

# Plyometric basketball training

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**Abstract.** Plyometric basketball training represents a widely used training method whose purpose is to resist the gravity force, meaning jump height improvement, better start acceleration, short section sprint, and direction change movement. The aim of this work was to analyze former plyometric basketball training researches, as well as to consolidate conclusions relevant to established work object analysis. This work covers 22 surveys published during a period from 2008 till 2018, which are shown in a chronological order and analyzed thoroughly. Obtained results suggest that fully planned and performed plyometric training within a defined time period has statistically significant positive effects on basketball explosive capacities development.

**Keywords.** Basketball, development, explosive capacity, plyometric training, motoric skills.

## Introduction

Basketball is a very complex activity, where being successful depends on numerous anthropometric and motoric skills. Basic characteristic of basketball activities are quick direction change movements, as well as those of motoric structure movement intensity with and without a ball. Ability of quick activity beginning, movement stereotype reorganization and precise movements in relatively small spaces with space and time limitations represent basketball player activity characteristics and are directly connected to ability of quality performance of speed-explosive capacities. Speed, explosivity and agility represent abilities of analogue ways of expression, making it possible to connect them in the same context of basketball players practice and training (Trunic & Mladenovic, 2014).

As one of the most interesting training methods of the 20th century, plyometric training appeared in Zaciorski's book in 1966. The term "plyometry" can

be connected to various terms such as stress training, speed capacity, jump and elastic reactivity training (Radcliffe & Farentinos, 2003). There have been many plyometry definitions given by different authors. It is one of the best methods for development of different types of explosive capacities, and can be described as any training with eccentric-concentric muscle activity (Canaki & Birkic, 2009).

Plyometric training is about using gravity force for quick muscle extension while touching back the ground within jumping, in order to create potential elastic energy for more efficient jump off the ground concentric phase realization (Radovanovic & Ignjatovic, 2009). Plyometry refers to exercises designed for better muscle capacities by jumping (De Villarreal et al., 2009).

Plyometric exercises are those exercises whose purpose is to connect force and speed of movement in order to achieve explosive-reactive movement, often defined as capacity (Pavlek, 2009; Vrcic, 2009).

Basic plyometric method means are vertical, horizontal and deep jumps. Such jumps include countermovement jump (CMJ), drop jump (DJ) and squat jump (SJ), which represent the most used jumps within plyometric training (Brankovic et al., 2008).

Plyometric training consists of exercises which can be performed with or without external burden, while the results obtained may vary depending on training, sex, age, sport activity, as well as on knowledge of plyometric exercise practice (Arazi & Asadi, 2011).

Plyometric training represents highly intensive training method which should be applied and dosed adequately in order to avoid unpleasant consequences like injuries. While planning and

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Received: October 10, 2018 - Accepted: December 26, 2018 - Published: December 30, 2018

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**To cite this article:** Nikolic A. Plyometric basketball training. Turk J Kinesiol, 2018; 4(4): 101-105. DOI: 10.31459/turkjin.468867

programming the training including plyometric exercises it is necessary to pay attention to sex, age, as well as morphological structure of an athlete (Stemm & Jacobson, 2007). Plyometric training is designed for those athletes with long term capacity training. Muscles have to be strong enough to endure due to big force production during plyometric exercises (Radovanovic & Ignjatovic, 2009).

## Methods

Descriptive method and theoretical analysis were used in this research. For searching former surveys on plyometric basketball training next electronic data bases were used: Google Scholar, SCIndex, MEDLINE, SPORTDiscus, PubMed and Web of Science. While searching these data bases next key words were used: basketball, development, explosive capacity, plyometric training, and motoric skills. The search covered publications from 2008 till 2018.

Surveys which were up to given criteria were analyzed and presented based on these parameters: reference (names of authors and publication year), sample of respondents (number, age and sex of the respondent), experimental treatment (time period of experimental treatment, groups and analyzed parameters), survey results.

## Results

Draganovic & Markovic (2011) came to a conclusion that plyometric method improves vertical jump height at junior basketball players. Similar results were obtained by Kukric et al. (2010). Namely, they discovered that 10 week plyometric training (twice a week), where number of exercises and jumps is higher each week with three minute breaks between series, and five minute breaks between exercises, brings to higher vertical jump at junior basketball players.

**Table 1**

Review of collected and analyzed studies.

References	Sample of respondents				Experimental treatment		
	n	Age	Sex	Time period	Groups	Measured parameters	Results
Boraczyński & Urnia, 2008	14	20.3 ± 1.9	M	8 weeks (3x a week)	P	Low limbs explosive capacity	Progress in measured parameters
Shaji & Isha, 2009	45	18–25	M	4 weeks (2x a week)	Di; P; DiP	Vertical jump height	Improvement in vertical jump height in all three groups
Kukrić et al., 2010	20	Juniors	M	10 weeks (2x a week)	P; K	Leg explosive capacity (CMJ and SJ)	Improvement in CMJ and SJ jumps in P group
Shallaby, 2010	20	16	M	12 weeks (3x a week/ 120minutes)	P; K	Vertical jump height	P group progressed more than K group
Draganović & Marković, 2011	23	Juniors	M	6 weeks (2x a week)	P; K	Vertical jump height	Statistically significant improvement of P group compared to K group
Adorable et al., 2011	9	Students	M	10 weeks	P	Vertical jump height	Statistically significant improvement of the measured parametre
Sharma & Multani, 2012	40	/	M	4 weeks	P; K	Low limbs explosive capacity	Significant improvement of P group compared to K group
Asadi & Arazi, 2012	16	19–20	M	6 weeks (2x a week)	P; K	Low limbs explosive capacity, Vertical jump height	Statistically significant improvement of Low limbs explosive capacity in P group

Table 1. (Continued)

Bavli, 2012a	91	15–17	M/F	12 weeks (3x a week)	P; K; Pv	Vertical jump height	Improvement of vertical jump height in P and Pv groups
Bavli, 2012b	24	20.7±2.6	M	6 weeks	P; K	Vertical jump height	P group progress in measured parameter
Arazi et al., 2012	18	18.81±1.46	M	8 weeks (3x a week/40 min)	P; Pv; K	Vertical jump height	Improvement of vertical jump height in P and Pv groups
Komal & Singh, 2013	45	16–18	F	8 weeks	P; K; T	Vertical jump height	Statistically significant improvement in P and T groups compared to K group
Zhang, 2013	17	18-24	M	4 weeks (3x a week/ 60minutes)	P	Vertical jump height with left leg, right leg and both leg jump	Improvement in all measured parameters, except for both leg jump
Asadi, 2013	20	20.1 ± 1.3	M	6 weeks (2x a week)	P; K	Vertical jump height long jump length	P group progressed in both measured parameters
Lehnert et al., 2013	12	24.36±3.9	M	4 weeks (2x a week) + 2 weeks (4x a week)	P	Low limbs explosive capacity	Statistically significant improvement was not noticed
Attene et al., 2014	36	14.9±0.9	F	6 weeks	P; K	Vertical jump height	Statistically significant improvement in Vertical jump height in both groups
Morsal et al., 2014	30	24–30	M	6 weeks (3x a week)	P; K	Low limbs explosive capacity	Low limbs explosive capacity improvement in P group
Zribi et al., 2014	51	/	M	9 weeks	P; K	Low limbs explosive capacity	Statistically significant improvement in P group
Gottlieb et al., 2014	19	16.3±0.5	M	8 weeks (2x a week)	P; Sp	Vertical jump height	P group progressed in measured parameter
Ramateerth & Kannur, 2014	21	12–13	M	6 weeks(2x a week/ 90 minutes)	S; Ps	Vertical jump height, long jump and ball throw	Statistically significant improvement in Ps group in all three measured parameters
Benis et al., 2015	24	15.9 ± 0.8	F	8 weeks	K; P	Vertical jump height	Improvement of vertical jump height in P
Khazai & Hematfar, 2015.	16	11–12	F	4 weeks (3x a week/ 60 minutes)	K; P	Vertical jump height	Statistically significant improvement in P group in measured parameter

Legend; P-plyometry program group; K- control group; Ps – combination of plyometry and strength training group (no weights); Di – dynamic extension group; DiP – combination of dynamic extension and plyometry exercises group; Pv- water plyometry training group; Ps- sagittal plane plyometry jumps group; CMJ Countermovement Jump -; SJ Squat Jump.

Shaji & Isha (2009) came to a conclusion that plyometric training program within four weeks (twice a week) brings to statistically significant improvement of vertical jump height at basketball players, with 3,6cm average (7,9%). Similar results

were obtained by Sharma & Multani (2012) and Khazai & Hematfar (2015) in female basketball players.

As Asadi & Arazi (2012) discovered, a six week plyometric training (twice a week) brings to

statistically significant vertical jump height improvement with 23% average at male basketball players, while Attene et al. (2014) came to a conclusion that six week plyometric training brings to 15,4% better vertical jump height at female basketball players. Similar results were obtained by Draganovic & Markovic (2011), who, based on the results obtained in their research, claim that a six week plyometric training brings to better vertical jump height for 6cm at junior players. This fact suggests that even though a four week plyometric training brings to a vertical jump height improvement, better results can be obtained by this method within a longer time period.

Drop jump, drop jump to standing, long jump and squat jump as plyometric exercises for basketball players jumping abilities development were used in Asadi & Arazi research (2012).

Some studies have shown that plyometric training does not have to last long to have positive effects on explosive capacity development at basketball players. Based on his own research, Bavli (2012) came to a conclusion that a six week plyometric training (twice a week, 20 to 30 minutes each) brings to a significant improvement of vertical jump height at basketball players.

Table 1 shows that a plyometric training lasting between six and ten weeks improves basketball players' explosive capacity, based on some researches. Besides having positive effects on explosive capacity development using experimental training with plyometric exercises, results obtained show that a plyometric training lasting from six to twelve weeks also has a positive effect on such capacity development at female basketball players.

The only research included in this work where plyometric training did not bring to any significant vertical jump height improvement was done by Lehnert et al. (2013). Their research respondents were of  $24.36 \pm 3.9$  average age, and experimental program lasted six weeks (twice a week from the first to the fourth week and four times a week during the fifth and the sixth week). In the last two weeks lower limb plyometric exercises were combined with upper limb exercises with a burden during one training and vice versa. Number of jumps increased gradually during the program. Besides plyometric program basketball players also had to do their condition trainings including speed and aerobic durability exercises, as well as burden trainings.

One of interesting methods of plyometric training which was proved to have positive effects on basketball players explosive capacities by Arazi et al. (2012) is a water plyometric training which lessens chances for injuries, besides being very efficient.

## Discussion

Being a sport activity with plenty of explosive movements like short sprints, quick stops and accelerations, direction movement changes, different types of jumps, throwing and passing the ball, basketball suggests the significance of basketball players' explosive capacities for achieving maximum results. One of the most used methods for these capacities improvement during the past decades has been plyometric training. Applying adequate plyometric exercises, their correct dosing, insisting on correct performance and adequate break between series and repetitions can undoubtedly bring to basketball players explosive capacity improvement, which represents one of the conditions for being successful at this collective sport. There are many proofs to these claims - many researches have been done on the subject of plyometric basketball training. Results of all the studies included in this work except one, have undoubtedly suggested that experimental treatment based on plyometric exercises within a limited time period brings to statistically significant improvement in studied parameters.

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