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Original Research

Effects of the 4 week plyometric training program on explosive strength and agility for basketball players

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Abstract. The paper was effects of the 4 week plyometric training program on explosive strength and agility for basketball players. Totally 20 basketball players were volunteered for the study (age = 15 years +/- 6 months). They were divided to 2 groups: the control group (CG, n = 10; height = 171.930 cm, weight = 70.840 kg, BMI = 20.563), the experimental-plyometric group (EG, n = 10; height = 173.090 cm, weight = 64.300 kg, BMI = 19.068). The tests are twelve (13) variables of them, 3 from anthropometric and 10 motor tests. According to the results of the CG, significant small differences are presented in two tests, such as 20m running (sprint) testing with significant differences (p= 0.013), and abdominal muscle testing with significant differences (p= 0.036). However, in the PG, significant differences in four tests, the jump from place to length with significant differences (p= 0.003), the high jump with the approach of one foot significant differences (p= 0.035), push-ups (pump) test with significant difference (p= 0.004), Illinois Agility test with significant difference (p= 0.004). Through which it was possible to conclude that the effects of the experimental-plyometric training program of the game basketball indicators.

Key words. Agility, basketball, plyometric training program, power.

Introduction

Basketball requires agility and vertical jump. Plyometric can help players in other strengthen skills such as strength, speed, and agility (Potach et al., 2000; Bal et al., 2011). Plyometric consists of a rapid muscle extension (ecstatic action) having immediately a concentric action or the same cut of muscle and connective tissue (Bompa, 1993; Baechlet et al., 2000).

Researchers have shown that plyometric training, when it is used with a program for design strength training can contribute in improving vertical jump performance, feet strength and muscular strength (Miller et al., 2002; Khlifa et al., 2010; Latorre Roman et al., 2017). Plyometric training usually includes stopping, jumping - off and changing the direction of movement explosively. These moves are the components that can help in the development of agility (Craig, 2004; Michael et al., 2006).

Otherwise plyometric is closely related to the speed and strength which is ultimately the result of strength. Regarding to plyometric exercises, we can consider the possibility of muscles which express the maximum strength for a short time used in

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basketball (Matavulj et al., 2003; Michael et al., 2006; Santos et al., 2011; Arazi et al., 2001; Adigüzel et al., 2016).

These abilities are the essential skills in many team games including basketball because they enable players to perform activities during the game at the required height, speed and at the right moment (Gamble, 2010).

The paper was intended to determine the effect of 4 week plyometric training program on explosive strength and agility players to the game of basketball.

Methods

Participants

This paper was a pre-test and post-test control group and an experimental plyometric group. The sample has 20 basketball players which are divided into two groups. The first group with 10 basketball players is the control group and while the second group with 10 basketball players is the experimental group-plyometric group.

Procedure

Variable sample

It consists of 13 variables, 3 of which are morphological parameters and 10 motor tests. 1. BH - Body weight; 2. BM-Body mass; 3. BMI - Body Mass Index; 4. JPL - The Jump from place to length; 5.JFH$_1$-Jump from place to height; 6.THJA$_2$ - The high jump with the approach of one foot; 7. S20m- Running (sprint) 20 meters 8. MB - Abdominal Muscles; 9. PU - Push-ups; 10. T-Test; 11. Illinois Agility; 12. TMBD-Throwing of Medicine ball in distance; 13. SR-Sit and reach. Measuring instruments are applied by getting based on the authors (Bal et al., 2011; Asadi et al., 2012).

Training procedure of the plyometric program

The plyometric program lasts about 60 minutes or 480 minutes into four weeks, including 10 minutes warming up and preparing muscles for 45 minutes of plyometric training. 5 seconds off from the interval of exercise, and 2 minutes after exercising. The exercises begun have from May 2, 2016, until May 31, 2016, during the interval time from 17:00 to 18:00. The plyometric model was applied based on the publication of the authors Poomsalood & Pakulanon (2015) which was applied to basketball players into 4 weeks of program training.

Data Analysis

The data of the study were evaluated with SPSS version 21.0 for Windows. The basic statistical method for determining the basic statistical indicators of descriptive variables are Arithmetic mean (Mean); Standard deviation (SD). The t-test was used to present significant differences between the two groups.

Table 1

Descriptive characteristics of groups (Mean ± SD).

Variables	Control Group (n=10)		Plyometric Group (n=10)	
Age (yrs)	15.6	2.73	15.7	2.80
Height (cm)	171.930	8.462	173.090	10.944
Weight (kg)	70.840	14.696	64.300	12.147
Body Mass Index (kg/m^2)	20.563	3.904	19.068	2.731

Table 2
Plyometric training program.

Training Weeks	Training volume (Foot contacts)	Plyometric drills	Sets × Repetitions	Training intensity
1.	100	Front cone hops	3x12	Low
2.		Lateral cone hops	3x12	Low
3.		Standing jump and reach	4x7	Low
1.	120	Lateral cone hops	3x10	Low
2.		Standing jump and reach	5x6	Low
3.		Lateral jump over barriers	3x10	Moderate
4.		Alternate bounding	3x10	Moderate
1.	140	Diagonal cone hops	3x8	Low
2.		Lateral jump over barriers	3x8	Moderate
3.		Cone hops with 180 degree turn	4x8	Moderate
4.		Cone hops with the change of direction sprint	4x8	Moderate
5.		Single-leg vertical jump	4x7	High
1.	120	Diagonal cone hops	3x10	Low
2.		Cone hops with 180 degree turn	3x10	Moderate
3.		Cone hops with the change of direction sprint	3x12	Moderate
4.		Single-leg vertical jump	4x6	High

Results

As we see from table no. 3 of the t-test in the control group (CG) and experimental-plyometric (PG) the pre-test and post-test measurement. Tests the Jump from place to length (cm) the PG the pre-test 174.21 cm ± 11.21 and post-test 185.00 cm ± 27.58. Test the high jump with the approach of one foot the PG the pre-test 32.80 cm ± 24.88 and post-test 37.40 cm ± 8.30. Tests running (sprint) 20 meters the CG the pre-test 4.46 cm ± .42 and post-test 4.19 cm ± .43, the PG the pre-test 4.56 cm ± .76 and post-test 4.13 cm ± .39. Test abdominal muscles the CG the pre-test 19.40 and post-test 22.80, the PG the pre-test 21.50 ± 6.53 and 24.60 ± 3.94. Test push-ups the PG the pre-test 14.10 ±11.50 and post-test 21.00 ± 10.91. Test Illinois agility the PG the pre-test 20.30 sec ±1.78 and post-test 18.99 sec ± 1.06.

According to the results of the CG of the test, significant small differences are presented in two tests, such as 20m running (sprint) testing with significant differences (p= 0.013), and abdominal muscle testing with significant differences (p= 0.036). However, in the PG significant differences in seven tests, the jump from place to length with significant differences (p= 0.003), the high jump with the approach of one foot significant differences (p= 0.035), push-ups (pump) test with significant difference (p= 0.004) and Illinois Agility test with significant difference (p= 0.004). There was no significant difference the CG and the PG in the test jump from place to height, abdominal muscle test, throwing of medicine ball in the distance and sit-reach test.

Table 3

The t-test of the CG and PG in the pre-test and post-test measurement.

Variable	Groups	Pre-test	Post-test	t	p
The Jump from place to length (cm)	CG	175.20 ± 19.61	175.56 ± 25.27	.479	0.644
	PG	174.21 ± 11.21	185.00 ± 27.58	-4.05	0.003*
Jump from place to height (cm)	CG	37.40 ± 4.92	36.86 ± 5.38	.522	0.522
	PG	28.10 ± 6.61	34.40 ± 10.73	-1.58	0.147
The high jump with the approach of one foot (cm)	CG	39.00 ± 4.39	38.26 ± 6.83	-.091	0.929
	PG	32.80 ± 34.88	37.40 ± 8.30	-2.48	0.035*
Running (sprint) 20 meters (sec)	CG	4.46 ± .42	4.19 ± .43	3.090	0.013*
	PG	4.56 ± .76	4.13 ± .39	2.724	0.023*
Abdominal Muscles (sec)	CG	19.40 ± 3.47	22.80 ± 3.76	-2.457	0.036*
	PG	21.50 ± 6.53	24.60 ± 3.94	-2.025	0.074
Push-ups (sec)	CG	14.00 ± 8.89	21.10 ± 13.31	-1.786	0.108
	PG	14.10 ± 11.50	21.00 ± 10.91	-3.892	0.004*
T-Test (sec)	CG	12.33 ± 1.38	12.55 ± 1.10	.605	-0.536
	PG	11.59 ± .92	11.43 ± .67	.433	0.821
Illinois Agility (sec)	CG	20.86 ± 2.10	20.96 ± 1.96	-.411	0.691
	PG	20.30 ± 1.78	18.99 ± 1.06	3.162	0.012*
Throwing of Medicine ball in distance (cm)	CG	4.08 ± .64	4.50 ± 1.15	-1.335	0.215
	PG	5.00 ± .70	5.90 ± .37	-1.987	0.078
Sit and reach (cm)	CG	6.40 ± 8.59	7.20 ± 9.059	.487	-0.725
	PG	10.88 ± 8.49	12.12 ± 7.40	.576	-0.581

* $p < 0.05$

Discussion

According to a 4-week study with a plyometric program of basketball jump performance, where it has been proven that high-vertical jump has improved between the first and the second, in particular, the experimental-plyometric group has had more the biggest experience compared to the other untreated (Hoe et al., 2011). In the training group, this result was in agreement with (Asadi et al., 2011) who reported a significant improvement in vertical jumping in male collegiate students following depth jump and countermovement jump training for 6 weeks. During the realization of this study, we have seen that during the 4 weeks of plyometric training we have reached agility tests, in this case (Asadi et al., 2012) researched a significant improvement of agility in tests (t-test and Illinois agility) of basketball players after 6 weeks of high-intensity plyometric training. Basketball players' studies did not positively support the assumption that plyometric exercises could be an effective tool for improving explosive strength and agility. However, in some players, the improvements corresponded to the average improvements after the training programs presented in the literature

(Lehnert et al., 2013). Can be that a 6-week in-season plyometric training program has positive effects for improving power and agility performance in young male basketball players and this study provides support for coaches and basketball players who use this training method during competitive phase (Asadi, 2013). Also, Poomsalood et al. (2015) realized research in a four-week study that has been able to confirm the significant statistical difference in the 20 meter run test for the experimental group. Also, Poomsalood et al., (2015) have researched 4 weeks the control group didn't have any significant statistical differences, while the experimental group had significant differences in agility tests.

The study was very encouraging and demonstrated that the mean of agility test of Experimental Group was better than the control group, thus there was a significant effect of 6 week plyometric training program on agility in young male basketball players (Jain et al., 2015). In a study by Adigüzel, et al., (2016) they realized research on 30 players of a basketball game where have present significant statistical differences in tests of explosive force in the experimental group followed for 8 weeks with a plyometric training program. Six-week plyometric training effects on the agility performance of basketball players. A total of 24 basketball players were conducted for six weeks (12 sessions), as the parameters for the evaluation were Illinois Agility and T-test. The results suggest that plyometric training is conducive to the development of the explosive force of low extras and agility (Sudhakar et al., 2016).

The difference between the statistical data was found in the final measurement between the experimental group and the short-cut tester, also the experimental group showed the best results that the tester group during the 10-week plyometric program as well as the pilot-trainer program led to reaching the level of explosive force and agility, so the authors suggest that basketball players exhibit strong muscular skills (Latorre Román et al., 2017).

In conclusion, according to what is presented in the plyometric model training we see that we have a positive impact on the accomplishment of important motor tasks, but the most important is the model was accomplished with the aim of achieving the impact of the plyometric program training. Explosive force and agility indicators have an improvement in raising these skills in order to increase the impact of program training. This experiment also confirms that it is possible to make progress on the significant statistical difference in particular in the experimental group of the plyometric training model. However, this plyometric training program model can be a tool, modality, methodology or technical useful for the work of coaches with players, because the innovative work or new product in this model of the plyometric training program can be a significant contributor to a set of players who have the goal of developing plyometric within four week days of the basketball game.

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Declaration of Interest

The authors report no conflict of interest.

References

Adigüzel NS, Günay M. The effect of eight weeks plyometric training on anaerobic power, counter movement jumping and isokinetic strength in 15-18 years basketball players. International Journal of Environmental & Science Education, 2016; 11(10): 3241-3250.

Arazi H, Asadi A. The effect of aquatic and land plyometric training on strength, sprint, and balance in young basketball players. J Hum Sport Exerc, 2011; 6(1), 101-111.

Asadi A, Arazi H. 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, 2012; 4(1): 35-44.

Asadi A, Ramirez-Campillo R, Meylan C, Nakamura FY, Cañas-Jamett R, Izquierdo M. Effects of volume-based overload plyometric training on maximal-intensity exercise

adaptations in young basketball players. J Sports Med Phys Fitness, 2017; 57(12): 1557-1563.

Asadi A. Effects of in-season short-term plyometric training on jumping and agility performance of basketball players. Sport Sciences for Health, 2013; 9(3): 133-137.

Asadi A. Effects of in-season short-term plyometric training on jumping and agility performance of basketball players. Sport Sci Health, 2013; (9): 133-137.

Asadi A. The effects of a 6-week plyometric training on electromyography changes and performance. Sport Science. 2011; 4(2), 38–42.

Atkinson SJ. The effect of a short term plyometric program on hard floor and sand for the improvement of vertical jump height in basketball. Cardiff Metropolitan University Prifysgol Fetropolitan Caerdydd Cardiff School of Sport Degree of Bachelor of Science (Honours) Sport and Physical Education, 2015.

Baechlr TR, Earle RW. Essentials of strength training and conditioning. 2nd edition. Champaign, IL: National Strength and Conditioning Association, 2015.

Bal BS, Kaur PJ, Singh D. Effects of a short term plyometric training program of agility in young basketball players. Brazilian Journal of Biomotricity. 2011; 5(4): 271-278.

Bompa T. Power training for sport-plyometrics for maximum power development. Coaching Association of Canada. 1993.

Bouteraa I, Negra Y, Shephard RJ, Chelly MS. Effects of combined balance and plyometric training on athletic performance in female basketball players. J Strength Cond Res. 2018; 2(1): 1-10.

Chu, D. (1993). Jumping into plyometrics. VHS. Human Kinetics, Champaign II, USA, 1993.

Ciacci S, Bartolomei S. The effects of two different explosive strength training programs on vertical jump performance in basketball. J Sports Med Phys Fitness, 2018; 58(10): 8.

Craig, B. W. What is the scientific basis of speed and agility? Strength Cond J, 2004; 26(3): 13-14.

Gamble, P. Strength and conditioning for team sports: Sport specific physical preparation for high performance. London: Taylor & Francis Group, 2010.

Hoe WE, Mudah F, Hian TC. Effects of a 4-week plyometric training on the jumping performance of basketball players. Malaysian Journal of Sport Science and Recreation. 2011; 7(1): 64-82.

Jain A, Tiwari M, Naqvi SA, Jain A. The effect of six weeks plyometric training on agility in male basketball players. International Journal of Therapies and Rehabilitation Research, 2015; 4(4): 183-190.

Khlifa, R., Aouadi, R., Hermassi, S., Chelly, M. S., Jlid, M.C., Hbacha, H., Castagna, C. Effects of a plyometric training program with and without added load on jumping ability in basketball players. J Strength Cond Res, 2010; 24(11): 2955-2961.

Latorre Román P, Macias FJV, Pinillos FG. Effects of a contrast training programme on jumping, sprinting and agility performance of prepubertal basketball players. J Sport Sci, 2012; 36(7): 802-808.

Latorre Román PÁ, Villar Macias FJ, García Pinillos F. Effects of a contrast training programme on jumping, sprinting and agility performance of prepubertal basketball players, J Sport Sci, 2017; 36 (1): 1-7.

Lehnert M, Hůlka K, Malý T, Fohler J, Zahálka F. The effects of a 6 week plyometric training programme on explosive strength and agility in professional basketball players. Acta Univ Palacki Olomuc Gymn, 2013; 43(4): 7-15.

Matavulj D, Kukolj M, Ugarkovic D, Tihanyi J, Jaric S. Effects on plyometric training on jumping performance in junior basketball players. J Sports Med Phys Fitness, 2001; 41(2): 159-164.

Miller MG, Berry DC, Bullard S, Gilders R. Comparisons of land-based and aquatic based plyometric programs during an 8-week training period. Journal of Sports Rehabilitation, 2002; 11: 269-283.

Miller MG, Herniman JJ, Ricard MD, Cheatham CC, Michael TJ. The effects of 6-week plyometric training program on agility. J Sports Sci Med, 2006; 5(3): 459–465.

Poomsalood S, Pakulanon S. Effects of 4-week plyometric training on speed, agility, and leg muscle power in male university basketball players: A pilot study. Kasetsart J Soc Sci, 2015; 36: 598-606.

Potach D, Chu D. Plyometric training. In: Essentials of strength training and conditioning (Second Edition). Editors: T.R. Beachle and R.W. Earle, Champaign, IL, USA: Human Kinetics, 2000.

Ramachandran S, Pradhan B. Effects of short-term two weeks low intensity plyometrics combined with dynamic stretching training in improving vertical jump height and agility on trained basketball players. Indian Journal of Physiology and Pharmacology, 2014; 58(2): 133-136.

Santos E, Janeta MA. Effects of plyometric training followed by short-term specific detraining and reduced training periods on explosive strength, agility and speed variables in early pubertal male basketball players. In: Aerobic exercise and athletic performance (Editor: D.C. Leberman). Hauppauge, NY, USA: Nova Science Pub Inc., 2010.

Santos EJ, Janeira MA. The effects of plyometric training followed by detraining and reduced training periods on

explosive strength in adolescent male basketball players. J Strength Cond Res, 2011; 25(2): 441-452.

Shallaby HK. The effect of plyometric exercises use on the physical and skillful performance of basketball players. World Journal of Sport Sciences, 2010; 3(4): 316-324.

Sudhakar S, Mohan Kumar G, Ramanathan K, Vasanth P. Efficacy of 6 week Plyometric training on agility performance in collegiate male basketball players. Indian Journal of Physiotherapy & Occupational Therapy, 2016; 2(2): 1-8.