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Effect of High Intensity Interval Training on Aerobic Capacity of Male Handball Players

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ABSTRACT *The purpose of this study is to find out the efficiency of high intensity interval training on aerobic capacity of male handball players. To achieve the purpose thirty (30) male handball players were selected from Department of Physical Education and Sports Sciences, Annamalai University, Tamilnadu, India. These subjects were tested on aerobic capacity before and after eight weeks of high intensity interval training (HIIT). The mean maximal aerobic speed 4.21 m/s was used as a criterion velocity to set running paces for high-intensity interval training. Statistical technique used in the present study was ANCOVA for aerobic capacity. The result of the study revealed that eight weeks of high intensity interval training resulted in 8.20% of improvement in aerobic capacity (F(1,27) =108.04, p < 0.05). It is concluded that high intensity interval training for eight weeks resulted in improvement of aerobic capacity of male handball players.*

KEYWORDS : Aerobic capacity, MDA, maximal aerobic speed, ANCOVA, handball, players.

Introduction

Today a handball players requires high level of general and specific fitness to compete during a competition. The diversity of efforts requires comprehensive preparation in terms of endurance, speed, flexibility, power and strength. Handball demands both aerobic and anaerobic energy required for sports participation of the players derives from processes. Good levels of general fitness, as well as a high aerobic and anaerobic capacity, form the foundation for success in intermittent sports. Several games which possess aerobic energy system as predominant one and anaerobic energy system which is also essential to perform sprints, high-intensity runs, and duel plays, all of which may contribute to the performance in the game and health. It has been shown that traditional endurance training improves aerobic capacity. Physiological adaptations from training, resulting from an increase in mitochondrial density, include changes in skeletal muscle substrate utilization and improved respiratory control sensitivity (Holloszy and Coyle, 1984).

Chittibabu (2013) in his study showed that handball specific repeated sprint training for eight weeks is more effective in increasing aerobic capacity of men handball players. The training load adopted in repeated – sprint training with game specific which resulted in 11.79% of changes in aerobic capacity. High-intensity interval training (HIIT) is a time-efficient way to induce similar adaptations, such as increased maximal mitochondrial enzyme activity (Burgomaster *et al*. 2005) and a reduction in glycogen utilization and lactate accumulation (Harmer *et al*. 2000; Burgomaster *et al*. 2006). In addition, HIIT may be more effective than conventional endurance training at improving muscle buffering capacity (Weston *et al*. 1997; Edge, Bishop and Goodman, 2006). HIIT consists of repeated bouts of short to moderate duration exercise completed at intensities greater than the anaerobic threshold, interspersed with brief periods of low-intensity or passive rest. HIIT is designed to repeatedly stress the body, physiologically, resulting in chronic adaptations and improving metabolic and energy efficiency (Laursen *et al*. 2005; Jenkins and Quigley 1993). Helgerud *et al*. (2007) found that HIIT significantly augmented maximal oxygen consumption (VO_2 max) and time to exhaustion (TTE) greater than a traditional training program with moderately-trained males. The purpose of this study is to find out the efficiency of high intensity interval training on aerobic capacity of male handball players.

Methods

Subjects

Thirty (30) male handball players were selected from Department of physical education and sports sciences, Annamalai University, Tamilnadu, India. The age of these subjects range between 21 to 26 years, the selected subjects gave willingness to participate in this study. These selected subjects were classified into two groups namely Group I: High intensity interval training and Group II: Control group. These subjects were randomly selected and equally divided into two groups. These subjects were free from diseases.

Variables and Test

Multistage fitness test was administered to measure aerobic capacity of the physical education students. The players ran continuously between 2 lines set 20 m apart at running speeds increased by a pre-recorded beep at appropriate intervals. Velocity was started at 8.5 $km.h^{-1}$ for the first minute, increasing by 0.5 $km.h^{-1}$ every minute thereafter. Players were instructed to complete as many stages as possible and the test was stopped when a subject was unable 3 consecutive times to reach a 3 m zone situated ahead of each 20 m line at the moment of the audio signal (Leger *et al*. 1988).

Training intervention

Aerobic training was given for 4 days per week (Monday-Morning (07:00 to 08:00 am, Tuesday-Evening (17:00-18:00, Thursday-Morning (07:00 to 08:00 am, Friday-Evening (17:00-18:00) for eight weeks. The formula proposed by Gerbeaux *et al*. (1991) was used to calculate Maximal aerobic speed (MAS). The MAS of 4.21 m/s was used as a criterion velocity to set running paces for high-intensity short intermittent exercises. They performed series of sprints lasting 10, 15 and 20 second for given distance. The training group performed training at 1:1 work rest ratio.

Statistical analysis

Descriptive statistics were derived for all test variables using SPSS (16). Changes in aerobic capacity and difference between the groups were assessed by Analysis of Covariance (ANCOVA). Statistical significance was accepted at an alpha level of p value ≤ 0.05.

Results

Table 1 clearly shows that there was significant difference between the groups after adjusting pre-test scores, on aerobic capacity (F = 108.04, p = 0.000). From table 1 it is also inferred that aerobic capacity increased 8.20% due to high intensity interval training.

Table 1
Mean and standard deviation of aerobic capacity at baseline and following eight weeks of high intensity interval training

Variable	Groups	Pre-Test	Post-Test	**Groups (F)**	**Covariate (F)**
Aerobic capacity (ml/kg/min)	HIIT	51.93±3.16	56.19±1.28	108.04 (p = 0.000)	14.81 (p = 0.000)
	CON	49.26±2.96	50.40±2.52		

Discussion

High-intensity interval training has been shown to be an effective method for improving endurance performance of handball players (Weston *et al*. 1997; Edge, Bishop and Goodman, 2006; Laursen *et al*. 2005; Jenkins and Quigley 1993; Helgerud *et al*. 2007; Burke, Thayer & Belcamino 1994; Daniels, Yarbrough & Foster 1978; Dolgener & Brooks 1978; Thomas, Adeniran & Ethridge 1984; Westgarth-Taylor *et al*. 1997). The results of the present study are in agreement with many studies demonstrating an increase in maximal oxygen consumption after high intensity intermittent training (Burke, Thayer & Belcamino 1994; Burgomaster *et al*. 2006; Edge *et al*. 2005; Gross, Swensen & King 2007). High intensity interval training may also induce up-regulation of glycolytic and oxidative enzymes, a possible mechanism influencing the improvements in VO_2 max (MacDougall *et al*. 1998). In addition, an increase in stroke volume following high intensity interval training (Helgerud *et al*. 2007) may contribute to an increase in aerobic capacity of handball players.

Conclusion

It is concluded that 4 sessions per week of 8 weeks of high intensity interval training is effective enough to improve aerobic capacity of male handball players.

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