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EFFECT OF BASKETBALL SPECIFIC ENDURANCE CIRCUIT TRAINING ON BODY COMPOSITION AND AEROBIC CAPACITY OF HIGH SCHOOL MALE BASKETBALL PLAYERS

N. Akilan[a]

[a]*Assistant professor, Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram. E-Mail: akilanraagul@gmail.com*

ABSTRACT

The aim of the study was to evaluate the effectiveness of a basketball specific endurance circuit training on body composition and aerobic capacity of high school male basketball players. We have selected twenty four (24) male high school basketball players were selected from Neyveli Lignite Corporation Sports School, Neyveli and St. Joseph Higher Secondary School, Manjakuppam, Cuddalore. These subjects were randomly distributed into two groups namely training group (TG: N=12) and control group (CG: N=12). The mean age of the selected players was 16.85 ± 0.67. The selected players had 3.8 ± 3.1 years of playing experience and regularly participate in training prior to the commencement of this study. Body composition and aerobic capacity were selected as dependent variables. Percent body fat, lean body mass, fat mass were measured using skinfold calliper and aerobic capacity through multi stage fitness test. TG is supplemented with basketball specific endurance circuit training was administered 3 days per week for six week. TG and CG were tested before and after six weeks of training. The collected data was evaluated using Analysis of Covariance (ANCOVA). The result of the study showed that percent body fat, lean body mass and fat mass between the groups remained unaltered significantly, indicating that after adjusting pre-test scores, there was no significant difference between the two groups on post-test scores. However, aerobic capacity showed significant difference between the group ($F = 7.890$, $p = 0.011$) and it elicited 3.29% of changes from pre to post in training group. It is concluded that six weeks of basketball specific endurance circuit training is effective in improving aerobic capacity without altering the body composition of male high school basketball players during competitive phase.

Keywords: Basketball, Body composition, Aerobic capacity, Percent body fat, Lean body mass, Fat mass

Introduction

Modern basketball requires greater amount of speed, power, agility, strength, endurance and flexibility. Along with these parameters body composition and physique which has significant impact on their performance. All these parameters contribute

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to efficient movement with and without the ball, thus play an important role in basketball technique and tactics. The importance of developing good conditioning programs based on the specific physiological demands of each sport is considered as a key factor to success (Gillam 1985; Taylor 2003 & 2004). The focus of this training was to enhance performance and gain advantages over other competitors.

The coaches and trainers adopted various methods to develop aerobic capacity and can prevent gaining of unwanted fat mass. The body composition of the children is an important aspect for health and which plays an important role in monitoring an athlete's performance and training regimens. It also provides a platform to identify possible feeding disorders and provide adequate nutritional advices to young players. According to Vanttinen and his colleagues (2011) states that aerobic training lowers percent body fat, fat mass and increase lean body mass. There is a strong relationship between body composition and aerobic capacity. When body weight and fat mass increases the aerobic capacity found to decrease (Sotiropoulous, *et al*., 2009). However, decrease in fat mass and increase in lean body mass which noticeably increase VO_2 max (Macpherson, *et al*., 2011). The intensity and duration of the activity also influences the aerobic capacity and body composition. According to Chittibabu (2013), "handball specific repeated sprint training programme significantly develop cardio respiratory fitness in male handball players" (p. 6). In the present study sport specific circuit training was employed. This incorporates skills and movements specific to the sport, at intensities sufficient to promote aerobic adaptations, are being increasingly implemented in professional team sports environment (Lawson 2001). The perceived benefit of performing sports-specific exercise is that the training will transfer better into the athletes competitive environment and that the greatest training benefits occur when the training stimulus simulates the specific movement patterns and physiological demands of the sport (McArdle, Katch and Katch 1996). The aim of the study was to evaluate the effectiveness of a basketball specific endurance circuit training on body composition and aerobic capacity of high school male basketball players.

Methods

Subjects

A total of twenty four (24) male high school basketball players were selected from Neyveli Lignite Corporation Sports School, Neyveli and St. Joseph Higher Secondary School, Manjakuppam, Cuddalore. These subjects were randomly distributed into two groups namely TG (N=12) and CG (N=12). The mean age of the selected players was 16.85 ± 0.67. The selected players had 3.8 ± 3.1 years of playing experience and regularly participate in training prior to the commencement of this study.

Variables and test

Body composition and aerobic capacity were selected as dependent variables. Percent body fat, lean body mass, fat mass were measured using skinfold caliper and aerobic capacity measured through multistage fitness test.

Design of the study

For the present study pretest – posttest randomized group design (Thomas, Nelson & Silverman, 2005) which consists of a control group (CG) and an experimental

group (TG) that was used to find out effect sports specific circuit training on the selected physiological variables. Equal numbers (twelve) of subjects were assigned randomly to all the groups. TG was exposed to training with a set of drills selected for specific purpose. The TG underwent training for a period of six weeks (42 days). The training sessions were conducted three days a week (i.e. Monday, Wednesday, and Friday). Measurement of physiological variables was taken for both the groups.

Collection of Data

All the subjects were tested on physiological variables prior to training and after six weeks of training at Neyveli and Cuddalore. The testing session consists of warm-up and test interspersed with rest. All tests were explained and demonstrated. Before testing, subjects were given practice trials to become familiar with the testing procedures. All tests were counterbalanced pre and post testing to ensure that testing effects were minimized. Subjects performed each test as per test procedure and the scores of best trials were taken for this study. In the morning of the first day of testing measurements like height, weight, body composition, were measured, however in the evening aerobic capacity was evaluated.

Sports specific endurance circuit training programme

TG is supplemented with sports specific circuit training was administered 3 days per week for six week. The TG performed 2 minutes of work at 90 to 95% of targeted heart rate using Karvonen method. They performed 8 repetitions during first and second week, followed by 10 repetitions during third and fourth week and 12 repetitions during fifth and sixth week of training. This was followed by 2 minutes of active resting at 70 to 80% of targeted heart rate. In this study 1:1 work rest ratio was followed. This training protocol was adapted from Helgerud *et al*. (2001). The average running time of one circuit was 59 s and the total distance covered during one lap was approximately 153 m, with 60.2% of the movements forward sprinting and 39.8% side shuffling. The portion of the circuit considered 'offence' activity where a basketball was dribbled, was 55.6% while 44.4% was considered 'defensive' activity without ball. Three layups, three rebounds, seven vertical jumps, one pivot and 20 change of direction were completed during one repeat of the circuit (Figure 1). Heart rate monitor was used to measure peak heart rate when performing the circuit. The subjects wore polar heart rate transmitter belt and watch (Polar heart rate monitor watch, Finland). The training intensity was fixed between 90 to 95% of THR. When the players perform below or above the prescribed intensity the watch will produce beep sound to alter their intensity accordingly.

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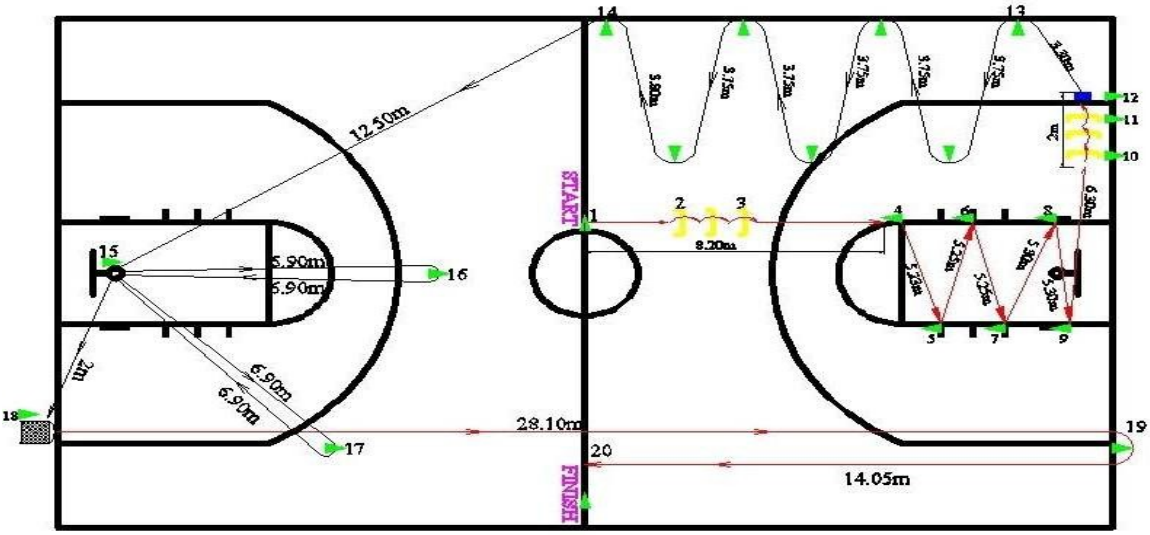

Figure1: Basketball Specific Circuit Training

The description of the circuit

1-2 forward sprint; 2-3 hurdle jump; 3-4 forward sprint; 4 pivot left; 4-5 shuffle left; 5-6 shuffle right; 6-7 shuffle left; 7-8 shuffle right; 8-9 shuffle left; 9-10 shuffle right; 10-11 hurdle jump; 12 vertical jump (collect ball upon landing); 13-14 Zig Zag Dribble; 14-15 speed dribble with complete layup; 15 collect the rebound; 15-16-15 speed dribble with complete layup; 15 collect the rebound; 15-17-15 speed dribble with complete layup; 15 collect the rebound; 15-18 run and place the ball in basket; 18 throw the medicine ball; 18-19-20 forward sprint.

Statistical technique

The collected data was evaluated using Analysis of Covariance (ANCOVA). The proposed hypothesis was tested at 0.05 level of confidence. Beside this mean and standard deviation were also calculated. SPSS statistic software package (SPSS Company, America, version 17.0) was used. The α value of 0.05 was set for statistical significance.

Results

The result of the study showed that six weeks of basketball specific endurance circuit training intervention manifested significant improvements in aerobic capacity ($F = 7.890$, $p = 0.011$) of 3.29%. This clearly indicates that after adjusting pre-test scores, there was a significant difference between the two groups on adjusted post-test scores. However, no significant changes were elicited in percent body fat ($F = 0.058$, $p = 0.812$), Lean body mass ($F = 0.035$, $p = 0.854$) and fat mass ($F = 2.803$, $p = 0.109$). The alterations on body composition and aerobic capacity were presented in table 1. The pre test scores were kept as covariate to nullify the pre test effect on post test.

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Table 1
ANCOVA for body composition and aerobic capacity of high school male basketball players

Variables	Groups	Pre-test	Post-test	%	*F*
Percent Body fat (%)	TG	5.96 ± 2.81	5.84 ± 2.87	2.01	0.058 (p = 0.812)
	CG	5.87 ± 1.68	5.82 ± 2.10	0.85	
LBM (Kg)	TG	55.23 ± 6.34	55.47 ± 6.46	0.43	0.035 (p = 0.854)
	CG	57.37 ± 8.70	57.56 ± 8.48	0.33	
Fat mass (Kg)	TG	4.51 ± 1.94	4.07 ± 1.98	9.75	2.803 (p = 0.109)
	CG	4.65 ± 1.87	4.61 ± 1.90	0.86	
Aerobic Capacity	TG	53.36 ± 5.82	55.12 ± 5.42	3.29	7.890* (p = 0.011)
	CG	53.31 ± 3.68	53.86 ± 3.60	1.03	

* Significant

Discussion

In the present study percent body fat, lean body mass and fat mass showed no significant alteration as a result of basketball specific endurance circuit training. Generally aerobic training lowers percent body fat, fat mass and increase lean body mass (Vanttinen *et al*., 2011). It is also noted that when body weight and fat mass increases the aerobic capacity found to decrease (Sotiropoulous, *et al*., 2009). This shows a strong relationship between body composition and aerobic capacity. However, decrease in fat mass and increase in lean body mass which noticeably increase VO_2 max (Mac Pherson *et al*., 2011). From this study it is clear that high school boys have lower percent of body fat and fat mass. So six weeks of basketball specific endurance circuit training showed no impact on body composition of high school male basketball players. However, basketball specific endurance circuit training for six week has significantly improved aerobic capacity 3.29% in TG. The changes observed in the present study have been reported previously in basketball (Balabinis *et al*., 2003) and soccer players (Helgerud *et al*., 2001).

The changes elicited in the present study found to be lower than the 7.5 to 9% increases in VO_{2peak} observed in soccer players following eight to ten-weeks of performing a similar sport-specific aerobic endurance training circuit compared to control group (Chamari *et al*., 2005; McMillan *et al*., 2005). The reasons for small change obtained in aerobic capacity was firstly, differences observed could be due to the fact that the training was carried out during the competitive phase in the

present study compared to the preparatory phase in other studies (Chamari *et al*., 2005; McMillan *et al*., 2005). Greater training adaptations are more likely to occur due to a potentially detrained state during preparatory phase. Secondly, the difference could also be due to the shorter duration training programme in the present study compared to others (Chamari *et al*., 2005). Basketball specific endurance circuit training results in increase capillary and mitochondrial density, enzyme activity (creatine phosphokinase and myokinase), metabolic stores (ATP, Creatine phosphate and glycogen), connective tissue strength (ligament and tendon) (Baechle & Earle 2000; Amigo *et al*., 1998). These factors result in slight improvement in aerobic capacity in male high school basketball players.

Conclusion

Basketball specific endurance circuit training is effective in improving aerobic capacity and showed no effect on percent body fat, lean body mass and fat mass in high school male basketball players during competitive phase.

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