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The effect of 8 weeks of plyometric and resistance training on agility, speed and explosive power in soccer players

Eskandar Taheri, Asghar Nikseresht* and Ebrahim Khoshnam

Department of Physical Education, Jahrom Branch, Islamic Azad University, Jahrom, Iran

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ABSTRACT

The purpose of the present study was to investigate the effect of plyometric and resistance training on agility, speed and explosive power in soccer players. 30 male soccer players who aged 18-25 voluntarily participated in the study. They were randomly assigned in plyometric (n=15) and resistance (n=15) groups. Both groups performed selected soccer-specified plyometric and resistance training for 8 weeks. Data was analyzed using paired t-test, independent t-test, and covariance statistical methods. The results showed that levels of agility, speed, and explosive power in plyometric training group (p=0.0001), and agility and explosive power in resistance training group (p=0.0001) were significantly improved in post-test compared to pre-test. Between-groups comparison showed better records in agility, speed and explosive power for plyometric compared with resistance training group after eight weeks (respectively p=0.032, p=0.0001 and p=0.002). According to the results, it can be concluded that both plyometric and resistance training exercises increase agility and explosive power and reduce sprint time in football players. Plyometric exercises also showed more favorable effects on study variables compared with resistance exercises. Therefore, these types of training methods are suggested to soccer players and coaches for improving speed and performance skill.

Keywords: Plyometric training, Resistance training, Agility, Speed, Explosive Power, Soccer players

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INTRODUCTION

Professional soccer players perform a large number of explosive bursts such as shooting, jumping, tackling, sprinting and pace changing during a football match (1-3]. Agility is the ability to change direction and maintain or control body position in some sport movements. Some training exercises help improve agility by influencing neuromuscular adaptation, muscle spindles, Golgi-tendon organs, tendons, joints and balance and body position control [4,5]. Training exercises which include stopping, starting, and direction changing and have explosive nature can help athletes to improve agility. Plyometric training exercises improve agility in soccer players [4,6]. Speed is of great importance in sports such as football, which include direction and acceleration change and leaping [1,7]. Explosive power is also an important factor in leg muscles of professional football players. It is very important to obtain a level of explosive power in football. Explosive power is one of the essential factors for skillful athletes, which enables them to achieve their peak jump height. However many explosive movements require little time. Therefore, obtaining maximum muscle strength from the major muscle groups of the lower limb for explosive power needs particular resistance training exercises [8,9].

Russian athletes first used plyometric exercises in 1960 summer Olympics as a type of explosive training. Plyometric training is a type of neuromuscular training leading to increased explosive power to use maximum power in minimum time. This training causes some changes in neuromuscular system and improves muscle's strength to response rapidly and strongly during competitions [10]. Lenhart et al (2009) in study investigated the effect of eight

weeks of plyometric training on speed and explosive power of volleyball players and observed significant improvements in these variables values [8]. Bal et al (2011) in a study examined the effects of plyometric exercises on agility of youth basketball players and observed significant improvements [5].

Resistance training has also become an essential method to improve athletes" speed and explosive power. Research results show that resistance training improves explosive power, vertical jump and speed in professional soccer players by affecting the leg extensor muscles [1,2,13]. Miller et al (2006) in a study investigated the effect of six weeks of plyometric training on young athletes' agility, and observed significant improvements [4]. In another study, Shahidi et al (2012) examined the effects of eight weeks of resistance training on speed and explosive power in male soccer players and observed significant improvements in these variables [12].

Agility, speed and explosive power are qualifying components of physical fitness and desirable athletic performance, and play a key role in most sports, especially football. Plyometric and resistance training can be a prerequisite for coaches and athletes success [10, 13,14]. Therefore, this study investigated the effect of plyometric and resistance training on agility, speed and explosive power of soccer players.

MATERIALS AND METHODS

The subjects of this study were 30 male soccer players who aged 18-25years old. The subjects were randomly divided into plyometric (n=15) and resistance (n=15) groups. To perform the study, the research topic, purpose, as well as the method of execution was explained to the subjects. Then the subjects voluntarily consented to participate in the study and signed a medical health questionnaire. The criteria for participating in the study included general health, lack of a specific diet and medication, age, and sport field. In addition, the questionnaires determined that any of the subjects had not participated in regular resistance and plyometric exercises before and they were forbidden to participate in such exercises except in the specific training program.

The correct way to perform the exercises was explained to the subjects at the preparatory meeting before the main test. At first, 40-meter sprinting, 4× 9 agility and Sargent jump tests were used to measure explosive power of the subjects of both groups. In addition to regular soccer training for eight weeks, subjects in both groups performed their groups' specified exercises three times a week for 60 minutes per session. After eight weeks, the tests were performed again to collect the data.

Plyometric Training Program

The subject warmed up for 15 minutes consisting of jogging and stretching. Then plyometric exercises were performed for 40 minutes and they performed soft jogging and stretching to cool down and recover for 15 minutes [15].

Resistance Training Program

Resistance training exercises were performed three days a week during the eight-week period. The resistance training program started with warm up, and continued by some exercises such as smith press, seated press, squat, lying dumbbell leg cruel, leg extension, leg press, standing barbell crul, lying barble extension, and sit up and finally the subjects cooled down. At the beginning of the study, the exercises were conducted with one maximum repetition, 60% intensity while one maximum repetition, and 10% intensity were added each the two weeks.

Statistical Methods

Statistical analysis was performed using SPSS version 18. Data normality was investigated using the Kolmogorov-Smirnov test. Paired t-test was used for within-group comparison and independent t-test and covariance were used for between-groups comparison. The significance level of the test was considered $p \leq 0.05$.

RESULTS

Within-group comparison of research variables is presented in table. The results showed that the levels of agility, speed, and explosive power in plyometric group (p=0.0001), and agility and explosive power in resistance training group (p=0.0001) were significantly improved at post-test compared with pre-test. However, there was no significant difference in speed at post-test compared with pre-test (p=0.499).

Table 2 compares the measured average between the two groups. Between- groups comparison showed that the plyometric training group registered better records in agility, speed and explosive power compared with resistance training group after eight weeks (respectively p=0.032, p=0.0001 and p=0.002).

Table 1. Comparison of within-group variables in both groups (Means±Sd)

Parameter	phase	Plyometric Training	P-value	Resistance Training	P-value
Agility	per	10.23±0.35	0.0001	10.55±0.41	0.0001
	post	10.04±0.33		10.50±0.41	
speed	Per	5.37±0.19	0.0001	5.77±0.27	0.499
	Post	5.20±0.19		5.73±0.28	
Explosive Power	Per	39.66±6.11	0.0001	32.84±4.57	0.0001
	post	48.33±6.45		38.33±5.32	

Table 2. Comparison of between-group variables in both groups (Means±Sd)

Parameter	Plyometric Training	Resistance Training	P-value
Agility	10.04±0.33	10.50±0.41	0.032
speed	5.20±0.19	5.73±0.28	0.0001
Explosive Power	48.33±6.45	38.33±5.32	0.002

DISCUSSION

The present study was designed to investigate the effect of plyometric and resistance training on agility, speed and explosive power in soccer players. The results showed that eight weeks of plyometric training had significant effects on agility records reduction. The results were consistent with Bal et al (2011) but did not match with Alemaglu et al (2012). Plyometric training affects muscle spindles, Golgi-tendon, tendons, joints, balance and body position controlling [4]. Maybe neuromuscular adaptations caused by plyometric exercises affects muscle spindles, Golgi-tendon, tendons, joints, balance and body position controlling favorably and this led to agility improvement in these athletes.

The results showed that eight weeks of plyometric training had significant effects on speed records reduction. These results were consistent with Mohebi et al (2012) but did not match with Hosseini et al (2011). A number of factors such as muscle length, strength, age, gender, temperature, body shape, force and flexibility can have profound impacts on speed [19]. Probably plyometric exercises led to speed improvements by affecting muscle length, force, muscle temperature, strength and flexibility during the eight weeks.

The results showed that eight weeks of plyometric training increased explosive power significantly. The results were consistent with Lenhart et al (2009) but did not match with Lamontage et al (2011). Plyometric is a training method, which is widely used to improve muscular strength to generate explosive power [1]. This method led to increased explosive power in subjects by rapid strength production and nervous system improvement after eight weeks.

The results showed that eight weeks of resistance training had significant effects on reducing agility records. These results were consistent with Miller et al (2006) but did not match with Tartibyan et al (2012). Agility along with other factors such as balance, coordination, speed, power, and reaction speed is one of the physical fitness factors related to skills [22]. Probably, muscle fibers hypertrophy due to resistance training led to the subjects' ability to change situation and direction rapidly without losing precision and balance.

The results showed that eight weeks of resistance training had not significant effects on reducing speed records. The results were consistent with Tartibiyan et al (2012) but did not match with Shahidi et al (2012). Research results show that resistance training improves speed in professional soccer players by affecting leg extensor muscles [1]. Apart from increasing power, other factors such as muscle length and temperature, body shape and flexibility also should be noted in speedy performances.

The results showed that eight weeks of resistance training had significant effects on increasing explosive power. These results were consistent with Shahidi et al (2009) but did not match with Lamontage et al (2011). Nerves adaptation improves strength in the first 3-4 weeks of resistance training. Muscle hypertrophy creates an increase in the size and function of muscle fibers after 8-12 weeks of resistance exercise [6]. Probably neural adaptations and hypertrophy caused by resistance exercises, improved explosive power in these subjects.

The results showed that the plyometric group registered better records in agility, speed and explosive power compared with the resistance group after eight weeks. Maybe neuromuscular adaptations caused by plyometric exercises affected muscle spindles, Golgi-tendon, tendons, joints, balance and body position controlling more favorably and this led to agility improvements in these athletes. Also in the plyometric group maybe the increased speed of message transfer from muscle to the nerve center and vice versa led to better records in speed test compared with the resistance training group. Moreover, about explosive power, probably fast twitch motor units are more called in plyometric exercises in comparison to resistance exercises. By calling for this type of fiber the larger

motor units which have higher discharge, frequencies will be involved and they produce more power than other types of muscle fibers.

CONCLUSION

According to the results, it can be concluded that plyometric and resistance-training exercises were effective in increasing agility and explosive power and reducing sprint time in soccer players. Plyometric training had more favorable effects on the study variables compared with resistance exercises. So these training methods are recommended to soccer players and coaches for improving speedy and skilled performances.

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