

Effects of Continuous and Interval Training on Different Fitness Parameters in Athletes

Majid Mazoochi, Seyyed Ehsan Fateminezhad and Tahere Mazoochi

Anatomical Sciences Research Center,
Kashan University of Medical Sciences, Kashan, Iran

Abstract: Coaches and athletes are always looking for training methods to improve physical capabilities of athletes. Therefore, different training methods have been developed and used based on the science of physiology and exercise science. Effects of interval and intermittent exercises on weight and fitness have been widely studied but few studies focus on fitness training. So we planned to evaluate the effects of interval and continuous training on different cardio-respiratory factors in athletes. The results of our study showed that interval and continuous training have significant effects in cardiac indices, respiratory parameters and blood parameters. Thus, these kinds of trainings can be used for increasing aerobic and anaerobic fitness of the athletes.

Key words: Exercise • Cardiology • Hematology

INTRODUCTION

Several factors are associated with success in sport performance and training is a major part of it. In fact, athlete's endurance, according to the type of exercise, is affected by factors such as aerobic power, efficiency, biomechanical, neuromuscular and cardiovascular adaptations, anaerobic power, lactate threshold and adaptation of the endocrine system [1, 2]. So much of the physiological differences between elite and novice athletes' endurance depend on training methods they use [3, 4]. Aerobic interval training is one of the most common training methods to improve athletes' endurance and performance in pre-competition's season [5]. The continuous training also works on endurance performance, but continuous exercise may increase Vo₂max, capillary density, oxidative enzyme activity and plasma volume in untrained individuals but are not effective on athletes in which interval training is more efficient [6]. However, the effect of resistance exercise on endurance is also an issue that has received considerable attention in recent years. Some evidence suggests that the addition of resistance training exercise for athletes, by

changing the physiological pressure and improved neuromuscular characteristics have a positive impact on endurance in athletes [7, 8].

Coaches and athletes are always looking for the traditional training methods to improve physical capabilities of athletes more and more. Therefore, different training methods have been developed and used based on the science of physiology and exercise science. Continuous and interval training are long used in practice to increase aerobic and anaerobic capacity of athletes. Continuity exercises that have a longer history than interval exercises commonly use to increase aerobic capacity and endurance of cardio-respiratory system [3]. Example of continuous practices is when the athlete runs continuously without a break from long distance during a given workout, or run continuously up to the given time. The advantages of this type of training is to improve and increase the capacity of the various sources of cardio -vascular and respiratory, increase maximum oxygen uptake, increase capillary network and increases mitochondrial enzymes in aerobic energy systems and also increase the energy producing system enzymes generally [1]. Another type of exercise which is commonly

Corresponding Author: Tahere Mazoochi, Anatomical Sciences Research Center,
5th Km-Qotb-e Ravandi Boulevard, P.O.Box: 87155.111, Kashan, Iran.
Tel: +98 361 5551070, Fax: +98 361 5579028.

used in various sports is interval training. This training method is alternate periods of exercise - rest - exercise - rest. These exercises are performed with a greater intensity than continuous exercises and anaerobic energy producing systems are being pressurized as well as aerobic systems in this kind of exercises. And also because of rest periods between exercises there is time for energy sources such as creatine phosphate (CP) and adenosine triphosphate (ATP) to be replaced and the athlete can continue with less fatigue. Many benefits that can be gained by doing interval training are improving levels of anaerobic capacity, lactate pathway enzymes and anaerobic energy creating enzymes [5-7].

Effects of interval and intermittent exercises on weight and fitness have been widely studied. However, the review of literature indicates that many experiments have examined the physiological factors but few studies focus on fitness training [8-13].

Performing studies to evaluate different fitness factors could clarify the positive effects of these practices and compare and judge the effectiveness of these exercises on athletes. On the other hand, it is still not clear yet which of these exercises can better improve the fitness indicators including aerobic fitness, cardiovascular variables and blood and breathing parameters. Comparison of the effects of these two types of exercise can help athletes and coaches in recognizing the positive effects of these practices and help them choose these practices in appropriate situations and for certain purposes. So we planned to evaluate and compare the effects of interval and continuous training on different cardio-respiratory factors in athletes.

MATERIALS AND METHODS

This was an experimental study to evaluate effects of interval and continuous exercise on different cardio-respiratory factors in athletes. This study was conducted in May 2011 to May 2013 in Kashan. We randomly selected 24 sportsmen from karate, handball and volleyball athletes of Kashan who had 1-3 year experience in different exercises. We divided them to 3 groups of 8. First one was interval exercise group, the second group was continuous exercise group and the third one was control group. Cardiovascular, respiratory and hematological parameters were recorded and compared with other groups.

Before manipulating the independent variable, a pre-test is performed according to the dependent variables. And after the taking effect of independent variable (8 weeks) post-test was performed. Before the pre-test,

subjects were introduced to the gym, weightlifting hall, weight lifting methods and devices that would be used in the exercises and also echocardiography in 4 sessions on 2.5 hour. The subjects were asked to avoid any intense physical activity in the period of 2 days prior to pre-test. The speed of 8 Km/h of treadmill, increasing every 3 minutes was the method of Vo₂max calculation. Structural and functional heart parameter measuring was performed by a cardiologist using an echocardiogram. Athletes attended three sessions per week for eight weeks of training.

Data was assessed with one way of analyzing of variance (ANOVA) and Kolmogorov-Smirnov tests in SPSS version 11.5. P values less than 0.05 was considered as significant.

RESULTS

The results of different parameters in the three groups were shown in table 1.

Vo₂ max: maximal oxygen consumption in L/min, Tmax: Time duration of exercise with the intensity of Vo₂max, LV: Left ventricle diameter in millimeters, LVSD: Left ventricle septal diameter in millimeters, LVPW: Left ventricle post wall diameter in millimeters, LVPD: Left ventricle post diastolic diameter in millimeters, LVPS: Left ventricle post systolic diameter in millimeters. H.Mus: heart muscle weight in grams. St.V: stroke volume in mm³, Ej.Fr.: ejection fraction in %, HCT: hematocrit in %, RBC: Red Blood Cell count *10⁶/mm³, HGB: hemoglobin in gram/DL, running: time of 3000 meters running (seconds)

Comparing the results of effect of continuous versus interval training showed that Vo₂ max, LVSD and HGB with p values of 0.17, 0.059 and 0.090 do not differ between the groups but other parameters that studied were different.

DISCUSSION

Effects of two training methods, namely interval and continuous training on different parameters of 24 sportsmen have been studied in this article. Results showed that both interval and continuous training have considerable effects on most echocardiographic parameters. These results are in line with the results of Smart *et al.* [1], Borel *et al.* [5] and Baquet *et al.* [6]. The results showed that the training methods have no effect on LVSD but these results are different from the results of Sfarenjani *et al.* [14]. This difference may be due to different training methods and also different study population in the two studies.

Table 1: Mean of different parameters in different groups of study

Parameter	Continuous training group		Interval training group		Control group		P value
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	
Vo2 max	60.46	61.82	68.76	74	71.67	68.38	0.17
T max	602.88	1163	700.50	1127	664.25	664.25	<0.001
LV	0.81	0.93	0.85	1.04	0.86	0.86	0.001
LVSD	0.76	0.87	0.77	0.91	1.20	1.22	0.059
LVPW	14	17.94	18.12	20.84	18.01	18.07	<0.001
LVPD	0.71	0.8	0.67	0.76	0.78	0.80	0.008
LVPWS	0.81	0.93	0.85	1.03	0.86	0.86	0.003
H.Mus.	157.15	290.7	139.07	200.39	137.28	154.48	0.011
St.V	40.28	75.31	70.59	82.51	61.91	63.40	<0.001
Ej.Fr.	31.86	61.98	59.52	64.87	54.48	57.33	<0.001
HCT	42.88	44.31	41.85	43.56	42.81	42.85	<0.001
RBC	5.12	5.28	4.96	5.18	5.21	5.23	<0.001
HGB	14.41	15.09	14.01	14.41	14.52	14.53	0.090
Running	913.5	1838.38	1123.13	1863.63	946.63	963.5	<0.001

Previous studies showed the results of interval and continuous training on heart muscle size and its strength [1, 5]. If these training are performed regularly, coronary network works more efficiently and stroke volume increases [6].

Interval and continuous training also had a significant effect on respiratory parameters like Tmax and 3000 meters running time. These results are in conductance with the results of Franch *et al.* [15], Billat [16], Smith *et al.* [17], Laursen *et al.* [18] and Sfarenjani *et al.* [14]. The results of our study showed no effect of such training on VO2max. Results of our study can be confirmed by the results of the study by Denis *et al.* [19]. But MacDougall *et al.* [20] and Harmer *et al.* [21] believed that these kinds of training have considerable effects on Vo2max. They had slightly different training methods and also training duration and time in their studies and it's possible that longer and more intense training have effects on Vo2max.

Our results showed increased HCT and RBC but not HGB in training groups. Ben Abderrahman *et al.* [22] also showed the effects of training on blood parameters but they showed increase in all parameters including HGB. This may be because of their slightly different method and study sample size.

The results of our study showed that interval training and continuous training have significant effects in cardiac indices including stroke volume, ejection fraction, Left ventricle diameter, Left ventricle post wall diameter, Left ventricle post diastolic diameter, Left ventricle post systolic diameter, heart muscle weight,

stroke volume, ejection fraction and respiratory parameters including Tmax, and the 3000 meters running time and blood parameters such as hematocrit and red blood cell count. Thus these kinds of trainings can be used for increasing aerobic and anaerobic fitness of the athletes.

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