recognize that when on-duty, officers will make tactical decisions relative to emergency situations that are tense, uncertain, and evolve rapidly, the behavior of offenders, laws and agency regulations, and their own physical abilities. For example, the LEA from this study has very specific rules and regulations associated to when an officer should conduct a foot pursuit, and recruits are trained and tested in this information (16,32). In addition to this, LEA staff may select certain officers for specific tasks as it better matches the officer's skills (2). This information collectively highlights that tactical decisions could be made to mitigate the influence lesser physical fitness could have on the performance of certain job tasks. Nevertheless, male and female law enforcement officers would clearly benefit from higher levels of fitness, and specifically fitness related to actual job tasks. Access to strength and conditioning programs for all officers would be beneficial for not only the job, but relative to general health as well (44).

There are study limitations that should be discussed. Fitness characteristics can vary between different agencies (35). Accordingly, the between-sex differences in specific job tasks could vary between agencies. LEAs should ideally investigate their own exit examinations to ascertain whether there are any between-sex differences, and what impact this may have on

female recruits. There has been some analysis of important fitness characteristics that contribute to WSTB performance (18) or the specific tasks of the BD in civilians (25). However, Lockie et al. (18) did not analyze absolute or relative maximal strength in their analysis of law enforcement recruits, and given the anaerobic nature of the WSTB, more information could be elucidated if these strength metrics were incorporated in the analysis of WSTB performance. Indeed, these data could find that any suggested between-sex differences are alleviated if the females (or the males for that matter) are stronger. Given the relationships between lower-body strength and speed in a simulated pursuit run (42), further analysis of strength relative to law enforcement tasks is warranted. This study only analyzed WSTB performance at the end of academy. It would also be worth measuring how physical fitness may change over the academy period, and how this could ultimately influence WSTB performance in male and female recruits.

PRACTICAL APPLICATIONS

Within the context of these limitations, this study demonstrated that female recruits were slower in all WSTB tasks compared to males. This could impact the performance of similar tasks when these recruits are on-duty following academy graduation. Accordingly, female recruits could benefit from more individualized training during academy, especially relative to those fitness qualities that could benefit job-specific task performance (e.g. muscular strength and endurance, anaerobic and aerobic capacity). It should be noted that there were male recruits who were similar to, or slower than, female recruits in the WSTB tasks. LEA training staff should ideally identify any weaknesses (e.g. lower-body strength as it pertains to the BD) in job-specific task performance of all their recruits prior to the end of academy. These qualities could then be targeted for improvement specific to the individual. Indeed, any weaknesses would ideally be identified as early as possible in screening and academy training to introduce

targeted interventions relative to deficits. LEA staff should consider the provision of evidence-based strength and conditioning programs for officers to ensure they can either improve, or at the very least maintain, their ability to perform physically demanding job tasks.

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FIGURE LEGEND

Figure 1: Individual scores for the 99-yard obstacle course (99OC) in male (n = 259) and female (n = 49) law enforcement recruits from five classes at the end of academy training.

Figure 2: Individual scores for the 165-lb body drag (BD) in male (n = 259) and female (n = 49) law enforcement recruits from five classes at the end of academy training.

Figure 3: Individual scores for the 6-foot chain link fence climb (CLF) in male (n = 259) and female (n = 49) law enforcement recruits from five classes at the end of academy training.

Figure 4: Individual scores for the 6-foot solid wall climb (SW) in male (n = 259) and female (n = 49) law enforcement recruits from five classes at the end of academy training.

Figure 5: Individual scores for the 500-yard run (500R) in male (n = 259) and female (n = 49) law enforcement recruits from five classes at the end of academy training.

Table 1: Descriptive data (mean ± SD) for the WSTB tasks for male and female law enforcement recruits.

WSTB Task	Males	Females	*p*	% difference	*d*	*d* strength
99OC (s)	18.78 ± 1.40	20.76 ± 1.71*	<0.01	11	1.27	Large
BD (s)	4.86 ± 2.49	6.71 ± 1.78*	<0.01	38	0.85	Moderate
CLF (s)	7.70 ± 1.29	9.48 ± 1.55*	<0.01	23	1.26	Large
SW (s)	7.39 ± 1.17	9.92 ± 3.09*	<0.01	34	0.56	Small
500R (s)	88.53 ± 7.74	100.41 ± 6.28*	<0.01	14	1.69	Large

* Significantly slower than the males.