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Research Article

Effect of handball specific aerobic training on aerobic power and anaerobic endurance 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 power and anaerobic endurance 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 training, after three weeks of training and after six weeks of training. The aerobic power of handball players was measured by Yo-Yo intermittent recovery test level II and anaerobic endurance through 300 yard shuttle. 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 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 training significantly improved aerobic power (F = 51.36, p = 0.000) and anaerobic endurance (F = 32.48, p = 0.000) of handball players. The training intervention showed aerobic power 4.75% of improvement after three weeks and 8.83% after six weeks of handball specific aerobic training. Similarly, anaerobic endurance showed 3.26% of improvement after three weeks and 6.74% after six weeks of training. We concluded that handball specific aerobic training programs might be appropriate enough to improve both aerobic power and anaerobic endurance of handball players in short duration.

Keywords : Handball, Yo-Yo, aerobic power, anaerobic endurance and male handball players

Introduction

Handball is a Handball is a body contact Olympic sports filled with complex sports activity. Handball require greater amount of aerobic and anaerobic fitness. Modern game structured with fast pace which keep the players on toe to sprint, fake, throw and jump repeatedly without getting fatigue. After inception of handball in Olympics, it gradually improved the system of play and players physical fitness, physique, physiological and psychological characteristics. The intensity of the game has been improved as a result of new training methodologies.

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,

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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. The game handball composed of repeated sprint of players. Chittibabu (2014) concluded that lower the total sprint time and fatigue index by repeated sprint ability is an important for wing players as they are the players who perform the most picks and require high levels of aerobic capacity to aid recovery after high-intensity bouts of activity. However, it also required for back court, pivot and goal keepers. It importance cannot be neglected since all the field players in the court gets equal chance for fast break and quick counterattacks. The role of the repeated sprint ability is greater and which determines the result of the match.

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 (Capranica *et al*., 2001). 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.

Methodology

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 have the average (±SD) age of 22.12 ± 3.22 years; height 174.50 ± 7.83 cm and weight 65.62 ± 7.79 kg. These players have a minimum of eight years of playing experience and gave willingness to take part in the study.

Study design

The subjects were randomly assigned into 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 as pre test, after three weeks of training as mid test and after six weeks of training as post test.

Variable and test

Yo-Yo intermittent recovery test level II

The aerobic capacity of handball players was measured by 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 (Bangsbo *et al*., 2008).

300 Yard Shuttle (274.3 meters)

The 300 yard shuttle run (274.3 meters) test was used to evaluate the subjects' anaerobic endurance. It is considered “An excellent test of anaerobic lactic endurance capacity” (Jones, 1991). The testing was conducted on an artificial turf football field. The test requires subjects to run maximally 25 yards (22.8 meters), turn and sprint back to the start line continuously for a total of 6 times, which equals 300 yards (274.3 meters).

Subjects were informed of the purpose of the test, and the importance of finishing in the shortest amount of time possible. After completion of the first 300 yards (274.3 meters), the time was recorded and a 5 minute clock was started for the rest interval. After 5 minutes rest the subjects were required to complete the test again. After completion of the second trial the time was again recorded. The times of the two trials were averaged to give the subject's score.

Handball specific aerobic training

Handball specific aerobic training will be performed for 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 (Verion 16). The level of statistical significance was set at $p<0.05$.

Results

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 and anaerobic endurance.

Aerobic power

There was a significant interaction between the groups and testing conditions on aerobic power (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 was applied (Fig. -1). This clearly show that aerobic power improved 4.75% after three weeks of training and 8.83% of improvement after six weeks of handball specific aerobic training in male handball players.

Anaerobic endurance

Two way repeated measure ANOVA on last factor showed significant interaction effect on

anaerobic endurance (F = 32.48, p = 0.000). The simple effect analysis revealed that at mid test (F = 6.66, p = 0.022) and post test (F = 18.95, p = 0.001) significant difference between the handball specific aerobic training group and control group. It can be inferred that HSAT group bettered anaerobic endurance performance time. However, handball specific aerobic training group showed significant difference at different testing conditions (F = 10.618, p = 0.001) 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 was applied (Fig.-1). This clearly show that anaerobic endurance improved 3.26% after three weeks of training and 6.74% of improvement after six weeks of handball specific aerobic training in male handball players.

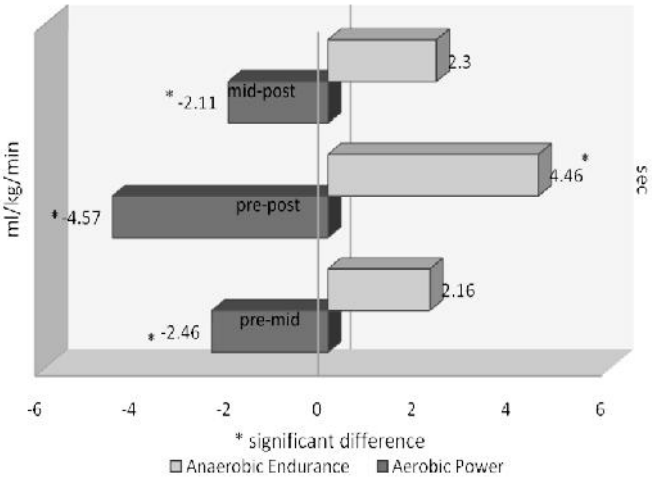

Fig. -1: Scheffe S post hoc test on aerobic power and anaerobic endurance

Discussion

The primary finding of our study showed that aerobic power and anaerobic endurance improved as a result of handball specific aerobic training for three and six weeks. This training design provided improvement in aerobic power by 4.75% and 8.83% after three and six weeks of training. Similarly, anaerobic endurance demonstrated 3.26% and 6.74% improvement after three and six weeks of training.

The aerobic power of handball players improved significantly after three and six weeks of high intensity game. 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. The training load adopted in repeated – sprint training with game specific which resulted in 11.79% of changes in aerobic capacity, however, the improvement in the present study is less. In the present study we implemented 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. 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. 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 (Gabbett, 2006). 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 (Baechle and Earle, 2008).

The anaerobic endurance of handball players measured through 300 yard shuttle test showed significant improvement as a result of

handball specific aerobic training for three and six weeks. Anaerobic interval training programme can significantly improve VO_2 max and anaerobic endurance, as well as increase enzymatic activities associated with glycolysis such as phosphofructokinase, lactate dehydrogenase, and glycogen phosphorylase (Parra *et al.,* 2000; Bompa and Haff, 2009). Research by MacDougall *et al.* (1998) supports these findings showing an increase in glycolytic and oxidative muscle enzyme activity. So the game based conditioning leads to improvement in aerobic power and anaerobic endurance of handball players that might contribute to improvement in match performance (Mohr *et al.,* 2003; Rampinini *et al.,* 2006). The 300 yard shuttle run performance for male handball players in this study (61.66 ± 1.70 s) was slower than values reported for 18 elite male soccer players before and after an 8 week intervention (56.99 ± 1.64s and 55.74 ± 1.63s, respectively) (Sporis *et al.,* 2008). It can therefore be concluded that the game based training significantly improves both aerobic and anerobic fitness in male handball players. This improvement might contribute to match performance.

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