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Orr, Rob Marc; Ford, Kelsie; Stierli, Michael

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Implementation of an Ability Based Training Program in Police Force Recruits

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Robin M. Orr (Corresponding author)
Bond Institute of Health and Sport
Faculty of Health Sciences and Medicine
Bond University
Gold Coast
Queensland
Australia 4229
Ph: +61 (0) 7 5595 4448
Ph:m: +61 (0) 468 646 027
Email: rorr@bond.edu.au

Kelsie J Ford
C/o Bond Institute of Health and Sport
Faculty of Health Sciences and Medicine
Bond University
Gold Coast
Queensland
Australia 4229

Michael J Stierli
Sydney Police Centre, Surry Hills
Level 6, 151 Goulburn St
Surry Hills
New South Wales
Australia 2010

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ABSTRACT

Current police recruit physical training programs generally employ group-based runs of a one-size-fits-all approach. The aim of this study was to assess the impact of an ability based training program, as derived from the 30-15 Intermittent Fitness Assessment, on the metabolic fitness and injury rates of police recruits undergoing basic training. Police recruits completing two different stages of training (Session 1, n=54: Session 2, n=233) were randomly assigned to either a control group (standard group running) or an intervention group (Ability Based Training running program). Physical training was completed once a week over a 10-week period. Aerobic fitness was measured via 20 m progressive shuttle run test performance. Injury data were captured via formal Accident and Incident forms. Results found that aerobic fitness was maintained but not significantly improved in both groups for Session 1, with no significant differences between the groups post-training. In Session 2, both groups significantly improved their aerobic fitness ($p<0.001$), although the intervention group to a greater degree, with no significant differences between the groups post-training. There were no significant differences in injury rates between groups (Session 1; x2(1)=1.533, p=0.216: Session 2; x2(1)=1.252, p=0.263). However, the intervention groups had a significantly lower relative risk of injury when compared to the control groups (Group 1 Relative Risk=0.31, p=0.28: Group 2 Relative Risk=0.59, p=0.24). The results suggest that coaches may benefit from implementing ability based training programs in tactical populations and achieve the same or better fitness gains with a lower risk of injuring recruits.

KEY WORDS

Conditioning, physical training, 30-15 intermittent fitness test, tactical.

INTRODUCTION

Reducing the rates of musculoskeletal physical training injuries is an ongoing challenge for the military (11, 13, 30). For this highly physically active population, the consequences of injuries include loss of time from training and work, adverse impacts on overall department sustainment and even mission success (21, 28). Apart from the personal implications of these injuries to the individual soldier, the training and additional recruitment costs for the military are astounding (33). As an example, the total cost of military workers' compensation benefits for Australian military personnel in the financial year 1997-1998 were reported to be in excess of $100 million, with the Australian National Audit Office estimating the total cost of injuries in that period to be between $210 and $840 million (4).

Recruit training is of particular concern, as the potential for injury during basic recruit training has been estimated to be threefold that associated with physical training in other military contexts (32). Furthermore overuse injuries, particularly in the lower limbs, are known to be the major cause of training days lost during recruit training (29), accounting for as much as 70-80% of musculoskeletal injuries (1, 12, 22). Two factors associated with injury and attrition risk in recruit populations are low aerobic fitness and excessive running mileage (5, 16, 28, 34). Pope et al. (28), while investigating fitness standards of Australian Army recruits, identified that recruits with poor aerobic fitness were approximately 25 times more likely to fail to complete basic military training than the fittest recruits. However, Trank (34) observed that exercise programs which employ high running mileages (> 25 miles) during basic training, while designed to improve aerobic fitness, led to a higher potential for overuse injury than recruits who completed less overall running mileage (< 25 miles) during basic training. Furthermore, the additional mileage did not appear to increase aerobic fitness to a greater degree (34). These findings have been reproduced in several other studies, which have found that the potential for injury increases disproportionally with increasing running mileage, once a certain threshold is reached, with little additional fitness benefit (8, 12, 31).

Thus, a dilemma exists – on the one hand, it would appear that aerobic fitness must be increased to reduce risks of injury and attrition in military training contexts, but on the other hand, traditional approaches to achieving this goal, involving group running, themselves cause injuries. In response to this dilemma, physical conditioning regimes for military populations are beginning to use Ability Based Training (ABT) (9, 15, 17, 18, 23), often incorporating intermittent, high intensity, short distance running training (interval training) rather than longer distance intervals or continuous running. ABT is a conditioning model where physical conditioning programs are tailored to the ability level of the individual within a group (18, 23), and interval training that is well matched to assessed ability levels can be a valuable component of this model. The ABT approach removes the 'one size fits all' approach to physical conditioning programs; an approach that is known to cause injuries within tactical populations (27).

Ironically, ABT programs typically determine an individual soldier's fitness, and hence ability group, based on a standard distance-run for time (e.g. 1-mile) (9, 15, 17, 18). However, it should be noted that urban warfare and fire and movement tasks demand intermittent, high intensity efforts for which a long slow continuous training methodology may not be the most appropriate. As such, the current measures for determining ABT groups may not provide a good indication of the capacity of individuals in relation to the intermittent, high intensity, short duration physical activities that are often a key component of ABT conditioning for these populations. Thus a timed-run for distance may constitute a poor basis for determining ability groups for an intermittent training stimulus.

Law enforcement agencies have similar injury concerns (16, 25) to those of the military with one police force estimating an average cost to recruit and train a police recruit at $85,000 per recruit (35). On this basis, the use of ABT may again be of value. However, once again policing is considered to be an occupation that involves physical tasks of an intermittent nature (2). Typically, police officers may be required to run short distances at maximal effort to 'get to the problem', followed by explosive tasks such as 'take-downs', wrestling, pushing and pulling and bending and twisting to 'control and remove the problem' (2).

For these reasons, metabolic fitness assessments that are intermittent in nature are becoming more commonly used in law enforcement (26). However, this development contrasts sharply with the fact that currently published ABT protocols are typically based on assessments using continuous running tests, like a 1 mile run (9, 15, 17, 18). Furthermore, publications directly verifying a positive impact of ABT approaches on metabolic fitness and injury rates are limited, as the observed differences in these outcomes between traditional non-ABT training programs (typically employing a 'one size fits all' methodology for run training) and ABT programs are frequently confounded by other differences between the programs (9, 15, 17). As an example, Harman et al. (9) compared the differences between two conditioning programs, an Army Standardized Physical Training program and a Weight-Based Training program where there were not only differences in running formats but also in the nature of neuromuscular exercises selected and in the overall daily training schedule.

The aim of this study was therefore to assess the impact of an ABT run training program, in which ability groups were established based on results of an intermittent fitness assessment, on the metabolic fitness and injury rates of police recruits undergoing basic training. This knowledge may assist the Tactical Strength and Conditioning Facilitator and other strength and conditioning professionals involved in the conditioning of tactical personnel in the design, and justification for use, of ABT training programs derived from an intermittent fitness assessment. It was hypothesized such an ABT program would improve the metabolic fitness and reduce the injury rates in recruits to a greater extent than a program primarily involving traditional group running sessions.

METHODS

Experimental Approach to the Problem

A randomized control trial was conducted to determine the impact of an ABT program on the metabolic fitness levels and musculoskeletal injury rates of police recruits undergoing training with new recruits randomly assigned to one of two groups (control group and intervention group). The control group completed the current police conditioning program, which included general resistance exercises (like push-ups and sit-ups) and group runs for aerobic fitness. The intervention group also completed the current police recruit conditioning program with one exception. All group runs were replaced with an ABT program devised from their 30-15 Intermittent Fitness Test ($30\text{-}15_{IFT}$) results. Metabolic fitness standards and changes were determined by 20 m Progressive Shuttle Run Test (PSRT) or 'Beep' test results conducted pre and post the 10 week intervention. Injury rates were determined though the Academy Accident and Incident forms submitted over the intervention period with this data used to compare injuries sustained between the two groups.

Subjects

A total of 287 police recruits, drawn from two police recruit training sessions, Session 1 (n=54) and Session 2 (n=233), participated in this study. These recruits were undergoing fulltime training at an Australian Police Academy. Recruits in Session 1 completed a different police education and training program compared to Session 2, with Session 2 recruits having a greater emphasis on defensive tactics and marksmanship. Due to the nature of the population and security precedence no demographic information on these recruits was available. However all recruits did meet the necessary entry requirements for age (a minimum of 18 years and 4 months of age), had completed a health clearance from a General Practitioner and had completed a full medical assessment provided by an external provider.

Institutional Board approval for their research was provided by the Bond University Research Ethics Committee (RO1596) and all participants were read an explanatory statement subsequent to giving voluntary informed consent for their participation.

Procedures

Participants in Session 1 and Session 2 were divided into tutor groups prior to reporting for physical training by Academy staff, who were blinded to the study. These tutor groups were then randomly assigned by the research team, who were blinded to the tutor group compositions, to Group A (control) or Group B (intervention). Both the control and intervention groups were blinded to the type of training they were completing, knowing only that they were completing physical training sessions as part of their recruit training. Group A completed the standard physical training protocol as per the current Academy recruit physical training program. This program included a strength program (push-ups, lying pull-ups and sit-ups) and a running program consisting of long-slow distance running and long (400 m) and short (20 m) interval running (~60 minutes in length). Group B completed the same warm-up and strength-training program; however a specifically designed ABT program replaced the current running training in Weeks 1-4 and Weeks 6-9 (~45 minutes in length). Both groups completed their allocated physical training once per week over 10 weeks as scheduled in the recruit training program. Physical training sessions typically took place first thing in the morning at around 0800 h, for a one hour period, although this was subject to change if competing priorities (like range bookings) were presented. To account for any diurnal variations between groups, both groups completed their physical training sessions in parallel. In Weeks 5 and 10 of training, all recruits completed a team challenge (e.g. a rope run) session in place of standard physical training. A Police Physical Training Instructor (PTI) conducted all physical training sessions.

Each recruit completed the $30\text{-}15_{IFT}$ assessment as part of the Academy fitness testing regime with these results used to establish ABT protocols for the intervention group. The $30\text{-}15_{IFT}$ is a prescriptive, intermittent fitness test developed by Buchheit (7). The test has been validated as a relevant tool for interval training prescription for intermittent sports players (6). In brief, the $30\text{-}15_{IFT}$ consists of 30 second shuttle runs interspersed with 15 second passive recovery periods. Running speed commences at 8 km/h and increases by 0.5 km/hr every 45 second stage. The ABT program was based off the recruits' initial $30\text{-}15_{IFT}$ assessment score. Each Interval was derived from the following formula: *Interval distance= running speed in m/s x % of effort x duration of interval*. Running speed was derived from speeds obtained during the $30\text{-}15_{IFT}$ assessments. A 10 second interval was selected in order to ensure the maximum run distances would not exceed the available running track distance at the Academy. Each run cycle consisted of a 10 second run interval followed by a 10 second rest interval alternating continuously for 6 minutes. For Weeks 1-4, each recruit completed 2 sets of run cycles with a 2-minute rest period between each set. The percentage of effort for the run interval commenced at 90% of running speed calculated from the above formula in Week 1, increasing in running speed by 2.5% per week to a maximum of 97.5% in Week 4. From Weeks 6-9, three sets of run cycles were performed with a 3 minute rest period between each set. Similarly, the percentage of effort commenced at 92.5% of running speed and increased by 2.5% per week to reach maximal running speed (100%) in Week 9.

To measure changes in metabolic fitness, the 20 m PSRT, was conducted in the first and last weeks of the police recruit training course sessions. The testing protocols follow those described in previous literature (28) and were conducted by police PTI in accordance with the number of shuttle run levels and stages completed recorded. The 20 m PSRT was selected as the outcome measure for several reasons. Firstly, this is a test commonly employed in tactical occupations (3, 10, 20). Secondly, 20 m PSRT scores are the current standard unit of measure by this police academy. Thirdly, the assessment has been shown to be a valid and robust predictor of VO_{2max} in adults (19).

Injury data were collected using the standard Charles Sturt University Accident and Incident form in accordance with normal Academy protocols. Recorders and data processors were blinded to the research and the participants. Upon cohort graduation, injury data were provided to the research team.

Statistical Analysis

Collected injury data were reviewed to remove any non-musculoskeletal data. As examples illness, fainting and hand laceration data were removed. Only data detailing injuries to the musculoskeletal system were retained. For incidences where a single member had sustained more than one musculoskeletal injury, each injury was considered a separate injury if it occurred on a different date to a different body site. If multiple injuries occurred on the same day the leading site of injury, as detailed in the Accident and Incident form, was given precedence. Statistical analyses were performed using IBM SPSS Software Version 20. Before any comparative analyses were conducted, consideration was given to the assumption of normality and the assumption of homogeneity of variances. Independent samples t-test for equality of means was used to compare differences between Group A and Group B before and after the intervention and paired t-tests were used to compare changes within groups. Pearson's Chi-Squared tests (2x2) were used to determine potential significance in the number of injuries sustained between cohorts. Relative risks of injury were calculated by groups using MedCalc® software. Due to differences in training programs Session 1 and Session 2 data were not pooled and were therefore analyzed separately. With power set at 0.8, effect size at 0.3 and alpha level at 0.05 the required number of recruits per group was 90. Statistical significance was set at $p<0.05$.

RESULTS

When viewed per session, injury rates between the two cohorts were similar (Session 1 n= 5 or 9%: Session 2 n=19 or 8%). However, injury rates were noticeably lower for the intervention groups. Of the 54 recruits in Session 1; four recruits (14%) in the control group suffered an injury while only one recruit (4%) was injured in the intervention group. For Session 2; 12 recruits (10%) in the control group suffered an injury and seven recruits (6%)

in the intervention group were likewise injured. While noticeable, the number of injuries between groups did not reach a level of significance (Session 1; $x^2(1)=1.533$, p=0.216: Session 2; $x^2(1)=1.252$, p=0.263). This is unsurprising given the small number of injuries sustained. Considering this the relative risk (RR) for the intervention groups were lower when compared to the control groups in both Session 1 (RR= 0.31: 95% CI, 0.38-2.58, p=0.28) and Session 2 (RR= 0.59: 95% CI, 0.24-1.43, p=0.24). No data was available on the severities of the injuries, with the sites of injuries similar between cohorts. The natures of injuries sustained are listed in Table 1.

Due to a total of 24 injuries across both cohorts and an additional 27 incomplete data sets (e.g. a recruit did not complete their initial or final assessment with the cohort due to various scheduling reasons), 51 data sets were excluded. The remaining 236 recruits, coming from the two separate recruit programs (Session 1: n=45: Male=35 Female=10 / Session 2: n=191; Male=118, Female=73), were retained for assessment of changes to aerobic fitness.

Excluding the two combined sessions in Weeks 5 and 10, recruits undertaking the standard physical training program completed a total distance of 28.5 km over the program duration. In comparison the ABT group completed a mean total distance of 16.3 km (± 1.3km) with the least fit recruits running a total of 14.2 km and the fittest recruits running 18.5 km.

In both the Session 1 cohort (CG n=25: IG n=20) and Session 2 cohort (CG n=96: IG n=95), no difference in initial fitness levels were found between the groups (Session 1; t(39)=0.451, p=0.655: Session 2; t(189)=-1.004, p=0.317). Likewise, there were no significant differences in initial $30\text{-}15_{IFT}$ scores between CG and IG groups (Session 1; t(19)=1.8, p=0.09: Session 2;

t(94)=-1.569, p=0.120). Descriptive statistics and values of the parameters measured before (and after) the 10 weeks of training are shown in Table 2.

Following the 10 weeks of physical conditioning, aerobic fitness did not improve significantly within the CG (p=0.476) or IG (p=0.493) for Session 1 (Figure 1). The mean number of shuttles completed on the 20 m PSRT for the Session 1 CG was 63.44 (± 17.30) shuttles at Week 1 and 65.40 (± 18.26) shuttles at Week 12 of the training program. The Session 1 IG completed 60.94 (± 17.42) shuttles at initial testing and 63.00 (± 19.24) shuttles at follow-up.

For Session 2, aerobic fitness improved significantly within the CG (p=<0.001) and IG (p<0.001) following the 10 weeks of PT (Figure 2). The mean number of shuttles completed on the 20 m PSRT for the Session 2 CG was 63.32 (± 15.70) shuttles at Week 1 and 67.48 (± 15.95) shuttles at Week 10. The Session 1 IG completed 60.98 (± 16.45) shuttles at initial testing and 70.11 (± 16.54) shuttles at follow-up.

There was no significant improvement differences in aerobic fitness between the CG and IG for Session 1 participants following the intervention (t(39)=0.402, p=0.690). Likewise, while the IG did improve their results to a greater extent, there was no significant differences in aerobic fitness between the CG and IG for Session 2 participants following the intervention (t(189)=1.119, p=0.265).

DISCUSSION

The aim of this study was to assess the impact of an ABT run training program, in which ability groups were established based on results of an intermittent fitness assessment, on the metabolic fitness and injury rates of police recruits undergoing basic training. It was hypothesized that such an ABT program would improve the metabolic fitness and reduce the injury rates in recruits to a greater extent than a program primarily involving traditional group continuous running sessions. This hypothesis was partially proven. The ABT program did show a lower injury rate and significantly lower relative risk when compared to the continuous running program. However, gains in metabolic fitness between the two groups were similar.

In Session 1, there were no significant differences or improvements in aerobic fitness between the control and intervention groups after 10-weeks of physical training. However, participants in Session 2 significantly improved their aerobic fitness regardless of the training regime followed. A potential reason for the differences in aerobic fitness gains between cohorts in Session 1 and Session 2 may be the nature of the training undertaken, with Session 2 having a more active program through incorporation of marksmanship activities, defensive tactics training and increased police scenario activities. These activities may have contributed to the overall training effect, through incidental loading (14, 24).

While the session type and subsequent training did not influence overall injury ratios (Session 1 = 9% of cohort: Session 2 = 8% of cohort), there were notable differences in the number of injuries sustained between control and intervention groups where, in both Sessions, the intervention group sustained fewer injuries than the control group and were at a significantly lower relative risk of injury. A potential reason for this reduction in injuries is the reduced distances run during the ABT training for the less fit participants. With the majority of recruit injuries during training considered to come from the recruits with the lowest levels of fitness (12, 28), reducing the running distance in this population, may provide a sufficient training stimulus while limiting the potential for overuse injuries.

Results of this study concur with previous military literature regarding running mileage and aerobic fitness, and also ABT and physical readiness. Research by Trank et al. (34) found that military recruits who ran half (or less) the number of miles had a significantly lower incidence of injury, and their improvements in final run times did not differ from those recruits who had the highest run mileage. These findings are commensurate with our study whereby the ABT group ran an average of 43% less distance than the standard training group and the least fit of the ABT group running 50% less distance.

In terms of ABT and physical readiness, several recent papers (9, 15, 17, 18) have suggested that ABT allows recruits to improve their aerobic fitness, pass the required physical fitness tests, and minimise injuries that result in lost time and lower fitness levels. Similar results were found in this study with recruits in the ABT group equalling if not exceeding the metabolic fitness of their counterparts whilst sustaining fewer injuries. Unfortunately, in this training context there were no final fitness assessments that the recruits had to pass to complete training. As such comparative pass and fail rates were not available for comparison.

Implications of this study are of note to the tactical population in three key areas being; reduced costs associated with injuries, training protocols that may be more conducive to daily tasks, and time savings in recruit training. With the potential cost to recruit and train a police officer estimated at $85,000, the reduced number of injuries sustained by the intervention ABT group could represent a cost saving of up to $680,000 for these two training sessions alone. While this figure is based on none of the injured recruits in the control group being able to complete training, it likewise does not include any initial medical treatment and potential ongoing medical treatment and compensation costs.

The intermittent nature of the ABT intervals, derived from the $30\text{-}15_{IFT}$, may more closely align themselves with the occupational nature of police duties. Typically, police officers are required to run short distances at maximal effort to ‘get to the problem’, followed by explosive tasks such as take downs, wrestling, pushing and pulling and bending and twisting to ‘control and remove the problem’ (2). As such, these ABT intervals may be of greater benefit in metabolic conditioning for the police recruit than the longer interval and continuous group running sessions currently undertaken. Furthermore, while aerobic orientated assessments, like the 20 m PSRT are often employed due to their ability to predict injury, the $30\text{-}15_{IFT}$ has been found to provide a similar predictive ability, notably in a police population (26). As such there is the potential for the $30\text{-}15_{IFT}$ to provide be used as not only an ABT grouping tool but as a predictor of injury risk in this population.

A final consideration rests in training time saved through the use of the ABT program. With each session being approximately 15 minutes shorter, this equates to a time saving of 2h over this program (8 x PT sessions). While this amount of time may not appear large, in time-critical tactical training programs, additional hours are generally difficult to acquire. More importantly, this additional 15 minutes may be used to focus on other forms of PT that may facilitate health and prevent potential injury (stretching, pre-habilitation, or corrective technique exercises as examples).

A key limitation of this study was the inability to standardize any potential additional physical training sessions conducted by recruits in their own time. However, while these personal PT sessions may have the potential to bias the results, staff claimed that relatively few recruits found time or motivation to conduct any personal PT outside of the recruit training program.

A second limitation was that of gender. The results provided to the research team were gender neutral and as such no potential impact of gender was able to be determined. Considering this, police staff were able to confirm that the gender distribution was commensurate across groups. Considering this, the intent of the ABT training is to facilitate individual fitness and as such should accommodate any differences in fitness due to gender.

PRACTICAL APPLICATIONS

As part of initial police training, new recruits participate in physical training sessions. These physical training sessions aim to physically prepare the recruits for the duties of police officers but must do so in a way that minimizes the new recruit's risk of injury. With lower fitness levels and higher running mileage associated with injury the optimization of metabolic fitness using a 'one size fits all' group running approach is questionable. The findings of this study demonstrate that an ABT program, derived from an intermittent fitness assessment, can be used with tactical or intermittent style athletes to maintain or improve metabolic fitness. Furthermore, this can be achieved in a manner that is metabolically specific, reduces the potential for injuries by reducing running mileage and catering for the fitness levels of individuals, and is time efficient.

On this basis, an ABT program, derived from the $30\text{-}15_{IFT}$ can be utilized by the Tactical Strength and Conditioning Facilitator (TSAC-F) or coach to replace the 'one size fits all' approach of group runs, which require greater mileage and a longer duration to achieve a similar outcome to ABT whilst simultaneously increasing the relative risk of injury. Through an ABT program derived from an intermittent fitness assessment, the metabolic fitness of recruits can be improved via an individualized metabolic conditioning dose tailored to the ability of the individual within the group. This approach could effectively reduce relative injury risk, reduce run mileage and even save time which can then be invested in other conditioning requirements (like technical training, pre-habilitation, etc).

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Table 1: Injuries sustained by Session and group.

	Session 1		Session 2	
	Control	Intervention	Control	Intervention
Size				
n	29	25	118	115
Injuries				
n (%)	4 (14%)	1 (4%)	12 (10%)	7 (6%)
Injury site	Foot x1	Foot x 1	Foot x1	
	Knee x 2		Knee x 3	
	Back x 1			Back x 2
			Ankle x 2	Ankle x 1
			Calf x 1	Calf x 1
			Lower leg x 3	Lower leg x 2
			Wrist x 2	Finger x 1

Table 2: Initial 30-15_{IFT} scores and number of shuttles completed in 20 m PSRT, and pre and post intervention 20 m PSRT stage results.

Session		Subjects		30-15_{IFT}	20 m PSRT	20 m PSRT-	20 m PSRT-
		Male n	Female n	(Score) M(SD)	(# Stages) M(SD)	Pre (# Shuttles) M(SD)	Post (# Shuttles) M(SD)
Session 1	Control	20	5	16.36 (1.71)	8.2 (1.68)	63.44 (17.30)	65.40 (18.26)
	Intervention	14	6	16.56 (2.10)	8.3 (1.78)	60.94 (17.42)	63.00 (19.24)
Session 2	Control	59	37	16.62 (1.63)	8.2 (1.49)	63.32 (15.70)	67.48† (15.95)
	Intervention	59	36	16.45 (1.71)	7.9 (1.60)	60.98 (16.45)	70.11† (16.54)

† Significant difference between Pre and Post assessment measures, $p<0.001$

Figure1. Number of shuttles completed pre and post for Control and Intervention in Session 1

Figure 2. Number of shuttles completed pre vs post for Control and Intervention in Session 2