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EFFECT OF HANDBALL SPECIFIC AEROBIC TRAINING ON AEROBIC CAPACITY AND MAXIMUM EXERCISE HEART RATE OF MALE HANDBALL PLAYERS

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Abstract: The aim of our study is to assess the effect of handball specific aerobic training on aerobic capacity of male handball players. Sixteen (16) handball players were selected and randomly classifieds into two groups namely handball specific aerobic training (HSAT = 8) and control group (CON = 8). Sixteen handball players were tested before, at middle and after six weeks of training. The aerobic capacity of handball players was measured through Yo-Yo intermittent recovery test level II and por heart rate monitor was used to measure maximum exercise heart rate. The HSAT group performed 4 × 4 min small sided game at an intensity of 90-95% of heart rate maximum (HRmax), separated by 4 minutes of active recovery during which handball passing drill was performed at 60-65% of HRmax.. To assess the training effect 2 × 3 repeated measure ANOVA on last factor repeated was performed. When interaction is significant simple effect was calculated and followed by Scheffe S post hoc test. The result of our study showed that six weeks of HSAT significantly improved aerobic capacity of handball players. The training intervention showed 4.75% of improvement in first three weeks and 8.83% after six weeks of handball specific aerobic training. The maximum exercise heart rate showed statistically significant interaction effect but it failed to show difference between the groups and within the groups at different testing conditions. Therefore, this study shows that handball specific aerobic training programs might be appropriate enough to improve aerobic capacity of handball players in short duration but it failed to show any alterations in maximum exercise heart rate.

Keywords: Handball, Yo-Yo intermittent recovery test level II, Aerobic capacity, Aerobic training, Maximum exercise heart rate.

Introduction

Handball is a team sports characterised by repeated sprint bouts of high intensity of short duration with partial rest. Handball players require greater speed, strength, power, endurance, agility and flexibility to excel in competition. However, the players have to

perform intermittent sprint repeatedly without getting fatigue for sixty minute duration, thereby endurance capability plays a vital role during a handball match.

Traditionally, coaches and trainers have planned conditioning programs for their teams by following regimens used by teams that have successful win-loss records. This type of reasoning is not sound because win-loss records alone do not scientifically validate the conditioning programs used by the successful teams. In fact, the successful team might be victorious by virtue of its superior athletes and not its outstanding conditioning program. Without question, the planning of an effective athletic conditioning program can best be achieved by the application of proven physiological training principles. Optimizing training programs for athletes is important because failure to properly condition an athletic team results in a poor performance and often defeat. The coaches presently use various conditioning skills among, skill based conditioning is prescribed to all level players, because this type offers many benefits. One of the benefits of implying this type of training is the combination of sports specific skills and fitness.

This type of training is also known as small-sided games which are very popular in soccer and rugby, where players use smaller play area and less number of participants during small-sided games, each player comes into contact with the ball and deals with common game situations more often [1]. These situations require good technical skills such as passing, dribbling, feinting and shooting as well as tactical skills such as running without the ball, unmarking and cooperation with other players. The advantages of this training ensure the players to perform optimally during a game. This suggests that small- sided game conditions may show different responses and this is the first attempt made on university level handball players. Therefore, the aim of our study is to assess the effect of handball specific aerobic training on aerobic capacity of male handball players.

Methods

Subjects

Sixteen (16) university level handball players were selected from Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India. The selected subjects represented Annamalai University in Indian University Competition. The selected handball players age 22.12 ± 3.22 years; height 174.50 ± 7.83 cm and weight 65.62 ± 7.79 kg. These players have minimum of eight years of playing experience and gave willingness to take part in the study.

Study design

The subjects were randomly assigned to two groups. Group 1 (n = 8) performed handball specific aerobic training while Group 2 (n=8) served as control group. Testing of each group was performed on three occasions first before administration of training, after three weeks of training and after six weeks of training.

Variable and test

The aerobic capacity of handball players was measured through Yo-Yo intermittent recovery test level II. The players were administered with ten minutes of warming up. Then players were asked to line up in front of twenty meter marked area with cones. The tester instructs the subjects to run half way and return to the starting point when the sound signal produced from music player. The tester keeps recording the distance covered by the players. We used formula for estimation of VO_2 max = distance in meter × 0.0136 + 45.3 [2]. The polar heart rate monitor was fixed during Yo-Yo test from which we assessed maximum exercise heart rate.

Handball specific aerobic training

Handball specific aerobic training will be performed 3 days per week for six weeks. They perform 4 repetitions of high intensity game with duration of 4 minutes with intensity of 90 to 95% of HRmax and 4 minutes of active recovery with intensity of 60 to 65% of HRmax they performed handball passing drills. The players were strapped with polar heart rate monitor and exercise heart rate were fixed and if they perform below or above the fixed range it produces the beep sound alert the players.

Rules

The coaches encourage the players to perform activity of high intensity. In this training 4 players play against 4 players at high intensity in a standard handball court of 40 × 20 meters. In order to play at high intensity we simplified handball rules in order to avoid interruption in the game and increase the exercise load. The rule modifications are a) dribbling and defence contacts are not allowed, b) walking, ball hitting below the knee of court player and illegal dribbles were not penalised, c) goal keeper throw was granted immediately after a goal, d) goal will not be validated unless all four players present in the opponents court at the time of goal, e) ball will be replaced immediately when it is thrown out of the playing area, f) throw in administered immediately without delay, g) penalty throw, substitutions, warning and disqualifications were not granted, g) goalkeepers were instructed to remain inside goalkeeper area during the entire duration.

Statistical technique

A two-way repeated measure ANOVA with last factor repeated was applied to examine the difference in aerobic capacity between groups and testing conditions. When interaction is significant simple effect was applied and Scheffe S post hoc test was applied to the difference between different testing conditions. All the statistical tests were calculated using the statistical package for the social science (SPSS) for windows (Version 16). The level of statistical significance was set at $p < 0.05$.

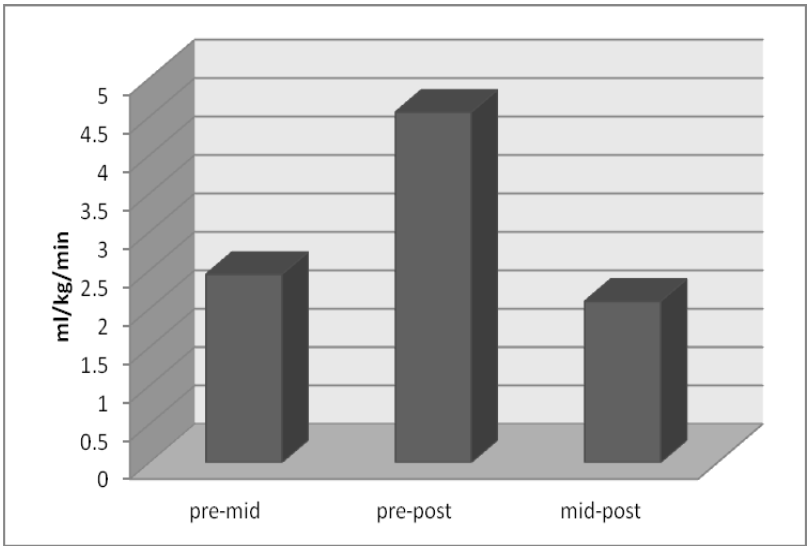
Results

Aerobic capacity

The two way repeated measures on last factor was conducted which examined the effect of handball specific aerobic training for three and six weeks duration on aerobic capacity. There was a significant interaction between the groups and testing conditions on aerobic capacity ($F = 51.36$, $p = 0.000$). The simple effect analysis revealed that at mid test ($F = 10.83$, $p = 0.005$) and post test ($F = 36.16$, $p = 0.000$) significant difference between the

handball specific aerobic training group and control group. However, handball specific aerobic training group showed significant difference at different testing conditions (F = 19.62, p = 0.000) but there was no difference on control group. Since handball specific aerobic training group showed significant difference at different testing conditions. Scheffe S post hoc test revealed difference between pre – mid (MD = 2.45, p = 0.011); pre – post (MD = 4.56, p = 0.000) and mid – post (MD = 2.10, p = 0.030). The changes obtained in handball specific aerobic training group on aerobic capacity are presented in Figure 1.

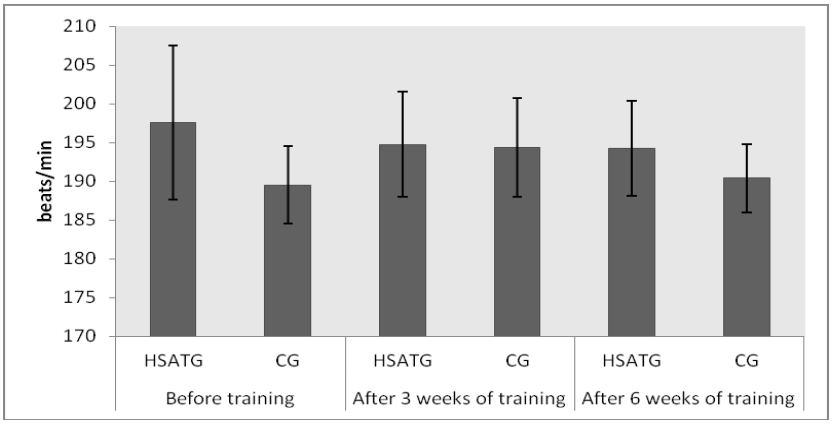
Figure 1: Changes on aerobic capacity



Maximum exercise heart rate

The result also reveals a significant interaction between the groups and testing conditions on maximum exercise heart rate (F = 3.573, p = 0.041). The simple effect analysis revealed that before, after three weeks and six weeks handball specific aerobic training group and control group showed no difference in the maximum exercise heart rate. Similarly, handball specific aerobic training group and control group showed no significant difference at different testing conditions (F = 0.434 & 1.899, $p > 0.05$). The maximum exercise heart rate recorded in handball specific aerobic training group and control group is presented in Figure 2.

Figure 2: Maximum exercise heart rate of HSATG and CG



Discussion

In the present study handball specific aerobic training for three and six weeks duration resulted on significant improvement in aerobic capacity of male handball players. This game based training results in significant improvement in aerobic capacity by 8.83%. Earlier 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 [3]. The training load adopted in repeated – sprint training with game specific which resulted in 11.79% of changes in aerobic capacity.

In the present study we used skill based conditioning games which constitutes both handball specific skills and fitness. The high intensity game and active recovery facilitate to improve aerobic capacity of male handball players. Similarly, Helgerud *et al*. (2001) proved that aerobic power has been shown to improve in soccer players [4]. Similarly, Coutts and his colleagues (2010) clearly state that game based training improves both fitness and skill. The present study clearly shows that 3 weeks of training resulted in 4.75% of improvement and 8.83% after six weeks of training [5]. This clearly shows that short duration of this training can improve aerobic capacity of male handball players. The improvement in aerobic capacity after the handball specific aerobic training protocol is consistent with the findings of previous studies in soccer (Helgerud *et al*. 2001) and rugby [4-6]. The changes in aerobic capacity due to handball specific aerobic training may result in several changes in cardiovascular function, including increased maximal cardiac output, increased stroke volume, and reduced heart rate at rest and during submaximal exercise. The most significant change in cardiovascular function with long endurance training is the increase in maximal cardiac output, resulting primarily from improved stroke volume [7].

In the present study three and six weeks of handball specific aerobic training showed a reduction in maximum exercise heart rate. Compared with the initial test condition, the mean reduction in maximum exercise heart rate after three weeks was 2.87 beats/min and

after six weeks was 3.35 beats/min. Our study statistically failed to find the difference as a result of handball specific aerobic training. Earlier it has been proved that the relationship between intensity and heart rate has been shown to be fairly linear (Åstrand & Saltin 1961; Legge & Bannister 1986) because coaches and physiologist prescribe training intensities based on heart rate [8-9]. It has been established that aerobic training can reduce or remain unchanged of maximum exercise heart rate. The reduction in maximum exercise heart rate depends on aerobic training programme, its duration and the frequency of training. Earlier studies has shown that aerobic training can decrease by 10 to 20 beats/min. Many sources purport that maximum exercise heart rate changes very little with training (Benson 1998) even though several longitudinal studies report data showing modest decreases in maximum exercise heart rate following training by sedentary adults (Zavorsky 2000) and endurance athletes [10-11]. The changes might occur as a result of decreasing sympathetic influence, increasing parasympathetic influences, plasma volume expansion, enhanced baroreceptor reflex function, increases in heart volume, decrease β – Andrenergic receptors number & density, changes in myocardial cell metabolism and alteration of electro physiology of sinoartrial node [11].

Conclusion

It is concluded that handball specific aerobic training programs might be appropriate enough to improve aerobic capacity of handball players in short duration but no changes is obtained in maximum exercise heart rate. In terms of practicability, it seems that handball specific aerobic training depict movement patterns executed during a game. This short duration training is a time efficient training strategy in enhancing both aerobic fitness and cardiovascular adaptation of handball players.

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