

Sports Coaching Science

(Original article)

วิทยาศาสตร์การกีฬา

(นิพนธ์ต้นฉบับ)

THE EFFECTS OF INTERVAL TRAINING ON ANAEROBIC CAPACITY OF SOCCER PLAYERS

Tavorn KAMUTSRI and Arom TREERAJ

College of Sports Science and Technology, Mahidol University, Salaya, Nakhonpathom, Thailand. 73170

ABSTRACT

Background : In professional soccer, high intensity interval training was used to improve players' anaerobic capacity. Anaerobic capacity improvement has been shown to enhance soccer performance. It has also been shown that, improvement in anaerobic capacity can be induced by specific interval training. However, it is not clear whether or not specific soccer position performance can be improved by anaerobic endurance training.

Objective: The main aim of this investigation was to study the effects of high intensity interval training on anaerobic capacity of soccer players.

Methods: The sample group composed of 30 male soccer players with a mean age of 24.33 (± 3.78) years. They were divided into 3 groups; Group 1 (defenders), Group 2 (midfielders), and Group 3 (strikers) with 10 players in each group. All groups were trained twice a week for eight weeks by using the same specific interval training programs followed by normal soccer training programs in pre-season period. The specific interval training programs were consisted of maximum speed endurance running for 150 m x 6 rounds and 200 m x 5 rounds, at 90-95% of individual maximum speed in each distance, with a 5 and 6 minutes walk in between intervals.

Results: The results were found that mean anaerobic capacity of group 1, group 2 and group 3 were 6.74(± 0.57), 8.11(± 1.57) and 7.32(± 0.59) watts/kg respectively. There were significant differences between group 1 and group 2 at statistical level $p \leq 0.05$. Pre and post of 50 m speed, maximum oxygen consumption, anaerobic power and anaerobic capacity were significantly different at $p \leq 0.05$.

Conclusion: It was concluded that specific intensity interval training was effective for improving anaerobic capacity of soccer players, especially in midfielders.

(Journal of Sports Science and Technology 2012;12(1): 69 - 74)

KEY WORDS : soccer, interval training, anaerobic power and capacity

INTRODUCTION

Soccer is a popular sports which needs an integration of aerobic and anaerobic energy systems. The National Academy of Sports Medicine stated that 50 percent of soccer game will require anaerobic energy source and another 50 percent will require aerobic energy source. (Micheal C. ,2010). Soccer is classified as a high intensity intermittent team sports. During 90 minutes of competitive soccer match play, elite players have to cover a distance approximately 10-12 km at the intensity close to the anaerobic threshold at 80-90% of maximal heart rate or 70-80% of maximal oxygen uptake (K. McMillan et al, 2005). Thus is a vital conditioning, concurrent with excellent ball-handling skills this sports are required. Moreover, cardiovascular training programs needed to optimize performance and maintain stamina are also crucial. Designing training programs which works on both anaerobic and aerobic systems in order to optimize speed, power and endurance are highly considered. The physiological adaptations to specific interval training programs can then be applied. Interval training is ultimately appropriate for multi sprint sports. It is based on the concept that more works can be completed at a higher relative intensity and continue throughout the training period. Since, intensity and duration of the work intervals and the length of the rest period maximize the training response, all-out bouts of work coupled with longer rest period are used for speed and speed endurance development. Basically, interval training should consisted of 3-5 minutes work bout with 1:1 work to rest ratio. The intensity should be equal to 90-100% oxygen uptake (Wilmore JH and Cossstil DL 2005). The multi sprint sports games can actually be detrimental to strength and power performance (Fox EL et al, 1988 and Gaesser GA et al, 1988). Anaerobic threshold is defined as the highest exercise intensity, heart rate or oxygen uptake, working dynamically with large muscle groups, in which the production and clearance of lactate is about the same (Helgerud J, et al 1990). Regarding the length of a soccer game, the average exercise intensity cannot be much higher than that of anaerobic threshold. However, players do not actually exercise for long period of the game at anaerobic threshold, but either above or below the threshold due to the need for lactate clearance (Helgerud J. et al, 2001). Thus, for multi sprint sports such as soccer, basketball, tennis and rugby, interval training may be more appropriate than continuous training, because it can increase anaerobic capacity, aerobic power and improve cardiorespiratory endurance. However, the interval anaerobic training phase require, intense effort on the running/sprinting part and correspond a jogging recovery. This phase should be started immediately after some base endurance sessions have been completed. Hence, 6-8 weeks will give a good foundation of which the starting of a soccer season. So, it is of interest to study, the effect of specific interval training programs on enhancing anaerobic capacity and physical performances of professional soccer players.

METHODS

bjects: Thirty male soccer players from Nakhonpathom FC (2010 Thai Division1, Thailand) participated in the study. They were a full time professional soccer players and trained on daily basis. Each subject had reviewed and signed consent form in accordance with the declaration of Human Research Review Committee of Mahidol University (COA.No.MU-IRB2010/250.3108). The players physical characteristics of were presented in Table1.

Training Programs

The subjects, divided into 3 groups; group 1 (Defenders), Group 2 (Midfielders) and Group 3 (Strikers), with 10 players in each group. They were trained with the same interval training programs. Which consisted of maximal speed endurance 150 m x 6 rounds, 5 minutes rest each round 200 m x 5 rounds , 6 minutes rest each round and 10 minutes rest between session. Exercise intensity was set at 90-95% of each player's maximum speed in each distance. The interval training was performed twice a week for 8 weeks in pre- preparation period. No emphasis was placed on improving strength, speed and jump performance throughout the intervention period.

Testing

he body weight and height of each player were recorded. The players were asked to perform a 10 minute warming up by bicycle ergometer prior to the tests. The tests were consisted of Wingate power test and cardio-respiratory endurance. All tests were conducted at pre and post training period of 8 weeks.

Table 1. Physical characteristics of players

n=10 per group)			
Group	Age (years)	Height (cm)	Weight (kg)
1	25.3 (± 3.89)	176.8 (± 5.71)	71.5 (± 7.79)
2	23.3 (± 3.62)	172.8 (± 5.16)	65.0 (± 5.08)
3	24.4 (± 3.84)	176.6 (± 7.65)	68.9 (± 8.63)

Values are mean (SD)

Statistical Analysis

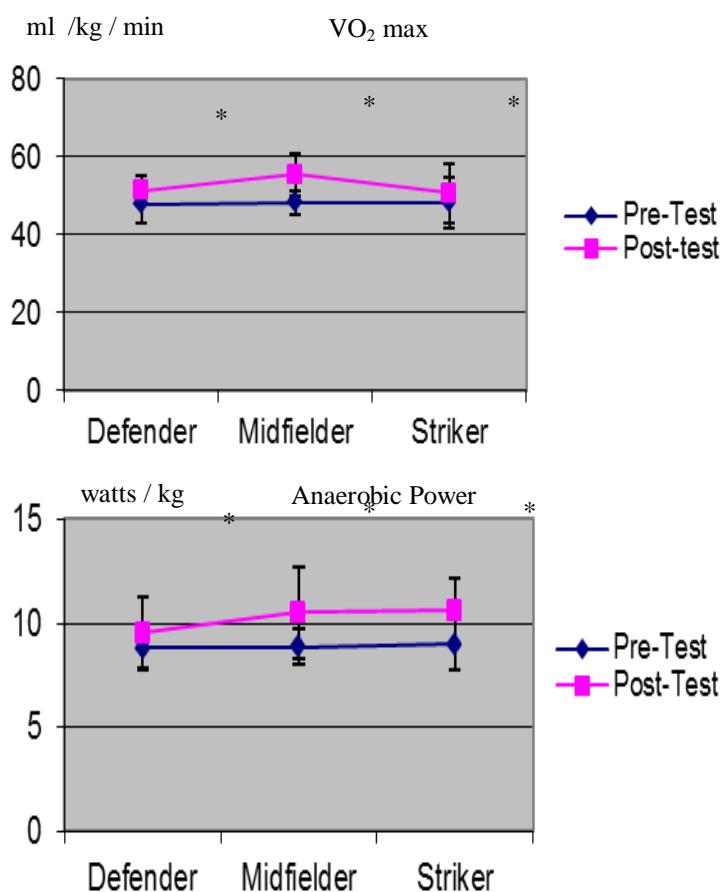
All data were analysed and shown as mean, SD and SEM by using SPSS program version 13. Differences between groups were determined using F-test(ANOVA) . Pre and post-test within group were also compared, by t-test at statistically significant level $p \leq 0.05$

RESULTS

After 8 weeks of interval training program, maximum oxygen consumption, anaerobic power and anaerobic capacity were increased significantly between pre -and post - training in every group at $p \leq 0.05$ (Figure1). Mean anaerobic capacity of group1 (defenders), group 2(midfielders) and group 3 (strikers) were $6.74(\pm 0.57)$, $8.11(\pm 1.57)$ and $7.32(\pm 0.59)$ watts/kg respectively. There was significant difference between group1 and group 2 at post training $p=0.020$ (Table 2).

Figure 1 .Illustrate the within group of VO_2 max, anaerobic power and capacity

significant different at p –value 0.05



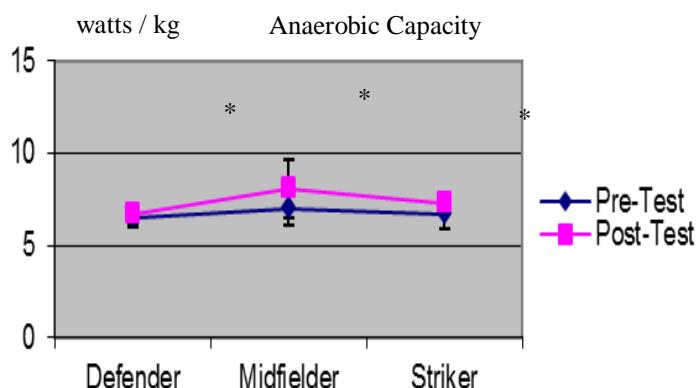


Table 2 ANOVA of Anaerobic Capacity

	SS	df	MS	F	p
Pre Training					
Between Groups	1.31	2	0.66	1.10	0.34
Within Groups	16.03	27	0.59		
Total	17.34	29			
Post Training					
Between Groups	9.47	2	4.74	4.52	0.020*
Within Groups	28.28	27	1.04		
Total	37.75	29			

ANOVA * significant different between group 1 and group 2 at p-value 0.05

DISCUSSION

The specific anaerobic interval training used in this study gave rise to increasing in 50 m speed, $\text{VO}_2 \text{ max}$, anaerobic power and anaerobic capacity significantly in every group (Table 2). Helgerud et al (2001) reported that 4 min interval training at 90-95 % of maximum heart rate in youth soccer players over a period of 8 weeks training, enhanced $\text{VO}_2 \text{ max}$ by 11% . However, the mean anaerobic capacity of group1, group2 and group 3 were 6.74 (0.57) , 8.11 (1.57) and 7.32 (0.59) watts/kg respectively. There were significant differences between group1 and group 2 in post training $p \leq 0.05$. Thus, the mean anaerobic capacity of group 2 (midfielders) was greater than those of group 3 (strikers) and group 1 (defenders) respectively. This training program seemed to be appropriate training for midfielders, because it was able to improve anaerobic energy of midfielders more than other groups. In addition, midfielders needed to move to various directions in the central area of the field. They had to perform short repeated

sprint movement to cover empty area, for controlling ball both in defending and attacking throughout the game. As a result the midfielders should have anaerobic capacity more than others positions. Micheal (2010) have shown that anaerobic training in soccer involved interval training activity which was specific to playing soccer. While anaerobic training needed energy to be supplied from glycogen, it was therefore crucial to eat properly to replenish the storage of glycogen in muscles and liver. The anaerobic exercise which is usually performed is interval training : 20-25 seconds sprinting and rest 1 minute. Thus, it is important for midfielders to apply specific interval training for enhancing performance. The global fitness community (2010) presented that, the midfielders traditionally performed most activities by running and jogging, then endurance training have to be emphasis by using interval training methods. Besides the midfielders, the strikers needed to have high muscle strength, as they had more chances to involve in physical contacts, pulling and pushing as well as being pushed and pulled during challenges with opposite defend. On the other hand, the defenders also need to focus on muscle strength in order to combat challenges with those opposite strong strikers. From the result of this study, it is found obviously that specific training programs are of important for all soccer players, especially midfield players. The main advantages of anaerobic interval training are the abilities to change speed over long distance with less fatigue, to facilitate and maintain top speed for a long period and to maintain soccer skills such as passing, heading, shooting and trapping. Hence, all players should pressing to apply specific training programs to enhance further performance for professional competition.

REFERENCE

1. Fox EL, Bowers RW and Foss ML. The Physiological Basis of Physical Education and Athletes, 4th ed. Dubuque, IA : Brown. 1988
2. Gaesser GA and Wilson LA. Effects of continuous and interval training on parameters of the power endurance time relationship for high intensity exercise. *Int J Sports Med.* 1988.9(6): 417-421
3. Global Fitness Community. Sport Specific Training : Soccer ,June 23.2010
4. Helgerud J, Engen LC, Wisloff U, et al. Aerobic endurance training improves soccer performance. *Med. Sci Sports Exerc.* 2001. 33 : 1925-1931
5. Helgerud J, Ingier F, Stromme SB. Sex differences in performance matched marathon runners. *Eur J Appl Physiol.* 1990. 61: 433-439
6. McMillan K, Helgerud J, Macdonald R and Hoff J. Physiological adaptations to soccer specific endurance training in professional youth soccer players. *Br J Sports Med.* 2005. 39 : 273-277
7. Michael C. National Academy of Sports Medicine. Essentials of Sports Performance Training.2010
8. Wilmore JH and Costill DL. Physiology of Sports and Exercise. 3rd ed, Champaign. IL. Human Kinetics.2005