The Use of Work Place Physiological Measurements to Establish the Minimum Fitness Standards Required for Entry into the United Kingdom Police Service

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Abstract

The use of pre-entry fitness tests as a means of screening recruits has been adopted by the United Kingdom Police Service. However, validating the minimum standard for such tests has proved to be challenging but essential if such tests are going to accurately reflect the aerobic demands of the job. This study compared heart rate and blood lactate acid values measured in the workplace environment, with values obtained during a 15m shuttle running test that is used as the test for aerobic fitness on recruits wishing to enter the police service in the United Kingdom. A total of 119 subjects were used in the study (75 males, 44 females), mean age 31.7 years. Work place physiological measurements focussed on “officer safety training” (OST), a compulsory and standardised programme of physical and technical activities, since it was felt that this provided an accurate reflection of the primary physical demands of the job including strength, power, aerobic demand and flexibility. The 15m shuttle run test was completed by all subjects until 4 shuttles on level 5 of the test had been completed, which is the current minimum standard for entry into the UK Police Service. Heart rate was expressed as the peak value observed, and as the highest mean value for any 4 minute period (Mean4) during both OST and the 15m shuttle run test. Lactic acid measurements were taken from finger prick capillary samples, immediately after the cessation of exercise. Peak and Mean4 heart rate values, as well as post-exercise lactate acid values, were all found to be significantly higher after the 15 m shuttle run test, than OST (p<0.05), thus suggesting that officers capable of completing 4 shuttles on level 5 of the test, who consequently possess a predicted maximum oxygen uptake of at least 35.0 ml.kg⁻¹.min⁻¹ have an aerobic capacity to complete the officer safety training, and cope with the related demands of the job.

Methods

A total of 119 serving police officers participated in this study, including 58 recruits and 61 serving officers. Seventy-five of the subjects were males, and 44 females, mean age 31.7yrs (±5.3, range 19yrs–56yrs). After consultation with the Police Service, it was deemed that the regular “Officer Safety Training” (OST) courses provided the best example of a “critical task” [2], reflecting the compulsory physical demands faced by police officers on a regular basis. OST involves a series of simulated drills and role play activities which reflect common workplace conditions.

Prior to commencing the OST course, subjects completed the 15m version of the Multistage Fitness Test (15MSFT), which has been adapted for use by the police service [3], from the 20 m version that is in wider use within the general population [4]. The test occurred in an indoor venue on a non-slip floor surface, under instruction from a police service physical training instructor. All subjects ceased the test upon completion of 4 shuttle runs on level 5 of the test, since this was the current minimum standard required in order to obtain entry into the police service. Based on the data provided for the police service by Loughborough University [3], attainment of this stage of the test is equivalent to a predicted oxygen uptake value of 35.0 ml.kg⁻¹.min⁻¹.

Before starting, all subjects wore a heart rate monitor (T31 transmitter, Polar, Finland) which was set to record data at 5 s intervals, and hence heart rate measurements occurred throughout the 15MSFT for all subjects. Heart rate data were subsequently analysed to determine peak heart rate and the mean heart rate for the last four minutes of the test (Mean4).

Introduction

Public sector bodies, including the armed forces, prison service, fire service and police, currently use pre-employment fitness tests as a means of screening new recruits, and determining if they have the necessary physical capacities for their future jobs. In cases where physical activity is a fundamental employee's role, employers are becoming increasingly aware that the need to ensure their staff members have the necessary physical capacities for their jobs is both a moral and legal obligation.

However, critical to the validity and success of pre-employment fitness testing is the need to ensure the fitness standard that recruits must reach does, as far as possible, accurately and fairly reflect the job demands. Jamnik et al. [1] highlights the need for legally defensible physiological employment standards, whilst Tipton et al. [2] refer to the importance of identifying the critical employment task upon which standards are based, and the acceptance that there will always have to be a subjective component in the development of any occupational fitness test. If the physiological standard is too low, recruits may be unable to cope with the required work and tasks; but if the standard is too high, it may prevent capable individuals from pursuing their chosen career.

Therefore the object of this study was to use heart rate monitoring as an indicator of the cardiovascular demands placed upon police officers during their work. These data were then compared with the same measurements when completing the fitness test that police officers must complete, to establish whether the fitness test provides an accurate reflection of the aerobic demands of the job.
in OST courses were monitored at one of 5 separate venues, and on each occasion, OST occurred indoors under instruction from a police service physical training instructor. OST courses were standardised across all venues, lasting for approximately 4 hours and a series of simulated activities that included the restraint of violent individuals, handcuffing, the carrying of weights, and lifting. OST commenced with a warm up period primarily consisting of aerobic activity and stretching, lasting approximately 10 minutes. The simulated activities required officers to demonstrate sufficient strength, power and endurance to carry out the tasks effectively, the exact nature and order of which was determined locally by the Physical Training Instructor. Heart rate data were collected throughout, and analysed to determine peak heart rate and the highest Mean4 period during the course of the training.

Blood capillary samples were collected from the fingertip of all subjects immediately after completion of OST and the 15MSFT, and analysed for the determination of lactic acid (YSI 1500 Sport). Data were compared for differences between the two conditions using a one-way ANOVA, and are reported as mean values, with standard deviations (SD). Significant differences have been accepted at the 0.05 level of confidence.

### Results

The progressive nature of the 15MSFT meant that peak heart rate occurred at, or close to, the end of the test, with the final four minutes of the test yielding the highest Mean4 values. The mean peak heart rate for all subjects at the end of the 15MSFT was 175 ± 13 bpm, and found to be significantly higher than the mean peak heart rate during OST, which was 152 ± 12 bpm, (p<0.05). The mean peak heart rate for male subjects during the 15MSFT was 171 ± 14 bpm, significantly higher than the mean male peak heart rate during OST of 150 ± 11 bpm. (p<0.05). Similarly, the mean peak female heart rate of 184 ± 15 bpm during the 15MSFT was significantly higher (p<0.05) than the mean peak female heart rate during OST (155 ± 10 bpm). Mean heart rate and blood lactic acid values for all subjects during the 15MSFT and OST are presented in Table 1.

The highest Mean4 value for all subjects during the 15MSFT was found to be 158 bpm, which was significantly higher than the Mean4 value of 126 bpm during OST (p<0.05). Similar Mean4 results were obtained for the males and females, with the mean male value during the 15MSFT of 154 ± 11 bpm, significantly higher than the OST Mean4 value of 123 ± 10 bpm. The corresponding female values for Mean4 were 167 ± 13 bpm during the 15MSFT, and 132 ± 11 bpm during OST, p<0.05.

At no time during the OST were heart rate values found to exceed the peak values recorded for any individual during the 15MSFT. Due to the progress nature of the 15MSFT, peak heart rate was generally observed during or very shortly after the last 15 seconds of the test.

Mean post exercise blood lactic acid concentrations were found to be 4.5 (± 2.1) mmol.l\(^{-1}\) and 2.8 (± 0.7) mmol.l\(^{-1}\) after the 15MSFT and OST (p<0.05), whilst corresponding values for the female subjects were 5.3 (± 2.2) mmol.l\(^{-1}\) and 2.8 (± 1.1) mmol.l\(^{-1}\) after the 15MSFT and OST, (p<0.05).

### Discussion

Few studies have investigated the link between the fitness of police officers, and their capability to fulfill their job of work. Capodaglio et al. [5] used sub-maximal treadmill testing to assess the fitness of urban police officers, but no attempt was made to relate the results to the demands faced in the work place.

Shephard [6] suggested that serving police officers require an aerobic capacity of 3 litres per minute, but was unable to provide any basis for this ascertainment, and admitted that there are significant difficulties in accurately assessing the demands of the job. In particular, Shephard [6] highlighted the fact that short sample periods may not be long enough to accurately reflect the demands faced during a normal working day. In recognising the need for police officers to have a level of physical fitness which exceeds that of a sedentary individual, Sorensen et al. (2000) presented a 15 year longitudinal study into changes in physical activity, fitness and body composition amongst 103 Finnish police officers. The authors concluded that the physical fitness of police officers could be strongly predicted from their physical activity patterns in early adulthood, and recommended early intervention and regular physical activity as a means of sustaining the physical fitness of police officers during their careers.

In 1995, Loughborough University published a report entitled “Standards of Fitness of Metropolitan Police Officers”, recommending a minimum maximum oxygen uptake (VO\(_{2}\) max) value of 42.5 ml.kg\(^{-1}\).min\(^{-1}\). Loughborough University recommended that police officers should demonstrate this level of aerobic fitness through the attainment of 1 shuttle on level 8 of the 20m shuttle run, more commonly known as the MultiStage Fitness test, (MSFT), which was validated as a reliable predictor of VO\(_{2}\) max by Ramsbottom et al. [4]. Subsequently, Loughborough University (Department of Sport and Exercise Science) validated a revised 15m version of the MSFT, and recommended a reduced minimum standard of aerobic fitness for police officers of 35.0 ml.kg\(^{-1}\).min\(^{-1}\), to be achieved on entry (only) into the police service. This is equivalent to the completion of 4 shuttles on level 5 of the 15m MSFT. According to Blair [7], this level of aerobic fitness, whilst below that of an “athletic” population, is sufficient to promote general health and well being.

The challenge faced by an employer who applies minimum fitness criteria to employees as a condition, or pre-condition, for their employment, is to ensure that these standards reflect, as far as possible, the job demands. If the standards are too high, there is a risk that perfectly capable individuals cannot pursue their careers; too low, and they risk exposing less fit individuals to potentially harmful situations. Therefore this study examined the aerobic demands faced by officers during the 15 m MSFT, compared with the aerobic demands experienced during OST. The use of heart rate monitoring has been identified by Vanhees et al. (2005) as a valid field testing method for assessing physical activity, which results in fewer practical challenges than other more laboratory based techniques. Hence heart rate monitoring, in combination with post-exercise blood lactic acid measurements, was used to evaluate the aerobic demands during OST and the 15 m shuttle run test.

The current data indicate the aerobic demands of the 15MSFT, as demonstrated by the heart rate of the subjects, are either equivalent
to, or above, those faced during OST. Both peak heart rate and the mean heart rate during a 4 minute period are consistently higher during the 15MSFT than they are during an OST session. Since OST was acknowledged by the UK and Northern Ireland Police Service to be representative of the aerobic demands faced by police officers during their normal duties, these data suggest the completion of 4 shuttles on level 5 of the 15MSFT ensures that individuals have a level of cardiovascular fitness to meet the aerobic demands of their job. Closer examination of individual data sets during OST did, however, reveal that there were times when the heart rate levels experienced during OST did come close to those attained during the 15MSFT, albeit for only short periods of time. This suggests that decreasing the minimum pass standard for the 15MSFT to a level below 35 ml.kg\(^{-1}\) (4 shuttles on level 5) could result in officers potentially having a level of aerobic fitness that is below the demands of normal OST activities. It could also result in police officers having a level of aerobic fitness that is sub-optimal when compared with the normal population [7].

These data and findings are supported by the post-exercise lactic acid values at the end of the 15MSFT and OST. The values, ranging from 2.8 to 5.3 mmol.l\(^{-1}\) suggest the demands of both forms of exercise are moderately high, but not excessive, and below those frequently observed in males and females after intensive exercise (Fox, 1979). For both the male and female groups, the post-exercise lactic acid levels were higher after the 15MSFT than OST, suggesting that individuals capable of completing 4 shuttles on level 5 of the test are capable of coping with the aerobic demands of OST.

However, there is always likely to be a scenario where individuals with the highest level of aerobic fitness, and faced with a highly demanding physical situation, will respond more effectively, and at a higher intensity, than those with lesser physical capacity. Thus the validation of the 15MSFT standard should be seen as the minimum requirement for a police officer, based on the demands of a training environment where the majority of external variables that might be encountered in a "real life" situation are controlled. Officers achieving the standard should be encouraged to remain physically active and to adopt a continuous and progressive programme of training to ensure that they are capable of meeting the aerobic demands of the job, particularly as they age.

There has been considerable debate within the police service on the possible need for different minimum standards of fitness for males and females, or for police officers as they age. Shephard et al. [8] reported on the need to ensure gender equity in the recruitment of police officers, stating that Human Rights Tribunals require the application of non-discriminatory standards in the hiring of potential employees. They highlight the issues that this has created in the recruitment of police officers, where physiological differences in the fitness of males and females have resulted in a disproportionate number of females being excluded by the employer. In a recent study of 699 Dutch police officers, Strating, Bakker, Dijkstra, Lemmink and Groothoff (2010) noted poorer performances by older subjects, and females, in a job related fitness test. The authors concluded that adhering to a consistent standard for all individuals may lead to the exclusion of certain demographic groups, but if there is a desire to promote diversity and inclusion, it will result in female and older officers who are less physically capable of doing their jobs than their male and younger colleagues.

Miller [9] highlighted the importance of employers who adopt pre-recruitment screening processes balancing such a requirement with a concern for employee health and well being. The results from the present study confirm the UK Police Service requirements ensure that candidates must attain a benchmark that is both fair and reflective of the job’s aerobic demands.

Conclusion

The heart rate and lactic acid data obtained from this study clearly show that the demands of completing 4 shuttles on level 5 of the 15MSFT are either equivalent to, or exceed those experienced by the same group of subjects completing OST. This suggests individuals capable of attaining 4 shuttles on level 5 of the test, and thus having a predicted VO\(_{2}\) max of 35 ml.kg\(^{-1}\) min\(^{-1}\) are capable of coping with the aerobic demands of OST safely and successfully.

As a result of this study, a report was provided for the United Kingdom Home Office and approved by the United Kingdom Government, recommending the completion of 4 shuttles on level 5 of the 15MSFT, (equivalent to a predicted VO\(_{2}\) max of 35.0 ml.kg\(^{-1}\)min\(^{-1}\)), as the minimum standard of aerobic fitness for all recruits. This recommendation has been adopted by the United Kingdom Police Service.

The results from this study suggest that heart rate data and post exercise lactic acid measurements can provide a useful means of comparing the physical demands of the workplace environment with the demands of a job related aerobic fitness test. The use of such data could enable minimum criteria for pre-employment fitness tests that produce a realistic physiological response that is reflective of the aerobic demands of the job, thus ensuring that the recruitment process is both fair and appropriately challenging.

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References


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