

## A Comparison of Small-Side Games and Interval Training on Same Selected Physical Fitness Factors in Amateur Soccer Players

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**Abstract: Problem statement:** Soccer is a team sport with an intermittent nature in which the athletes need to improve their physical fitness and skill factors in order to engage in high intensity exercises. The aim of this study was a comparison of small-side game and interval training on some selected physical fitness in amateur soccer players. **Approach:** Twenty , soccer players (height  $165.34 \pm 4.75$  cm, weight  $58.5 \pm 5.22$  kg , age  $15.7 \pm 0.7$  years), were randomly selected and assigned to two groups (intermittent training, specific training in form of Small-Side Game (SSG)) 3 times a week for 6 weeks. The intensity of two training programs was similar according to heart rate (70-95% HR max, progressively and time (4 bouts of 4 min at 70% -95% of maximum heart rate with 3 min active rest periods). For measuring the above variables 12-min running test and RAST test were used, respectively. Data analysis by independent and dependent T test, the level of significance in all statistical analyses was set at  $p \leq 0.05$ . **Results:** Results showed that the 6-week training of both groups significantly increased in all the variables, ( $VO_2$  max, maximum power, minimum power, average power and RSA variable). **Conclusion:** according to the results of the study, it is recommended to employ specific training in preparatory programs (especially, of in-season), because such training, in a similar amount of time improve the same physical fitness factors of amateur soccer players and they are applicable in soccer players.

**Key words:** Interval training, detrimental index, small-side game, soccer players, training methods

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### INTRODUCTION

Soccer is one of the most exponent sports in most societies all people in society whether woman, man, old man, young and children are interested in soccer. The first reason for this generalization is that it doesn't require much equipment. In order to improve soccer performance in sport teams, technique, tactics and physical fitness are often of special importance (Stolen *et al.*, 2005). Physical fitness play an important role in a soccer game, so that a player has to make a decision at any time is good for that special occasion. When the athlete is tired, his activity becomes slow and discordant and consequently his technique will be influenced. Elite professional players run about 10kms (on the average at 80-90% of heart rate) at their anaerobic threshold. A soccer player needs several explosive burst activities such as jumping,

kicking, tackling, Turing, sprinting, changing position area and making strong contraction to keep balance and control the ball against the competitor presses (Stolen *et al.*, 2005).

While teams have same tactics and skill abilities, a team with higher general fitness is superior team and act more powerful when the game gains speed (Science and Soccer, 2003). One of the commend training methods in soccer is employing interval training. Regard to the intervals of training period and rest in interval training is necessary. Interval training can also increase the speed or the ability of keeping speed in long term periods in addition to improvement of aerobic ability resulting from the rest periods between the activities. Helgerud, *et al.* (2001) showed that  $VO_2$ max, lactate threshold and running economy improved by 11, 16 and 7% respectively after the interval training two times a week for 8 weeks (4 bouts of 4 min at 90-95% of maximum heart rate with 3 min active rest periods).

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Furthermore, total distance covered increased by 20%, average intense during a match increased by 25% and the number of sprint doubled and involvements with the ball during a match increased by 23% (Helgerud *et al.*, 2001).

But many former instructors traditionally still use long term running at 70%-80% of maximum heart rate. Using training methods may be difficult for athletes which have to use several sprints with short distance during a match. The researches show that using long term running can reduce anaerobic capacity and the activity of glycolytic enzymes. Since every few years, the rules and regulations of games especially soccer (like the rule of passing back 1992 and 6s goal keeper, 1997 (Dupont *et al.*, 2004) all the changes were made to speed up play during a match and that the ball be in the course more time. So because the athlete can keep the intensity of game during 90 min and show the best response during man to man contacts, counter attacks, sending high passes and changing position area, physical fitness factors must be separately regarded in preparatory programs.

In contrast many researchers believe that soccer specific trainings like the small-side games training improve  $VO_{2max}$  more than other trainings (Bangsbo, 1998; Drust *et al.*, 2000; Reilly and Gilbourne, 2003). Moreover they recommend performance of a series of simulated trainings than intermittent trainings and believe that this trainings increase aerobic fitness and better performance in exercise (Hoff *et al.*, 2002). Furthermore, it is recommended that ever the manner of arranging players in time training in small-side games must based on the kind of muscular groups involvement during a match and a soccer play (Bangsbo, 1998). The technique and tactics skills must be planned similar to actual condition and the athlete has a suitable performance when being under match condition (Reilly and Gilbourne, 2003). Haff, *et al.* reported that soccer players with higher  $VO_{2max}$  tend to show a lower  $VO_{2max}$  in time of trainings and small-side games and this problem was usually associated with teams in which the training program of most athletes was similar (Hoff *et al.*, 2002). Then using this trainings like small-side games would not lead to enough stimulate for the physiologic adaption in all members.

As come from above studies, contradictory results has been given about different kindly of training and effectiveness of each one. Furthermore, few articles have referred both aerobic and anaerobic factors together. Regarding the importance of preparatory programs and the fact that soccer needs players with

high  $VO_{2max}$  and high explosive speed and low fatigue index, planning a program that would cause a suitable adaption with the simulation of match condition. Since players coaches commonly use the interval and small-side games training programs, but not a regular study has been made to review the effect of this training on physical fitness factors especially in our country. Therefore this study is going to answer this question that which method of training, interval or small-side games has more effect on improvement of the athletes' aerobic, agility and anaerobic systems.

## MATERIALS AND METHODS

In this study after informing the soccer players twenty (height  $165.34 \pm 4.75$  cm, weight  $58.5 \pm 5.22$  kg, age  $15.7 \pm 0.7$  years), having necessary condition including non-participating in other physical programs during the program and having physical health were selected and assigned to two equal groups intermittent training ( $n=10$ ), specific training in form of small-side game ( $n = 10$ ) after taking the consent and filling the questioner. In an explanatory session, doing intense physical activity two days before the performance of test has not been let and non-participating in other physical programs during the program was emphasized. The pre-test was made in two process at an interval of 3 days consists of RAST test to evaluate anaerobic capacity in the first day and Kouper 12-min running test to evaluate  $VO_{2max}$  in the second day. Then both groups performed their special trainings three times a week for 6 weeks. Duration of each exercise was 80 min for both groups. Activity intensity for both groups was 70-95% of maximum heart rate, significantly increased by 5% every week which controlled by the coach during the exercise. The post-test was made like the pre-test after the end of the period.

**Interval training group program:** The subjects performed below interval trainings after 10 Min warm-up: 4 bouts of 4 min with 3 min rest between each bout (Helgerud *et al.*, 2001), (70%-95% HRmax, every week, increased 5% HRmax to activity intensity) controlled by the coach. Then 5 min rest, 30 min competitive play and finally after 10 min recovery the exercise ended.

**The small-side games group program:** It contained technical and tactical small-side games trainings. They performed following activities simultaneously after 10-min warm-up and rested 3 min between each activity, then 5 min rest and 30 min competitive play and finally exercises ended after 10 min recovery:

- Three with 1 ball in a triangular area of 4m (Bangsbo, 2007)
- 2-people two teams competed in a area with 10-15m and empty goal doing their best (Bangsbo, 2007)
- 3-people two teams competed in a area with 35m.35m and empty goal with 2 balls doing their best (Impellizzeri *et al.*, 2006)
- 4-people two teams competed in a area with 40-50m, empty goal with 2 balls doing their best (Impellizzeri *et al.*, 2006)

**Tests used in the research:**  $VO_{2max}$ : 12-minute running test was used to measure  $VO_{2max}$ . The obtained distance within 12 min was set in formula (1) and the subject  $VO_{2max}$  was computed:

$$\text{Formula(1) } VO_{2max} = \frac{\text{Distance covered (m)} - 504.9}{44.73}$$

**Anaerobic capacity:** (RAST) test was used to measure anaerobic capacity.

**RAST test performance method:** The weight of testable was measured and recorded before the test. The test consists of 6 maximal sprint repetitions of 35 m with 10-second rest period between. Prior to conducting the test, the subjects performed light stretching for 10 min as warm-up. For obtaining desirable results from the RSA test, the subjects were asked to avoid distributing energy between the repetitions and to do their best for each exercise. For increasing the subjects' motivation, the recorded time of each repetition was reported to them. For each subject the fastest sprint time (the fastest 35 m running time among 6 repetitions) and the total sprint time (the total time of 6 repetitions of 35 m running) were recorded. Based on these data and using the following equation RSA was calculated (Dupont *et al.*, 2005).

$$RAS* = \frac{\text{fastest sprint time} \times \text{the number of repetitions}}{\text{Total sprint time accumulated}} \times 100$$

**Statistical analysis:** The average value and the standard deviation were used as central and scattering determinant respectively to describe studied variables and also to evaluate the normalization of numerical variables; Kulmogrov-Smirnov statistical test was used. Finally, spss15 at  $p < 0.05$  was applied to test resulting data. The couple t test was used to determine the intergroup significance difference in different steps (pre-test-post-test) and the single t test was used for comparing the two groups( Table 1).

## RESULTS

Results showed that 6-week training of both groups significantly increased in  $VO_{2max}$ , maximum power, minimum power, average power and decremental index variable ( Table 2). Furthermore a comparison of the two groups showed there is no significant difference between  $VO_{2max}$  ( $p = 0.11$ ,  $t = 1.6$ ), maximum power ( $p = 0.21$ ,  $t = 1.3$ ), minimum power ( $p = 0.89$ ,  $t = 1.3$ ), average power ( $p = 0.56$ ,  $t = 0.58$ ) and decremental index ( $p = 0.36$ ,  $t = 0.92$ ).

## DISCUSSION

Results showed that all variables increased in 6-week training than pre-test. In order to achieve optimal fitness and making effective adaption, all systems should be under overload and under press. To attain this purpose, player coaches and athletes use systematically a set of training principle including overload principle, training characteristic principle and so on called training timing (Bompa *et al.*, 2004). Metabolic, cardiovascular and neuromuscular coordination can be generated through relatively intense regular trainings which depend on the duration and intense rate. Since the subjects were amateur soccer players which had no exercise or being at very low level of activity for their final exams, above mentioned factors improvement seems obvious. Comparing the two groups, results are as follows.

Table 1: The average and deviation standard of measured variables in pre-test and post-test

Groups	Interval training		SSG training	
	Post-test	Pre-test	Post-test	Pre-test
Determinants				
$VO_{2max}$ (ml $kg^{-1}$ $min^{-1}$ )	43.48±1.38	33.96±1.38	42.89±1.42	34.19±1.6
Maximum power (w)	362±25	287.5±39	348±46	265.5±27
Minimum power (w)	263±32	177±36	240±40	150±23
Average power (w)	309±39	220±24	291±38	207±29
Decremental index (%)	0.945	0.898	0.938	0.900

Table 2: Results of analysis

Variable	T	P	Freedom degree
VO <sub>2</sub> max	1.60	0.110	18
Maximum power	1.30	0.210	18
Minimum power	1.30	0.890	18
Average power	0.58	0.560	18
Decremental index	0.92	0.360	18

Results showed that VO<sub>2</sub>max increased significantly in the interval and small-side game training groups during 6 weeks. But not statistically significant difference between the two groups was found. These findings are in agreement with the results obtained in Impellizzeri *et al.*, 2006; Rampinin *et al.*, 2007; Sassi *et al.*, 2003; Stephan *et al.*, 2009). Although not statistically significant difference between VO<sub>2</sub>max was found, however difference between the averages (8.69±1.34 in small-side games training) and (9.52±0.84 in interval training) shows that VO<sub>2</sub>max has increased more in the interval group. Though it's not significant level at p<0.05. But it remembers the fact reported by Hoff *et al.* (2002) that players with higher VO<sub>2</sub>max tend to show a lower VO<sub>2</sub>max in time of small-side games trainings and player coaches have to change playing area and number of players in each playing field and encourage players to avoid this problem in time of small-side game trainings (Rampinin *et al.*, 2007).

Results showed that 6 weeks interval and small-side games training caused a significant increase in maximum power, minimum power and anaerobic capacity and detrimental index. Not similar research concerning maximum power, minimum power and anaerobic ability and detrimental index was found in time of training in small-side games. This result was similar to the results obtained Billat *et al.* (1999); Collins *et al.* (2000); Rozenenek *et al.* (2000); Sokmen *et al.* (2002). Though aerobic metabolism is dominant system of energy in soccer play, but during a match, repeated short term interval activities are performed which such activities energy is supplied by phosphate system and lactic acid. Moreover according to made researches during a soccer match, the entire duration activity with high intensity is about 7min for well-trained man players performed through 19sprint with time average of 2-3s (Stolen *et al.*, 2005). Therefore the anaerobic system can be involved more times through interval training along with soccer play. Anaerobic capacity is influenced by several factors including genetics, age, gender, training, ATP and the way of muscular fibril distribution which difference in each of them can change anaerobic capacity (Bishop and Spencer, 2004; Seiler and Sjursen, 2002).

## CONCLUSION

Young players need to develop and improve physiologic abilities affecting physical fitness and to generalize and adapt them with the soccer skills during a match. This physiological factors depend not only on the intensity of play but also on the direct involvement in activities with the ball. Since small-side games training causes more involvement with the ball and more opportunity to perform skills like passing, kicking, dribbling for the players, it can improve and develop physiologic abilities affecting physical fitness and adapt them with soccer skills during a match and the problem that small-side games training would not lead to enough stimulate for physiologic adaption of all members can be remove by changing the playing area, encouraging players and changing number of players in each playground section. As a result, since small-side games training in a similar amount of time has resulted in more increase of some of the selected physical fitness factors in this study, it is recommended that teams should apply specific training in preparatory programs especially in-season.

## ACKNOWLEDGEMENT

This research was supported by a grant from Islamic Azad University, Ayatollah Amoli Branch. The authors wish to thank volunteers for their participation in the study.

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