http://doi.org/10.22282/ojrs.2019.44

THE EFFECT OF EIGHT-WEEK PLYOMETRIC TRAINING ON AGILTY IN MALE VOLLEYBALL PLAYERS

Elvan ÖZ[1], Barbaros ÇELENK[2], Özkan HAYIRLI[3], Elif ÖZ[4]

[1]Gazi University, Institute of Health Sceinces, ozelvann@gmail.com
[2]Hacettepe University, Department of Exercise and Sport Sciences, barbaros.celenk@hacettepe.edu.tr
[3] Istanbul Metropolitan Municipality Sports Club
[4]Gazi University, Department of Trainer Education, elifoz@gazi.edu.tr

ABSTRACT

The aim of this study was to examine the effect of eight-week plyometric training on the agility of elite male volleyball players. A total of 28 elite male volleyball players were included in the study; the experimental group consisted of 14 ($_{mean\ age}$ 29.1±4.3) players and the control group was composed of 14 ($_{mean\ age}$ 20.2±1.4) players. The experimental group performed lower extremity plyometric training for twice a week for eight weeks after the warm-up exercises conducted before volleyball training, in addition to regular volleyball training. The control group, on the other hand, performed only volleyball training for eight weeks. T-drill agility test was used in the study. Measurements were performed in two separate test periods, pre- and post-test. SPSS 22.0 statistical package program was used for data analysis. Paired sample t-test was conducted to investigate whether there were intra-group statistically significant differences or not, while an independent sample t-test ($p<0.05$) was used for inter-group comparisons. The experimental group showed statistically significant differences between pre-test and post-test data whereas the control group did not show any statistically significant differences between pre- and post-test ($p<0.05$). In conclusion, it was found that eight-week lower extremity plyometrics training significantly increased the volleyball players' agility.

.

Key Words: Volleyball, agility, plyometric, training

 Copyright © The Online Journal of Recreation and Sport

INTRODUCTION

Volleyball, with not having a set time limit, is a dynamic physical game that is based on a high tempo, agility, strength, mobility, flexibility, endurance, and jumping. (Şimşek B. et. al., 2007). Having had many transformations, volleyball is a sport demanding basic motor functions and mental organization. The motor functions required for almost every type of sports differ in field-specific ways. The distribution of motor functions is 45% strength, 15% flexibility, 15% coordination, 15% speed and 10% endurance for volleyball (Baktaal DG., 2008).

Agility, comprised of other motor functions like turning and speed, is the ability to move the body as fast, fluent, easy and controlled as possible during movement from one spot to another. Associated with an individual's speed of changing positions, agility should also have balance, explosiveness, and coordination (Atacan, 2010). Plyometric drills consisting of explosive movements like stopping, beginning and turning help improve agility. Agility training is improving neuromuscular conditioning and strengthening motor functions of muscle fibers through neural adaptation of Golgi tendon organ and joint movement perception. Theoretically, agility improves by honing balance and body control skills during movement (Atacan, 2010).

The modern training program prepares elite volleyball players to face semiweekly or more high-level games (Mroczek et al., 2017). It is necessary to adopt training methods that increase vertical and lateral jumping abilities and improve leg strength to achieve a successful performance, jump faster and higher in volleyball and other jumping-based sports. Various training methods have been developed to increase jump strength. One of these is plyometric training that is also known as depth jumping or the shock method (Ateşoğlu, 2001). It has been suggested that the increase in strength and efficiency due to plyometrics will increase the objectives of agility training (Atacan B. 2010).

Previous research showed that plyometric training positively increased agility. Some of the studies are on other sports types (Miller et al. 2006, Rameshkannana & Chittibabub 2014, Vaczi et al. 2013, Asadi 2013, Lehnert et al. 2013, Singh et al. 2015), while some of them are

on different age groups (Asadi & Arazi 2012, Thomas et al. 2009, Söhnlein et al., 2014). In volleyball, the studies usually investigate the effect of plyometric training on jumping (Voelzke et al., 2012, Stojanovic et al. 2012, Vassil & Bazanovk, 2012). However, there are not any studies on the effect of plyometric training on agility in volleyball. Moreover, the past studies have used different plyometric training programs in terms of an amount of repetition and sets, the order of exercises etc. The effects of each unique plyometric training used in different types of sports and categories arouse curiosity.

Therefore, the study aims to examine the effect of eight-week plyometric training on elite male volleyball players' agility.

METHODS

The sample consisted of 28 voluntary participants who are elite volleyball players from Istanbul Metropolitan Municipality Men's Volleyball Team, 14 made up the experimental group and the remaining 14 composed the control group (Table 1).

Table 1: Characteristics of the subjects

	Experimental Group (n=14)			**Control Group** (n=14)		
	Mean±SD	Min	Max	Mean±SD	Min	Max
Age (year)	29.1±4.3	22	26	20.2±1.4	18	22
Body height (cm)	195.2±5.8	184	202	192.6±4.8	182	198
Body weigth (kg)	92.6±8.8	74.4	107.2	83.9±4.4	77.2	91.4

The participants performed approximately 90 to 120 minutes of volleyball training for six days a week during the preparation period. Athletes were randomly divided into two groups. The experimental group performed lower extremity plyometric training for eight weeks semiweekly after the warm-up exercises in addition to regular volleyball training. The control group only performed volleyball training.

Data Collection

At the beginning of the study, athletes' agility was measured and initial measurement values were determined. The experimental group performed lower extremity plyometric training for eight weeks semiweekly after the warm-up exercises in addition to volleyball training. The control group, on the other hand, performed only volleyball training for eight

weeks. After eight weeks, the athletes' agility is remeasured and second measurement values were determined. During the measurements, the athletes were granted two tries and their best values were recorded. The athletes had a four-minute full rest period between their first and second tries. The study used a T-drill agility test to measure agility.

Exercise Protocol

The warm-up protocol before the start of plyometric training consisted of 3 minutes of warm-up running, 10 minutes of stretching and 3 minutes of running drills, approximately 20 minutes in total. The experimental group performed plyometric training in two different days (Tuesday and Thursday). During the first day of plyometric training, the athletes performed depth jumps and lateral jumps. The athletes first jumped to the ground from a 40cm-high platform and then jumped on the 85cm-high platform from the ground. After the full rest period, the athletes performed lateral jumps over aligned cones to both right and left. During the second plyometric training day, the athletes jumped over 8 aligned obstacles which are 85cm-high for the determined sets and repetitions (Table 2).

Table 2: Plyometric training program

	1st day					2nd day	
		Depth Jump		Rigth Lateral	Left Lateral		Repeated Jump
Week	Set	(rep)	Set	Jump (rep)	Jump (rep)	Set	(rep)
1	2	10	3	8	8	5	8
2	2	10	3	8	8	5	8
3	3	12	4	8	8	6	8
4	3	12	4	8	8	6	8
5	4	14	5	8	8	7	8
6	4	14	5	8	8	7	8
7	5	16	6	8	8	8	8
8	5	16	6	8	8	8	8

Data Analysis

SPSS 22.0 package program was used to evaluate the descriptive statistics. Paired sample t-test was conducted to investigate whether there were intra-group statistically

significant differences or not, while an independent sample t-test ($p<0.05$) was used for inter-group comparisons.

RESULTS

The mean pre-test measurement values for the experimental group were 9.9±0.4 seconds, while the control group's pre-test values were 10.10±0.5 seconds. The mean post-test measurement values for the experimental group were 8.59±0.4 seconds while mean values for the control group were 9.9±0.6 seconds (Table 3).

Table 3: Athletes' T-drill agility test values (in seconds).

	Experimental Group				Control Group			
	n	Mean±SD	Max	Min	n	Mean±SD	Max	Min
Pre-test (sec)	14	9.9±0.4	10.60	9.31	14	10.10±0.5	10.66	9.89
Post-test (sec)	14	8.59±0.4	10.21	8.59	14	9.9±0.6	10.48	9.83

Based on the statistical analyses, while there was a statistically significant difference between pre- and post-test agility values in the experimental group ($p=.001$ $p<0.05$), there was no statistically significant difference in control group's pre- and post-test agility values ($p=0.563$ $p<0.05$) (Table 4).

Table 4: Statistically significant differences between intra-group pre- and post-test means (*: $p<0.05$)

	Experimental Group			Control Group		
	Mean±SD	Difference	p	Mean±SD	Difference	p
Pre-test (sec)	9.9±0.4			10.10±0.5		
Post-test (sec)	8.59±0.4	1.3 sec	.000*	9.9±0.6	0.13 sec	.563

*: $p<0.05$

In inter-group comparison, statistically significant differences were found between the t-test values of experimental and control groups ($p=.001$ $p<0.05$) (Table 5).

Table 5: Significance Test of Experimental and Control Group's means

	n	Experimental Group	Control Group	p
Pre-test (sec)	14	9.9±0.4	10.10±0.5	0.001
Post-test (sec)	14	8.6±0.4	9.9±0.6	

DISCUSSION and CONCLUSION

Plyometric training has a positive effect on the performances of athletes. Regular, systematic and correct plyometric training affects agility positively in jumping-based sports (Atacan, 2010).

In their study, Sheppard and Young (2006) describe agility as 'sudden body movement involving a change in speed and change of direction in response to a stimulus'. Atacan (2010) used the Illinois agility test to determine the effect of eight-week plyometric training on young male football players' agility and found a 6.88% increase in experimental group athletes, and a 2% increase in the control group. The analyses indicate statistically significant differences between pre- and post-test agility values of the experimental group ($p<0.01$).

Miller et al. (2006) investigated the effect of six-week plyometric training on agility in elite tennis players, and a significant increase of 4.86% in T-drill test agility values were found in their study. However, there was no statistically significant difference in the control group ($p <0.05$). In another study, they investigated the effect of plyometric training on subjects' Illinois agility performance and revealed a significant difference in the experimental group (Miller et. al., 2006).

Asadi (2013) found that after six weeks of semiweekly in-season plyometric training, elite male basketball players from the experimental group significantly improved their Illinois agility test performance by 7% from 17.36 ± 0.48 seconds to 16.14 ± 0.5 seconds. A significant increase in the performance of Taekwondo athletes' agility, isokinetic strength, and vertical jumps was observed after six-weeks of plyometric training (Singh et al., 2015).

According to the findings and studies in the relevant literature, one or two types of plyometric exercises improve motor performance significantly, if continued for eight weeks

once to thrice a week. Additionally, producing these positive results may be possible with low-volume training programs like 10 repetitions for 2 to 4 sets or 8 repetitions for 4 sets.

In conclusion, it was found that eight-week lower extremity plyometric training significantly increased the volleyball players' agility. Therefore, it may be advisable to use plyometric training and similar training methods in training plans to improve agility performance of volleyball players.

Acknowledgements

This study was presented as oral presentation at the International Congress of Sports for All and Wellness in 2018.

REFERENCES

Asadi A. (2013). Effects of In-Season Short-Term Plyometric Training on Jumping and Agility Performance of Basketball Players. Sport Sciences for Health, 9:133–137.

Asadi A. & Arazi H . (2012).Effects of High-Intensity Plyometric Training on Dynamic Balance, Agility, Vertical Jump and Sprint Performance in Young Male Basketball Players. Journal of Sport and Health Research, 4(1):35-44.

Atacan B. (2010). Özel Düzenlenmiş Pliometrik Antrenmanın Genç Erkek Futbolcularda Güce ve Çevikliğe Etkisi. Kırıkkale Üniversitesi, Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Anabilim Dalı, Yüksek Lisans Tezi, Kırıkkale.

Ateşoğlu U. (2001). Kendi Vücut Ağırlığı ve Ek ağırlıkla Yapılan Pliometrik Antrenmanın Bazı Fiziksel ve Fizyolojik Parametreler Üzerine Etkisi. Gazi Üniversitesi, Sağlık Bilimleri Enstitüsü, Doktora Tezi, Ankara.

Baktaal D.G. (2008). 16-22 Yaş Bayan Voleybolcularda Pliometrik Çalışmaların Dikey Sıçrama Üzerine Etkilerinin Belirlenmesi. Çukurova Üniversitesi, Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Anabilim Dalı, Yüksek Lisans Tezi, Adana.

Lehnert M., Hulka K., Maly T., Fohler J., Zahalka F. (2013). The Effects of a 6 Week Plyometric Training Programme on Explosive Strength and Agility in Professional Basketball Players. Acta Univ. Palacki. Olomuc., Gymn., 43(4): 7-15.

Miller J.M., Hilbert S.C., Brown L.E. (2006). Speed, Quickness, and Agility Training For Senior Tennis Players. Strength and Conditioning, 223(5):62-66.

Mroczek D., Superlak E., Seweryniak T., Mackala T., Konefal M., Chmura P., Borzucka D., Rektor Z., Chmura J. (2017). The Effects of a Six-Week Plyometric Training Program on the Stiffness of Antrerior and Posterior Muscles of the Lower Leg in Male Volleyball Players. Central Eurpoean Journal of Sport Sciences and Medicine, 20(4): 107-115.

Rameshkannana S. & Chittibabub, B. (2014). Effect of Plyometric Training on Agility Performance of Male Handball Players. International Journal of Physical Education, Fitness and Sports, 3(4): 72-76.

Sheppard J.M. & Young W.B. (2006). Agility Literature Review: Classifications, Training and Testing. Journal of Sports Sciences, 24(9):919-32.

Singh A., Boyat A.K., Sandhu J.S. (2015). Effect of a 6 Week Plyometric Training Program on Agility, Vertical Jump Height and Peak Torque Ratio of Indian Taekwondo Players. Sports and Exercise Medicine, 1(2): 42-46.

Söhnlein Q., Müller E., Stöggl T.L. (2014). The Effect of 16-Week Plyometric Training on Explosive Actions in Early to Mid-Puberty Elite Soccer Players. Journal of Strength and Conditioning Research, 28(8):2105–2114.

Stojanovic N., Jovanovic N., Stojanovic T. (2012). The Effects of Plyometric Training on the Development of the Jumping Agility in Volleyball Players. Physical Education and Sport, 10(1):59-73.

Şimşek B., Ertan H., Göktepe A.S., Yazıcıoğlu K. (2007). Bayan Voleybolcularda Diz Kas Kuvvetinin Sıçrama Yüksekliğine Etkisi. Egzersiz, 1(1):36-43.

Thomas K., French D., Hayes P.R. (2009). The Effect of Two Plyometric Training Techniques on Muscular Power and Agility in Youth Soccer Players. Journal of Strength and Conditioning Research, 23(1):332–335.

Vaczi M., Tollar J., Meszler B., Juhasz I., Karsai I.(2013). Short-Term High Intensity Plyometric Training Program Improves Strength, Power and Agility in Male Soccer Players. Journal of Human Kinetics, 36:17-26.

Vassil K. & Bazanovk B. (2012). The Effect of Plyometric Training Program on Young Volleyball Players in Their Usual Training Period. Journal of Human Sport & Exercise, 7(1):34-40.

Voelzke M., Stutzig N., Thorhauer H.A., Granacher U. (2012). Promoting Lower Extremity Strength in Elite Volleyball Players: Effects of Two Combined Training Methods. Journal of Science and Medicine in Sport, 15:457–462.