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Original Research

The Effects Aerobic Fitness has on Heart Rate Responses for a Custody Assistant Recruit Class Performing a Formation Run

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ABSTRACT

International Journal of Exercise Science 14(4): 1219-1233, 2021. This study measured the heart rate (HR) responses to a formation run (group run completed along a set route) performed by higher fitness (HF), moderate fitness (MF), or lower fitness (LF) custody assistant (CA) recruits. Retrospective data from 26 recruits (12 males, 14 females) were analyzed. Prior to academy training, a YMCA step test was administered. Recruits were divided into three groups based on recovery HR: top 25% were HF; bottom 25% were LF; the rest were MF. Recruit HR was measured during a formation run completed at an ~11-minute mile · pace^{-1}. HR zones were defined as: very light (< 57% of age-predicted maximum heart rate [HR_{max}]); light (57%-63% HR_{max}); moderate (64%-76% HR_{max}); vigorous (77%-95% HR_{max}); and very vigorous (> 95% HR_{max}). A one-way ANOVA, with Bonferroni post hoc, calculated between-group differences in time spent and percentage of total time in the HR zones during the run; effect sizes (d) were also calculated. HF recruits spent a significantly longer time and percentage of total time in the very light HR zone compared to the LF group ($p \leq 0.039$; d = 1.20-1.35). There were no other significant between-group differences (p = 0.070-0.980). HF CA recruits spent more time in the very light training zone compared to the other groups (d = 0.92-1.35), which may not be optimal for aerobic adaptations. LF recruits spent more time in the vigorous-to-very vigorous HR zones (~45 minutes; 70% of the run). These recruits may potentially be working above their current capacity. Formation runs may not be the most efficient aerobic conditioning method for all CA recruits.

KEY WORDS: Cardiovascular endurance, correctional officers, law enforcement, police, tactical, training intensity

INTRODUCTION

A custody assistant (CA) is responsible for assisting law enforcement officers with maintaining security in detention facilities for a law enforcement agency (40, 41, 46). Some of the physical tasks required of CAs and other individuals working in custody facilities include cell searches, responding to alarms to assist colleagues, and physical confrontations with inmates (20, 21). Although custody positions are predominantly characterized by low-intensity work (e.g., inmate processing and supervision, office work) (20, 21, 45), the physical tasks that may be required can place a high physiological load on a CA. For example, CA recruits recorded heart rates (HR) in excess of 90% of the age-predicted maximum HR (HR_{max}) during a defensive tactics simulation which involved a physical encounter with training staff role playing as inmates (29). As a result of the potential occupational demands, law enforcement agencies will often conduct academy training to physically prepare CA recruits. An important component of law enforcement academies is physical training, which can be used to enhance the fitness characteristics (e.g., muscular endurance, strength, and power, anaerobic and aerobic capacity) that underpin the performance of job tasks (8, 11, 43).

Physical training sessions completed by recruits often consist of circuit-style training and formation running (6, 8, 44, 51, 52). Formation running is a traditional exercise performed by tactical populations in which a group of personnel run in an organized group along a set route (44). Once organized, it is expected that the personnel will remain in this formation running at the same pace for the duration of the run. The distance and pace of the run typically depends on the overall fitness level of the unit (44). Anecdotally, the purpose of a formation run is often the development of morale and team cohesion. Nonetheless, specific to law enforcement academy training, formation running has often been one of the primary modalities used to develop aerobic fitness in recruits (6). This is because academy classes can feature high recruit numbers (38), which means training staff often use modalities that can be completed as one group. However, there has been little analysis of the actual demands of formation running.

Aerobic fitness is a critical quality for CAs when they need to sustain physical actions (e.g., responding to a critical situation to restrain an inmate) (20, 21). Additionally, better aerobic fitness has been linked to academy graduation in law enforcement recruits (13, 28, 31, 35, 59), so this quality should be developed in CA recruits. However, formation running may not be the best approach to achieve this. The American College of Sports Medicine (ACSM) suggests that 30-60 minutes a day of moderate exercise (defined as 64%-76% of HR_{max}) or 20-60 minutes a day of vigorous exercise (defined as 77%-95% of HR_{max}) is sufficient to elicit aerobic adaptations in adults (15). CA recruit classes are typically composed of recruits with a variety of physical abilities (41). For example, from a sample of three CA academy classes, Lockie et al. (41) found that 2.4-km (1.5-mile) run duration (which was used as a measure of aerobic fitness) had a fastest time of 9:59 minutes:seconds, and slowest time of 31:35 minutes:seconds. If a formation run is adopted during training, it is possible that the same physical stimulus (i.e., a formation run performed at a set pace) will result in different exercise intensities being experienced by individual recruits. This may not be appropriate for eliciting the desired aerobic adaptations for all individuals.

The HR responses of CA recruits to a typical formation run is important to detail, as previous research has shown that other typical law enforcement academy training methods can elicit different physiological responses within a CA recruit class (52). For example, Moreno et al. (52) investigated the influence that aerobic fitness had on the HR responses of CA recruits during two circuit training sessions. The results from Moreno et al. (52) indicated that recruits with lower aerobic fitness (measured by the YMCA step test) tended to spend more time in very vigorous training zones (> 95% HR_{max}) compared to recruits with better aerobic fitness. Specifically, recruits defined as having lower fitness spent 23-36% of ~60-minute circuit training sessions in the very vigorous training zone; other recruits spent ~1-20% of training time in this zone. Essentially, this meant the recruits with lower aerobic fitness were working harder during the same circuit training sessions. Circuit training was investigated in that study as it was a foundation of many law enforcement academy training programs (8, 51). As formation running can also be a foundation of law enforcement academy training (6, 44), it is important to specifically analyze how CA recruits with different fitness levels may experience this training modality.

Therefore, this study detailed the HR responses to a typical formation run performed by CA recruits from one academy class. Additionally, recruits were grouped as higher fitness (HF), moderate fitness (MF), or lower fitness (LF) to ascertain whether fitness influenced the HR response during the formation run. It was hypothesized that the HF CA recruits will be working at a lower intensity during the run, while LF recruits will be working at a higher intensity.

METHODS

Participants

Deidentified archival data from 26 recruits (age = 29.46 ± 9.47 years; height = 1.69 ± 0.07 m; body mass = 69.42 ± 13.35 kg), comprised of 12 men and 14 women, from one CA academy class were analyzed. Similar to Moreno et al. (52), this was a convenience sample of deidentified data that was provided by the agency, and the researchers had no control of the final sample size used in this investigation. Participants were required to complete the formation run as part of physical training for their employment. Accordingly, participants were medically cleared for physical training at the agency and read and signed the agencies' required contracts for employment. As stated, the CA recruits completed fitness testing and wore HR monitors during physical training as part of the requirements for employment, and this was supervised by the law enforcement agency training staff. Inclusion criteria for the participants included complete data sets (i.e., YMCA step test and HR data from the formation run). As the study involved the analysis of archival data, recruits were excluded if they had incomplete data sets. The characteristics of the participants in this study, in addition to the ratio between males and females, was typical of CA populations from the literature (29, 33, 41, 46, 52). The researchers were provided permission to analyze the deidentified data via gatekeeper approvals from the associated law enforcement agency (10, 43, 49, 60, 61). Based on the archival nature of this analysis, the California State University, Fullerton Institutional Review Board approved the use of pre-existing data (HSR-17-18-370). Even though this research incorporated archival data, this study was still conducted in accordance to the ethical standards of the International Journal of Exercise Science (53), and the recommendations of the Declaration of Helsinki (63).

Protocol

This study was modelled on that conducted by Moreno et al. (52). The data were collected by staff working for one law enforcement agency as part of the employment expectations for the CA recruits (29, 33, 40, 41, 46, 52). The staff were trained by a certified Tactical Strength and Conditioning Facilitator who verified the proficiency of the staff members. The YMCA step test was completed in an indoor basketball stadium the week prior to academy as part of an overall fitness assessment of the recruits by agency staff. The YMCA step test was used as it is a valid measure of aerobic fitness (2, 64), and the law enforcement agency staff were reticent to utilize other maximal aerobic fitness tests used for law enforcement personnel (e.g., the 2.4-km run and multi-stage fitness test) (37, 42). This was due to the wide fitness variability present in CA recruits (41), and the costs associated with losing a recruit due to injury if they were injured (58). As noted, previous research has also used the YMCA step test as a measure of aerobic fitness in CA recruits (52). Height and body mass were recorded at the start of this session. Height was measured barefoot using a portable stadiometer (Seca, Hamburg, Germany), while body mass was recorded by electronic digital scales (Health o Meter, Neosho, Missouri). The formation run was performed outdoors in the first week of an 8-week academy during a physical training session between 0600-0800. The CA recruits were required to complete fitness testing and wear HR monitors as a standard component of their physical training as mandated by the law enforcement agency training staff (29, 33, 40, 41, 46, 52).

A YMCA step test was administered as a fitness assessment and followed standard procedures (2, 52, 64). This test has been used previously to assess aerobic fitness in CA recruits (52). As described by Moreno et al. (52), the YMCA step test has face validity for custody populations as climbing stairs is a daily job task for these personnel. Recruits completed the YMCA step test in groups of 8-9 so they could be paired with a tester who would measure their HR. The basic characteristics of the YMCA step test were adopted and performed on a basketball court, with approximately 12-inch (~31 cm) high bleacher seats used for the step. CA recruits were required to step in time to a metronome (96 beats per minute) continuously for 3 minutes. The beat frequency was played from an iPad handheld device (Apple Inc., Cupertino, California) connected to a portable speaker (ION Block Rocker, Cumberland, Rhode Island) positioned on a higher bleacher seat in front of the recruits. Following the 3 minutes, recruits immediately sat on the step while recovery HR was manually taken by a staff member via the radial artery for 60 seconds. The total number of heart beats during this time provided the recovery HR measure. The HR monitors used during the formation run were not available for use during the YMCA step test. Accordingly, HR was measured manually. This method has been shown to be a valid and reliable procedure for measuring HR (12, 19).

The formation run completed by CA recruits in this study was similar to that detailed by Lockie et al. (44), and was commenced on an outdoor concrete area, before continuing on neighboring asphalt-surfaced roads. The roads featured minimal gradient and the training staff set a pace of about an 11 minute $\cdot$ mile^{-1} for approximately 60 minutes. Exact speed and time cannot be expressly detailed as the training staff adapted and responded to the behavior of recruits, especially with regards to the socialization aspect of law enforcement training (1, 33). For example, staff may have slowed or sped up the pace of the run due to the actions of recruits during the session. Additionally, as the class were running on neighboring roads there were times when they needed to slow for traffic and pedestrians. Recruits were organized in height from shortest to tallest in rows of 4-5 recruits and were expected to stay in this formation for the duration of the run.

HR data were collected in the same manner as that previously detailed by Moreno et al. (52). CA recruits wore a HR monitor chest strap (Zephyr Performance Systems, Annapolis, MD) underneath their physical training attire. The Zephyr heart rate monitors have been shown to be a valid and reliable device to record HR data (26, 54). CA recruits were fitted with the HR monitor prior to the formation run and wore them throughout the run. HR, measured in beats per minute, was acquired at a frequency of 250 Hz via electrode sensors that detected *r* waves of the QRS complex (17). After the formation run was completed, HR data were downloaded and exported to Microsoft Excel (Microsoft Corporation™, Redmond, Washington, USA) as a comma-separated value file at a sampling rate of 1 second (17, 52). The start and end times for the formation run was noted so as to remove any data not related to the run (17, 52). HR data were analyzed relative to exercise intensity zones defined according to ACSM standards: very light (< 57% HR_{max}), light (57%-63% HR_{max}), moderate (64%-76% HR_{max}), vigorous (77%-95% of HR_{max}) and very vigorous (> 95% HR_{max}) (15). Exercise intensity was defined relative to age-predicted HR_{max} within the equipment software (29, 33, 52). The total time and percentage of total time spent in each of the training zones for the formation run was recorded for statistical analysis.

Statistical Analysis

All statistics were computed using the Statistics Package for Social Sciences (Version 26.0; IBM Corporation, New York, USA). Descriptive statistics (mean ± standard deviation [SD]) profiled all variables. The CAs were divided into three groups based upon recovery HR from the YMCA step test, using a percentile split (32, 47, 52). The top 25% (lowest recovery HR) of the performers were considered HF, the bottom 25% (highest recovery HR) were assigned to LF, and the remainder made up the MF group. The use of percentile quartile splits has been used in previous law enforcement research to ensure that there were clear differences between groups of recruits (32, 47, 52). Specific to this study, this was an essential procedure to undertake given the importance of determining whether there were differences in the physiological responses between recruits of different fitness capabilities within the formation run. This is because many law enforcement training academies still utilize 'one-size-fits-all' training models (e.g., formation running) (38). Building the evidence base for more ability-based training could have a great impact on law enforcement agencies (30), especially relative to the financial costs associated with the loss of recruits due to physical training injuries (58). Further analysis was conducted with the YMCA step test data to ensure the appropriateness of the percentile split. Normality of the data was assessed by visual analysis of the Q-Q plots (5, 22, 56, 57). A frequency analysis was conducted to analyze the spread of scores, with skewness and kurtosis also calculated. Skewness and kurtosis scores between -2 and +2 were considered acceptable (16).

A one-way analysis of variance, with Bonferroni post-hoc for multiple comparisons, was performed to determine any significant differences between the HF, MF, and LF groups in time spent and percentage of total training time in the different HR zones during the formation run. An alpha level of $p < 0.05$ was required for significance. Sexes were combined within the groups for this analysis, as all recruits were expected to perform the same formation run regardless of sex or age (44). Previous law enforcement research has combined data for the sexes (3, 7, 36, 39, 47, 48, 52). Furthermore, within this study recruits of different sexes ended up being intermixed within the fitness groups (HF: 4 males, 3 females; MF: 7 males, 6 females; LF: 1 male, 5 females). As has been completed in other research (31, 39, 45), effect sizes (d) were calculated for the between-group comparisons, where the difference between the means was divided by the pooled SD (9). A d less than 0.2 was a trivial effect; 0.2-0.6 a small effect; 0.6-1.2 a moderate effect; 1.2-2.0 a large effect; 2.0-4.0 a very large effect; and 4.0 and above an extremely large effect (18).

RESULTS

The frequency analysis of the YMCA step test recovery heart rate is shown in Figure 1, and the skewness (0.152) and kurtosis (-0.497) of this variable was deemed acceptable. Following this analysis, the researchers determined that the percentile split adopted in the current study was the best approach to take within the context of this research. There were no significant differences between the groups in age ($p < 0.535$), height ($p < 0.059$), or body mass ($p < 0.530$) (Table 1). There were large effects for the height differences for the LF group compared to the HF and MF groups; the LF groups was shorter (Table 2). The HF had a recovery HR from the YMCA step test that was significantly ($p < 0.001$) lower than the MF (very large effect) and LF (extremely large effect) groups, and the MF group's recovery HR was significantly ($p < 0.001$) lower than the LF group (very large effect).

The HF spent a significantly longer time ($p = 0.019$; Figure 2A) and percentage of total time ($p = 0.039$; Figure 2B) in the very light HR zone (< 57% HR_{max}) compared to the LF group, both of which had large effects (Table 2). There were no other significant differences between the groups in the time spent ($p = 0.070$-0.953) or percentage of total time ($p = 0.125$-0.980) in the other HR zones. However, there were large effects for greater time and percentage of time spent in the vigorous and very vigorous zones, and moderate-to-large effects for the lower time and percentage of time spent in the moderate zone, for the LF group compared to the HF group. The LF group also spent more total and percentage of time in the very vigorous zone compared to the MF group, and less time in the moderate (total and percentage) and very light (percentage) zones, all of which had moderate effects. There were also moderate-to-large effects for the lesser time spent in the very light (total and percentage) and light (time) zones for the MF group compared to the HF group, and a moderate effect for the greater percentage of time spent in the vigorous zone.

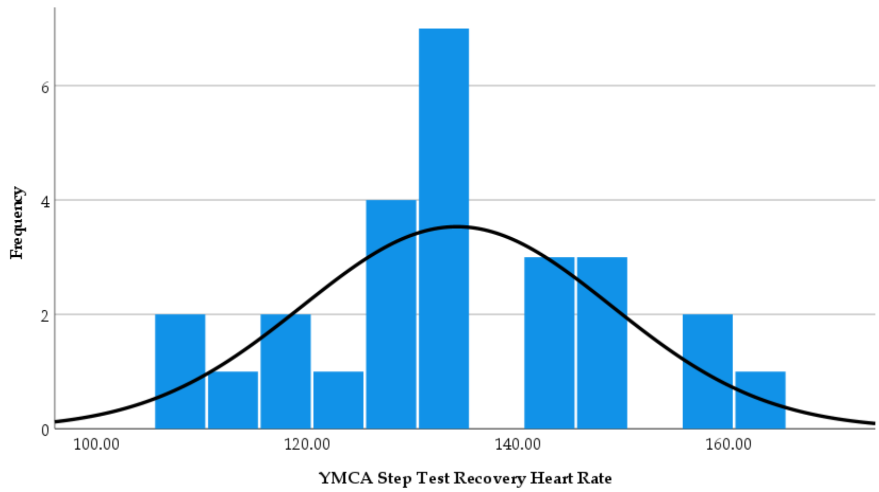

Figure 1. Frequency distribution of the YMCA step test recovery heart rate for 26 custody assistant recruits.

Table 1. Descriptive data (mean ± SD) for age, height, body mass, and recovery heart rate (HR) from the YMCA step test for higher fitness (HF), moderate fitness (MF), and lower fitness (LF) custody assistant recruits.

	HF (n = 7)	MF (n = 13)	LF (n = 6)
Age (years)	27.57 ± 5.29	28.85 ± 7.38	33.00 ± 16.22
Height (m)	1.69 ± 0.06	1.71 ± 0.07	1.63 ± 0.05
Body Mass (kg)	69.30 ± 10.24	71.88 ± 15.91	64.24 ± 10.50
YMCA Step Test Recovery HR (beats)	116.43 ± 6.19	134.46 ± 4.84*	154.50 ± 6.16*§

Note: * Significantly ($p < 0.05$) different from the HF group; § Significantly ($p < 0.05$) different from the MF group.

Table 2. Pairwise effect size data for higher fitness (HF), moderate fitness (MF), and lower fitness (LF) custody assistant recruits in age, height, body mass, and YMCA step test recovery heart rate; and time spent and percentage of total time spent during a formation run in heart rate intensity zones defined by the American College of Sports Medicine (15).

Variables	HF-MF	HF-LF	MF-LF
Age	0.16	0.45	0.37
Height	0.31	1.09*	1.32§
Body Mass	0.19	0.49	0.57
YMCA Step Test Recovery HR	3.44ϕ	6.50¥	3.62ϕ
Time Spent in Training Zone			
Very Light (< 57% HR_{max})	1.18*	1.35§	0.58
Light (57%-63% HR_{max})	1.12*	0.17	0.04
Moderate (64%-76% HR_{max})	0.47	1.26§	1.05*
Vigorous (77%-95% of HR_{max})	0.49	0.64*	0.09
Very Vigorous (> 95% HR_{max})	0.03	0.86*	0.91*
Percentage of Time Spent in Training Zone			
Very Light (< 57% HR_{max})	0.92*	1.20§	0.65*
Light (57%-63% HR_{max})	0.03	0.12	0.07
Moderate (64%-76% HR_{max})	0.39	1.10*	0.90*
Vigorous (77%-95% of HR_{max})	0.62*	0.97*	0.56
Very Vigorous (> 95% HR_{max})	0.00	0.82*	0.83*

Note: * Moderate effect for the pairwise comparison; § Large effect for the pairwise comparison; ϕ Very large effect for the pairwise comparison; ¥ Extremely large effect for the pairwise comparison.

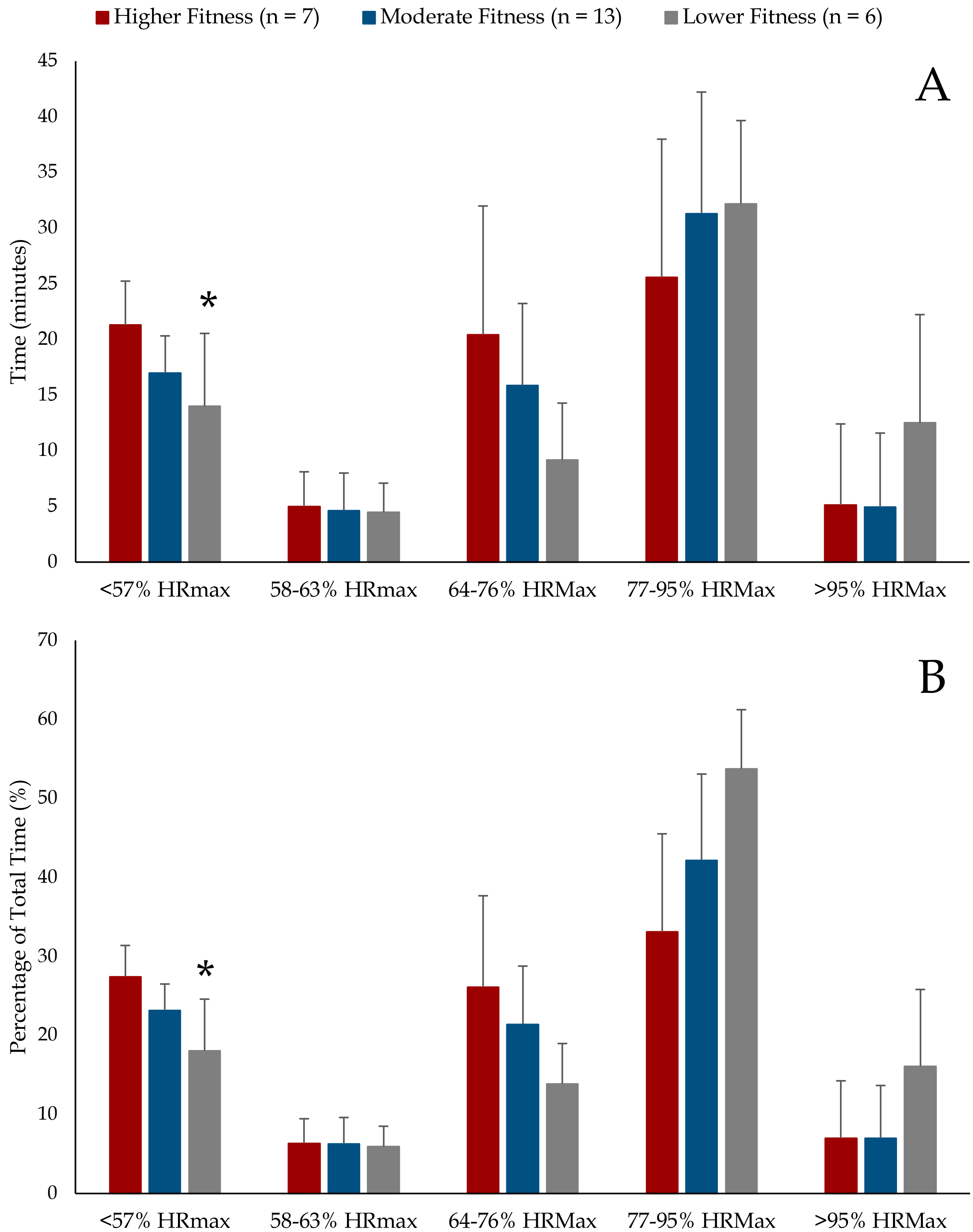

Figure 2. Descriptive data (mean ± SD) for time spent (A) and percentage of total time spent (B) in heart rate intensity zones defined by the American College of Sports Medicine (15) for higher fitness, moderate fitness, and lower fitness custody assistant recruits during a formation run. * Significantly ($p < 0.05$) different from the HF group.

DISCUSSION

This study investigated archival data to detail the HR responses of a CA recruit class to a formation run. Recruits were defined as HF, MF, and LF according to recovery HR measured following the YMCA step test. With regards to the vigorous exercise guidelines set by the ACSM (20-60 minutes at 77%-95% of HR_{max}) (15), all groups surpassed the suggested requirements for improving aerobic fitness (HF = ~26 minutes; MF = ~31 minutes; LF = 32 minutes). It could be suggested that this formation run provided the conditions necessary for the development of aerobic fitness in the CA recruits. Nonetheless, there were still limitations with regards to formation running and aerobic improvements. The run itself had a duration of ~60 minutes, and the HF and MF recruits only spent between 40-50% of the session working at a vigorous-to-very vigorous intensity. This may not be the most efficient approach, especially considering the time limitations often present during academy training (6). It should also be noted that although not significant, the HF group spent the least amount of time in the vigorous-to-very vigorous HR zones (HF = ~31 minutes or 40% of the run; MF = ~36 minutes or 49% of the run; LF = ~45 minutes or 70% of the run). There was a large effect for the lower percentage of time spent in the vigorous zone compared to the MF group. There were also large effects for total time and percentage of time in both the vigorous and very vigorous zones compared to the LF group. Although not statistically significant, there is practical information that can be drawn from this effect size data (4, 34, 62). Thisis especially the case considering the significant differences that were found in this study.

The HF group spent a significantly greater amount of time in the very light (< 57% HR_{max}) HR zone compared to the LF group. Indeed, the HF recruits spent almost 30% of the formation run at a very light exercise intensity. Given that fitter individuals may need a higher-intensity training stimulus to improve aerobic fitness (24), this may not be ideal for the HF recruits. As CA academy classes have individuals with a range of fitness capacities (41, 52), group sessions may be targeted more towards the less fit recruits to ensure they can at least do most of the training exercises. If this approach is maintained over the course of a training academy, this could mean that HF CA recruits do not receive an adequate stimulus to enhance their aerobic fitness. Over an 8-week academy, this could result in the HF recruits experiencing decrements to their aerobic conditioning. Future research should track the changes in fitness that can occur during a CA academy class. It is important to detail whether CA recruits who report to academy training with superior fitness experience any decrements if the training stimulus applied is below their capabilities. Any decreases in fitness would be less than ideal for a CA recruit, given the potential physical demands of the job (20, 21, 29, 45). This type of information could also be impactful for law enforcement officer recruit training, whose academies can be conducted over 22 weeks (42). Nonetheless, the data from this study reinforce the need for ability-based training in law enforcement training academies (3, 6, 30, 51, 52, 58).

The need for ability-based modification within law enforcement academy training was also highlighted when considering the LF recruit group. The LF group spent the greatest amount of time in the vigorous and very vigorous HR zones. Although not significant, there were moderate-to-large effects when compared to the MF and HF groups. Effect sizes are useful in the context of this study as they can determine the between-group difference irrespective of the *p* value (4, 14, 34). This can then provide useful and practical information for the practitioner who may work with CA recruits (4, 34, 62). The data would seem to indicate that the LF recruits found the formation run challenging. Similar data was presented by Moreno et al. (52) with regards to circuit training completed by CA recruits. The HR data from the current research could be concerning to training staff as they will tend to pace the formation run to the slower members of the group to ensure the group stays together (44). As a result, even though the intensity of the run appeared to allow for aerobic adaptations according to the ACSM guidelines (15), the intensity may still have been too great for LF CAs to maintain an appropriate running intensity. Although this study only analyzed one formation run, if this was to continue over the course of a training academy, this could place LF CA recruits at risk of overtraining and injury (25, 27, 50, 58). This is partly because lesser fit recruits may experience a higher training load above their current capacity (55), which increases their risk of injury when this is occurs over the course of an academy. While the duration of academy can be different between law enforcement and CA recruits (e.g., 22 weeks vs. 8 weeks) (42, 52), future research should track injury rates for CA recruits during academy and ascertain whether this could be influenced by fitness.

It is important to note that physical training sessions are limited by class size and the time limitations placed on staff due to the short duration of the academy. As a result, law enforcement agency training staff may use modalities such as formation runs as they are easier to program for larger groups. However, there are other options available to training staff. Orr et al. (58) asserted that ability-based running can be used with tactical operators to maintain or improve metabolic fitness. Cesario et al. (6) has provided examples of interval-based training that can be tailored to the fitness of recruits, especially when organized into groups such as those presented in this study. The data from this study suggests that training staff should explore more ability-based training methods to enhance the aerobic fitness of their recruits. However, it should be note that this study analyzed one formation run. More research is required regarding ability-based running in CA recruits and other tactical populations. Future studies should compare different types of conditioning modalities and how they could influence the fitness of CA (and other law enforcement) recruits. This could be particularly impactful for CA recruits, especially considering the wide disparity in fitness that is present in this population (41, 52).

There tended to be higher variability, evidenced by the greater standard deviations (±7.27-9.73 s for total time, and ±9.67-11.99% for percentage of total time), in the very vigorous (> 95% HR_{max}) training zone. These data could be impacted by how recruits respond to the cumulative stress imparted during academy physical training. In addition to the exercise being completed (i.e., the formation run), the training staff can also provide an additional stress with their verbal commands (1, 33). The verbal commands from training staff can cause a palpable physiological response in recruits (33). Depending on how recruits respond to this stress, this could lead to extra spikes in HR (and greater variability) that led to the HR data from the very vigorous training zone. The nature of HR monitors and how they were worn in harness could have also affected this data. It could be expected that faster running would lead to time spent in the very vigorous training zone. Increases in movement speed can lead to greater variation in the HR data collected (23), so this could have also affected the results.

There are other study limitations that should be noted. The YMCA step test was used as a measure of aerobic fitness, and there are arguably more common field tests for law enforcement populations, such as the 2.4-km run and multi-stage fitness test (37, 42). However, as stated the agency staff were reluctant to use these tests due to the potential risk of injury to the recruits. Future research should analyze recruits training to become patrol officers, as their fitness capacities could be different to the CA recruits in this study. Lastly, only one formation run was analyzed, with a running pace of approximately an 11 minute · $mile^{-1}$. It is likely formation runs with different pacing, and conducted in different environments, will result in different HR responses for recruits.

In conclusion, and within the context of these limitations, the results from this study demonstrated that HF CA recruits spent more time in the very light training zone compared to LF recruits. This may not be optimal for aerobic fitness adaptations in recruits with better aerobic fitness. Although not significant, the LF recruits spent the most time in the vigorous-to-very vigorous HR zones, indicating they found the formation run challenging. Although the class spent enough time in the vigorous training zone for aerobic adaptations as recommended by ACSM (15), HF and MF recruits still spent almost half the formation run outside of this HR zone. The data from this research suggests that formation runs may not be the most efficient method for aerobic conditioning in CA recruits. Training staff should explore the use of ability-based training modalities to enhance the aerobic fitness of their recruits. For example, modalities such as interval running, which can be adapted to the fitness of individual recruits, should be used more frequently than formation runs. Adopting this approach could lead to more beneficial aerobic adaptations in CA recruits.

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