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EFFECT OF HIGH INTENSITY INTERVAL TRAINING ON AND ANAEROBIC CAPACITY AND FATIGUE INDEX OF MALE HANDBALL PLAYERS

B. Chittibabu[a,*]

[a]*Assistant Professor,Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram – 608002,Tamilnadu, India.*
**Corresponding Author Ph: 09443531508; Email:* b.chitti@hotmail.com

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Abstract: The purpose of this study is to find out the efficiency of high intensity interval training on anaerobic capacity and fatigue index 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, Chidambaram, Tamilnadu, India. These subjects were tested on anaerobic capacity and fatigue index 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 anaerobic capacity and fatigue index. The result of the study revealed that eight weeks of high intensity interval training resulted in 28.58% in anaerobic capacity ($F_{(1,27)}$ =28.54, $p < 0.05$) and fatigue index ($F_{(1,27)}$ =14.11, $p < 0.05$). It is concluded that high intensity interval training for eight weeks resulted in improvement of anaerobic capacity and fatigue index of male handball players.

Keywords: RAST, MAS, handball, players, anaerobic capacity and fatigue index.

Introduction

Handball is fast body contact team sport which require tremendous amount of aerobic and anaerobic capacity. However, these players spend time on sprinting, jumping, agile, power to throw the ball harder faster and longer. They had to sprint repeatedly without fatigue with ample energy which improves indirectly his concentration, accuracy while throwing and errors. The secret behind the success of the team is to minimize the errors which results as a result of poor fitness among the players. In order to improve the efficiency of players during competition they are exposed to various kinds of training.

The players undergo endurance training to develop both their physiological and biochemical adaptations. Earlier studies have shown that repeated sprints are part of intermittent team sports. In soccer, handball, basketball, rugby repeated sprints are evident during competition. However, handball composed of repeated sprint of players for fast breaks

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and quick counter attacks which require great aerobic capacity. The players with greater aerobic capacity tend to show lower fatigue index which show negative correlation in handball players [1]. Chittibabu (2013) [2] 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. The energy required for handball players during handball match derives energy from both aerobic and anaerobic processes.

High-intensity interval training (HIIT) is a time-efficient way to induce similar adaptations, such as increased maximal mitochondrial enzyme activity [3] and a reduction in glycogen utilization and lactate accumulation [4,5]. In addition, HIIT may be more effective than conventional endurance training at improving muscle buffering capacity [6,7]. 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. The purpose of this study is to find out the efficiency of high intensity interval training on anaerobic capacity and fatigue index of male handball players.

Methods

Subjects

Thirty (30) male handball players were selected from Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India. The age of these subjects range between 19 to 25 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

Anaerobic capacity was measured by running based anaerobic sprint test (RAST). Subjects completed six 35 m runs at maximum pace (10 s allowed between each sprint for turnaround). Power output in watts for each sprint was calculated according to the following equation:

Anaerobic capacity = Weight × Distance ^{2} ÷ Time ^{3}

Fatigue Index = (Maximum power - Minimum power) ÷ Total time for the 6 sprints

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) [8] 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

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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 and difference between groups were assessed for anaerobic capacity and fatigue index 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 anaerobic capacity ($F = 14.11$, $p < 0.05$) and fatigue index ($F = 20.36$, $p < 0.05$). From Table 1 it is also inferred that anaerobic capacity increased by 28.58% and fatigue index decreased by 38.74%. The simple effect reveals that a significant difference exists between HIT and CON group at post test and also difference exist within HIT group between pre and post test.

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

Variables	Testing Conditions	GROUPS		Groups A	Test B	AB
		HIT	CON			
Anaerobic capacity	Pre test	372.09±66.88$^{\#}$	375.80±41.75	6.21*	14.52*	14.11*
	Post test	478.45±40.99$^{\$}$	377.79±43.35			
Fatigue index	Pre test	6.84±2.35$^{\#}$	7.00±1.79	2.94	21.94*	20.36*
	Post test	4.19±1.53$^{\$}$	6.98±1.74			

*****$p < 0.05$
$^{\$}$Difference between HIT & CON at post test
$^{\#}$Difference between pre and post test in HIT

Discussion

Anaerobic performance is mainly determined by fiber-type proportion and glycolytic enzyme capacity of skeletal muscle, both of which are largely influenced by genetic factors; however, there is always a training potential to be considered [9]. Improvement in anaerobic performance may vary according to training intensity, training period and trainability of athletes. Previous studies reported that high- or maximal-

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intensity training methods influenced the improvement of anaerobic performance variables in few team sport players [10]. In this study, anaerobic capacity of the HIT group showed significant increases of 28.58% (p<0.05), respectively and fatigue index decreased by 38.74% (p<0.05). The increases in power after the training program could be partly related to the increases in muscular performance; or muscle-fiber size for muscle force production have been associated with increases in muscle- fiber size [11]. Developing muscle performance with a training program may also be partly related to increase motor unit function or neuromuscular adaptation. A previous study indicated that neuromuscular adaptations such as increased inhibition of antagonist muscles and contraction of synergistic muscles might account for improvements in power output [12]. Medbo and Burges (1990) [13] provided evidence that anaerobic performance can be enhanced the maximal-intensity intermittent training program. It is also agreed that maximal-intensity intermittent training has different training effects on anaerobic performance [14].

Anaerobic performance, in relation to the increase in muscle enzyme activities, can be improved with high- or maximal-intensity exercises [15,16]. Parra *et al*. (2000) [17] indicated that maximal-intensity training for eight weeks enhanced muscle enzyme activities. Another mechanism affecting improvement of anaerobic performance is cellular regulations providing the continuity of energy production. Maximal- intensity training is suggested to increase anaerobic performance due to the improvement of cellular regulations. These regulations in the cellular mechanism buffer metabolic acidosis, which increases during exercise, causing fatigue; thus fatigue may be delayed or the resistance to fatigue may increase [7,18]. Therefore, it was assumed that the anaerobic performance of male handball players might be improved by increasing both muscle buffering capacity and enzyme activities, which are both affected by training stimulus.

Conclusion

It is concluded that 8 weeks of high intensity interval training on male handball players showed an increase in anaerobic capacity and reduction in fatigue index. The training program was sufficient enough to trigger a consequent adaptive response of the metabolic system and repeated sprint ability.

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