ORIGINAL ARTICLE

Effects of Interval Training Exercises on Athletic Performance and Physical Fitness

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ABSTRACT

Aim: To investigate the effects of interval training on physical fitness and performance in athletes.
Methods:Fifteen male players from athletics were recruited through convenience non-probability sampling for this study to undergo 25 weeks of interval training.Physical fitness was evaluated in terms of 600m run time, agility run test, broad jump height, number of push-ups, and number of sit-ups. Athletic performance was assessed through the running time in their respective athletics event. Data was collected before, during, and after the training although statistical results are reported for pre- and post-training data only. Paired-samples t test was used to compute the training-induced effects.
Results:Significant improvements (P<0.001) were observed in 600m run time, agility run test, number of push-ups and sit-ups.Furthermore, the broad jump height also improved significantly due to interval training (P<0.01).
Conclusion:Interval training can significantly improve physical fitness and performance of athletics players. It is recommended to be included in the fitness plans of these athletes.
Keywords:Athletics, 600m run, push-ups, physical fitness, interval training.

INTRODUCTION

Interval training can be defined as “Bouts of exercise interspersed with short rest intervals”[1]. The concept behind this ideology is that interval-type training delivers better and more performance and work completion in comparison to higher relative intensity training. The interval workouts for particular sports may be taken care of by considering the aims and nature of the sports[2]. Past exercise physiology research has suggested,based on laboratory data, that in young healthy individuals, vigorous interval training can help in regulating musculoskeletal aspects as compared to traditional training[3]. Current scientific research also indicate that High Intensity Interval Training (HIIT) is significantly effective in enhancing cognitive skills[4].

Fox et al. compared two types of running:interval-running and continuous-running simultaneously with respect to the metabolic energy sources and the consequent physiological effects in athletes. It was found that interval training was more successful in performance enhancement of eliteplayers due to slow accumulation of lactic acid in muscles, thus delaying the onset of fatigue for considerable time[5]. Similarly, Gorostiaga et al. found out that maximal oxygen uptake increased significantly (VO_{2max}) when the athletes repeated 30-second work-bouts at maximal velocity at maximal oxygen uptake (vVO_{2max}) with 30-second break between the workoutversus continuous training at 70% of vVO_{2max}[6].

The inclusion of multiple sports (running and cycling) concurrently in a singleinterval training sessioncould enable athlete to become acclimatized to various environments. Furthermore,triathlon athletes could integrate running, swimming and cycling in a single session of interval training work-out as has been studied in a past scientific project[7]. Past researchers have evaluated the 10-minutes performances of runners who received interval training for3 km running. Significant increase in the oxygen kinetic was reported by the research team. Additionally, the improved performance of the running athletes was maintained at the same level for prolonged time despite large inter-individual variation regarding vVo_{2max}. It was also demonstrated that the performance of interval training achieved at invariable exercise intensity could improve maximal oxygen uptake by approximately seven percent[8].

The effect of 3 different types of interval training programs on the endurance performance of elite endurance sportsmen has also been investigated in the past. The study reported that when these endurance playersconducthigh-intensity interval trainingfor a period equivalent to 60% of T_{max} and while maintaining the intensity of Peak Power output, the 40 kilometre trial run performance could be improved substantially[9]. A separatetrialsignified beneficial influence of high-intensity interval training on muscular cross-sectional area, mechanical work done, and several other physical variables in ice-hockey athletes when tested against more traditional continuous training[10]. Past research has alsoimplied that such interval trainingcould bring more significant improvements in power production and aerobic capacity of the playersversus the traditional continuous endurance regimen. Furthermore, high-intensity interval training is speedier in improving the muscle capacity than traditional training could provide[11,12].

Physical fitness may be defined as "The ability to carry out daily tasks, specialized tasks or sports tasks with vigour, alertness, agility and control without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies”[13].

A past study based onvarious tests performed on thirtyplayers, randomly assigned to study and control groups, to give insights into the physical fitness parameters concluded that high-intensity interval trainingwas able to induce significantly more positive improvement in the fitness. The fitness components that were studied included agility, power, and speed in the interval-training group which underwent training for six weeks[14].Yet another study reported that high-intensity interval training could assist with performance improvement as well as quality of life[15].

The purpose of the current study was to investigate the effects of high-intensity interval training on components of physical fitness and performance on players with athletics background.

METHODS

This study utilized a single group pre-post test design to investigate the effects of interval training on athletic performance and physical fitness in players. Fifteen semi-professional athletics players were recruited through convenience non-probability sampling technique to participate in this trial. The inclusion criteria was male athletics players within 18-28 years of age range who participate in 100m, 200m, 400m, and 600m running athletics events at university level. Athletes with recent history of musculoskeletal disorder, cardiovascular disease, and already participant of a training program were excluded from the study.

The study was conducted in accordance with the guidance provided by the declaration of Helsinki by the world medical association. All athletes were asked to give a signed, informed consent form for their unconditional participation in the project. The data collection and training was performed at the PAF sports complex and Air University Islamabad campus. Following the approval of the study from the institutional review board, a questionnaire was circulated among the university students and 15 university athletes were recruited based on their responses to the questionnaire.

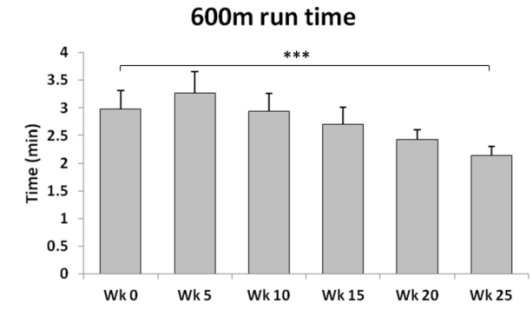
The data included the time the athletes took to complete a 600 meter run, number of sit-ups and push-ups they could achieve in single continuous session, time required to complete the agility run test, and height reached during the performance of the broad jump test. Additionally, basic demographic and anthropometric information of the athletes was also recorded. Data was collected at baseline before the induction of the interval training, at 4-week intervals throughout the training, and at the end of the training. The interval training description can be seen in Table I.

Paired-samples t test was used to compare the physical fitness and performance before and after the 25-week training. SPSS was used for all statistical analyses and significance level was decided to be at a P value equal or less than 0.05.

RESULTS

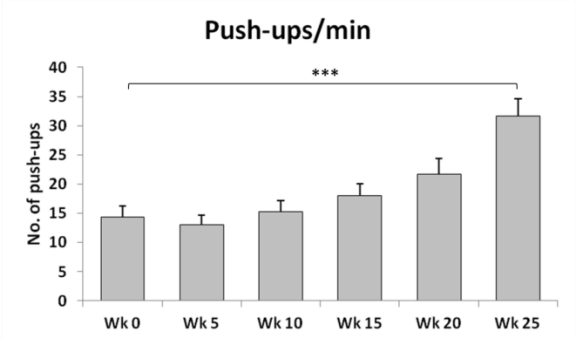
Average age of the athletes was 21.29 (SD:1.29) years. Average weight, height, and body mass index of the participants were 66.9 (5.3) kg, 1.8 (0.1) m, and 22.0 (2.0) kg/m2 respectively. As a result of interval training, significant reduction (P<0.001) was observed in the time required to complete a 600-m run (Fig. I).

Fig. I: Knee flexion and extension torque before and after the isokinetic strength training in athletes with knee pain. (*** indicates significant change P<0.001)



Similarly, the athletes were able to perform significantly more (P<0.001) push-ups at the end of 25-week training compared to the baseline performance (Fig. II).

Fig. II: Knee flexion and extension torque before and after the isometric strength training in athletes with knee pain. (*** indicates significant change P<0.001)

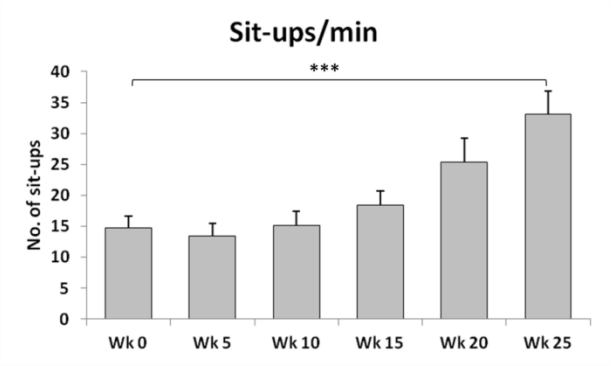


Additionally, the run required to complete the agility run test was found to be significantly reduced after 25 weeks compared to the pre-training values (Fig. III).

Fig. III: Athletic single leg stability before and after isometric and isokinetic strength training of the thigh musculature. (*** indicates significant change P<0.001)

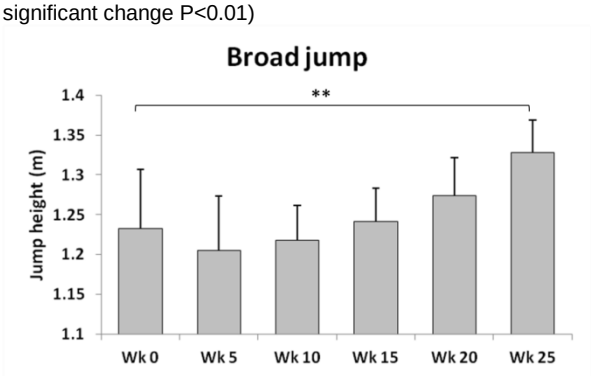
At baseline, the athletes were able to perform around 15 sit-ups in a minute on average which significantly improved (P<0.001) to more than 30 after the training period (Fig. IV).

Fig. IV: Athletic single leg stability before and after isometric and isokinetic strength training of the thigh musculature. (*** indicates significant change P<0.001)



Finally, the broad jump height significantly increased (P<0.01) due to interval training in the athletics players (Fig. V)

Fig. V: Athletic single leg stability before and after isometric and isokinetic strength training of the thigh musculature. (** indicates significant change P<0.01)



DISCUSSION

The present study was conducted to find the effectiveness of 25-week interval training on some physical fitness components and sports performance. The results of the current study have indicated that all components of the physical fitness and performance improved significantly after the athletes completed the interval training. The findings of this study are in agreement with those of an earlier study according to which HIIT seemed to be superior to conventional endurance exercises as fifteen weeks of low volume HIT played key role in lessening fat mass especially intra-abdominal fat in theparticipants[16].

The initial decline in fitness components and performance may be attributed to new first-time-training model to which participants were not acquainted with. Also adaptation to new training program, adjusting to new environment and interval training load may have contributed to their decreased level of output. New training protocol affects athletic performance due to the distribution of rest periods. It has been observed that shorter recovery periods with sedentary objects may induce larger increase in levels of pyruvate kinase, cretonne kinase and lactate dehydrogenase which are bio-chemical markers of muscle fatigue, inflammation or injury and hence, as a result performance declination may be expected[17].

New training approaches should be well monitored to see training adaptations and responses to new exercise patterns and new training load so as to detect decreased output or other problems so that training program's intensity, rest period frequencies & duration may be adjusted or designed accordingly to maximize performance[18]. These improvements in the fitness components indicate that interval training played positively a key role in increasing the physical fitness of the athletes. Health and fitness can be improved by practicing an effective training model that uses short repeated bursts of relatively intense workouts. It is very likely that the very strong nature of HIIT causes quick changes, whereas adaptations associated with traditional endurance training may reflect slowly[19].

It has been demonstrated that low volume HIIT exhibited improvised skeletal muscle performance and balanced body composition in the subjects. Enhancement in exercise performance and cardiorespiratory fitness along with improved glycaemic and insulin controls were witnessed in a previous research study. In general, IT (low and high intensity) seems to enhance many aspects of physical fitness of athletes that are long sought by the coaches and exercise scientists[20].

Lindsay et al. conducted a similar study to find out whether interval training program would improve the 40-kilometre time trial (TT) performances of well-trained competitive athletes. In their study, twelve male well-trained athletes with no interval training background, but at least had 4-years of endurance training were subjected to a interval training program after preliminary baseline testing in a laboratory. Baseline measurements such as body mass, heart rate, the maximal incremental test (on electronically braked ergometer), timed ride to fatigue (TF) and peak power output were recorded. Also all subjects performed a simulated 40-km time trial to measure athletic performance. At the end of interval training program, all laboratory testing were repeated. All subjects completed POMS test to detect any psychological changes that might be associated to interval training program. TF150 increased significantly after 2 week of HIT (60.5±9.3 to 67.9±12.3 s; P=0.05). Peak power output was not significantly greater after 2 week (P=0.08), but it increased significantly over the 4 week of HIT program (416±32 vs 434±32 W; P=0.01). These time differences resulted from an increase in the average 40-km cycling speed from 42.7 ±2.8 to 44.2±2.7km•h-1 (P<0.001). Post-HIT analysis showed that subjects were able to sustain both a significantly higher absolute (301±42 vs 326±43 W; P<0.0001) and relative (72.1± 6.8% vs 75.0± 6.8% of PPO; P < 0.05) power output for the TT40[21].

CONCLUSIONS

High intensity interval training is significantly effective in improving physical fitness and performance in players with

athletics background. Such exercises should make an integral component of the physical training and rehabilitation plans in such athletes.

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