

EFFICACY AND LEGITIMACY OF PLYOMETRIC TRAINING APPLICATION IN VOLLEYBALL PLAYERS

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Key words:

- jumping,
- effectiveness,
- program,
- team sports.

Abstract:

Plyometric training incorporates strength and speed training and is often applied in team sports to master explosive power of lower extremities. The main goal of review paper was to verify modern literature which reveals an influence of basic-to-plyometric training integration in volleyball. Most of articles show positive impact of implemented plyometric drills as to motor abilities level increase (e.g. jumping ability, speed, endurance) in research group of athletes. The highest progress was noticed in players at directed phase of training, lesser then at special training phase. Considering available research results it may be claimed that plyometric training application is legitimate and profitable in volleyball players what translates into shorter time to reach the ball and increase vertical jump both spiking and blocking. Team coach is expected to consult various plyometric drills in training structure of year-long periodization. Singularly significant question is plyometric training and its loads in kids and adolescents training as theoretic and practical knowledge of coach is first-rate required. Children who are in stage of natural psychomotor growth must not be a subject of full-load plyometric exercises instead training is required to be basic. Else, incompetent plyometric training performance might inhibit individual development. Only well-periodized and deliberate training based on three strength mastering phases may provide expected results which determine effective court performance.

INTRODUCTION

The conception of plyometric training developed at the turn of '60 and '70 in 20th century and was set in the area of eastern countries that is in USSR [13]. During that time period Soviet athletes dominated at the Olympic Games and other high rank international events especially in jumping competitions (high jump, triple jump etc.). Regardless the fact this type of training was not precisely named at the beginning, jump-implemented exercises were the method to cause significant improvement of motor abilities in sportsmen. Finally, American coach of athletics Fred Wilt was the 'plyometric training' name setter. Instead, the etymology of the word 'plyometric' descends from words 'plyo' (increase) and 'metric' (measure).

Plyometric training mainly consists in application of special drills which contribute to muscle power increase. The drills should be conducted in connection with others which impact on muscle strength disposition as to result in holistic training concept. This would rationalize relation between maximal strength and power generated by muscles [7]. Nowadays, the priority of plyometric training application is to increase strength (relative power especially) with no excessive mass building collaterally. It is believed to influence negatively on speed of motion execution. As result of analysis, it may be contended that

plyometric training leads to muscle strength growth by proprioception reaction enhancement and on the other hand by inhibitory function debilitation of Golgi tendon organ [5].

Plyometric training is widely applied in team sports which are based on jumping ability (i.a. volleyball, basketball, handball). Although, plyometric training is mainly consociated with jumping ability it also affects other motor abilities positively which are crucial for volleyball players e.g. reach-the-ball reaction time, 5-set-match endurance.

Underperforming explosive power of lower limbs is a limitation to select pro volleyball players. This potential is used in vertical, horizontal and side movements while working on the volleyball court.

An important part of training is its periodization (figure 1) which modulates implementation legitimacy and schedule load norms in adequate time periods [2].

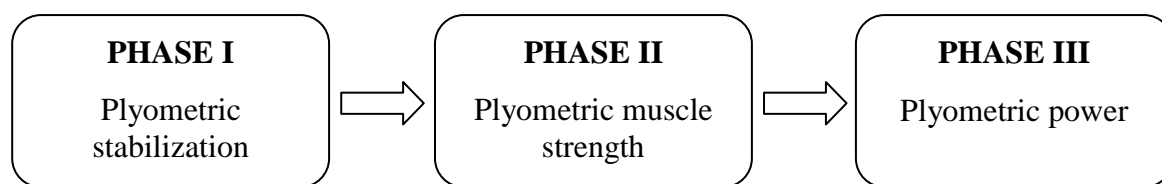


Figure 1. Phases of plyometric training.

1st phase contains drills based on stabilization of particular body segments predominantly notwithstanding the main goal is to teach how to land on two feet optimally, safely and stably. The skill of motion hold influences on court movement economy and optimization. 2nd phase is equal with muscle strength mastering during which significant changes are observed. Muscle strength increase as well as power and speed in addition while ground-contact time is in reduction tendency (that is phase occurring between eccentric and concentric muscle contraction). This type of exercises is graded as high-intensity in comparison with first phase while the last one is oriented at deep neuromuscular activation. 3rd phase exercises are characterized as movements similar to special sports movements e.g. in volleyball. Maximal dynamic and short time of ground contact is required in particular.

Modern times and continuous sport development force searching for original and effective training methods which would provide appropriate stimulus to reach increased body possibility considering endurance, speed and jumping ability. On the other hand, what has been proven and employed so far as method of plyometric training should not be cheapen.

THE AIM OF THE WORK

The aim of the work was to review and enunciate advantages of plyometric training implemented in volleyball training regimes.

MATERIAL AND METHODOLOGY

The latest (2009-2012 years) scientific articles on plyometric training effects in volleyball were reviewed. All of them were selected from EBSCO online database and the following key words were ticked: volleyball, plyometric training.

RESULTS

Most of released research outcomes which were analyzing plyometric training as support for technical and special motor training revealed its efficacy and practicalness.

Table 1. Research works revealing positive influence of plyometric training on motor abilities in volleyball players in comparison with control groups

| Authors | Age | Sex (F/M) | Testing group | Time of training | Training effects (ratio of experimental group to control group) or (ratio of after/before)* |
|---------------------------|--|-----------|---|------------------------------------|---|
| Lehnert et al. 2009 | 14.8 ± 0.9 years | F | 11 players: height 169 ± 6 cm, weight 58 ± 9 kg | 8 weeks, twice a week | standing vertical jump – average improvement 4 cm* vertical jump with an approach – average improvement 4.9 cm* shuttle run for 6 x 6m – average improvement by 0.7 sec* |
| Khazhal 2013 | 11 ± 1.4 years | F | 20 players: height 143 ± 4 cm, weight 41 ± 5 kg | 9 weeks, triweekly | seated medicine ball throw – 6.86/4.04 % standing long jump test – 4.37/2.28 % quadrant jump test (10s) – 13.02/6.75 % vertical jump test – 8.58/7.71 % 30 second endurance jump (30s) – 15.37/5.57 % |
| Soundara et al. 2010 | 18-25 years | M | 30 players | 6 week, twice a week | spike jump – 4.0/0.73 cm block jump – 3.07/0.8 cm |
| Benedek 2012 | 17-18 years | M | 8 players | 9 weeks, twice a week | volleyball jump: 1) 62/57 cm, 2) 67/58 cm, 3) 67/64 cm, 4) 66/66 cm |
| Kamalakkannan et al. 2011 | 18-20 years | M | 36 players: 3 groups: 1) aquatic exercise with weight, 2) aquatic exercise without weight, 3) control group | 12 weeks, triweekly | 50m sprint (speed) – 6.81 sec/7.27 sec/7.52 sec Cooper's test (endurance) – 2258.00 m/2212.50 m/2137.50 m standing vertical jump height (leg explosive power) – 51.00 cm/48.90 cm/47.40 cm |
| Vassil et al. 2011 | 14.4 ± 1.80 years 17.0 ± 1.25 years | F M | 12 players: height 167.8 ± 6.97, weight 59.0 ± 8.85 9 players: height 182.0 ± 6.32, weight 73.7 ± 4.71 | 16 weeks, twice a week | standing long jump – 203.3 ± 13.2 cm/194.8 ± 13.2 cm (F)* 248 ± 15.5 cm/ 240.9 ± 16.7 cm (M)* depth leap long jump – 193.8 ± 13.6 cm/185.3 ± 14.7 cm (F)* 246.4 ± 17.7 cm/238.3 ± 17 cm (M)* maximal vertical jump height – 49.9 ± 6.0 cm/ 45.3 ± 6.4 cm (F)* 67.2 ± 6.3 cm/62.1 ± 5.9 cm (M)* |
| Stojanović et al. 2012 | 16lat ± 6 months | M | 38 players | 6 weeks, twice a week or triweekly | Six measuring instruments (jumping agility): jumping - feet apart – 6.38/1.54 % the jump and turn – 7.17/3.57 % quick jumps sideways – 3.44/0.94 % quick jumps - with both hands touching – 7.14/1.89 % jumps to the side – 10.83/3.31 % hop steps - scissor legs – 7.13/1.44 % |

Sizable increase in motor abilities indicators was observed primarily in basic volleyball training phase while at the level of professional players increments were lesser.

Obtained results of experiments shown in table 1 confirmed that plyometric program-involved players both males and females who trained volleyball professionally (different plyometric drills and forms – jumping) reached statistically significant improvement ($p < 0.05$) in motor skills (jumping ability, speed, endurance) in comparison with non-training control group [10,12]. On the grounds of research, it was proven that implemented 6-week plyometric training influenced on increase of lower limbs explosive power hence jumping abilities gained as well. The most auspicious effects are acquired when training session is aimed at individual, especially adolescents [11]. Other authors of works also claim that significant improvement was noticed essentially in lower limbs maximal explosive power which is critical in volleyball and all its actions [9]. Coaches should become acquainted with plyometric training with water load that is in the water. As shown in research, such drills are no less effective than traditional form. Moreover, it is suggested to exercise in water because of conducive environment which protects joints, ligamentous and musculoskeletal apparatus against overloading (occurring when exercising on hard surface) [6].

Each method may be supposed to bring advantages and disadvantages. Authors noted that plyometric training should be applied when athletes are well-prepared physically and healthy. Amateurs are group which is not capable of performing because of often injuries and trauma.

As plyometric training may result in conspicuous jumping abilities increment it also carries the risk of injury thus coaches role is very important as they are the only to monitor and adjust loads [4]. Additionally, the most sensitive group of athletes are children and adolescents whose biological development attendant should take care of. To reach the most effective outcomes every individual is needed to train with adequately-matched loads.

CONCLUSIONS

Basic plyometric exercise is jump down from platform and jump back on platform as soon as possible. Height of platform should be matched with abilities depending on actual motor preparation of athlete. It is not recommended for those who train less than 3-4 years and if even applied, period of performance is expected not to exceed 1-2 months [1].

Bompa et al. [2] maintain and point the most important effects of plyometric training in relation to volleyball as well as other sports:

- Power, speed and muscle strength increase
- Neuromuscular control improvement
- Perception and postural composition and control improvement
- Anaerobic potential modification
- Motor abilities enhancement

Advantages of plyometric training confirmed its application legitimacy in volleyball programs. Implementation of this method within periodization plan seems to be rational and attention worth. It is necessary to respect main rules prior to execution:

- 4-week preparation regime involving agility
- Minimum 4 weeks of strength and speed low-to-moderate intensity drills
- Athletes fully recovered
- Hard surface avoidance
- Plyometric training performed directly after warm-up and stretching [8]

The key part of plyometric training is load selection which if conducted properly is a stimulus to gain expected effects. When mastering muscle ability of power release, graded overloading rule applies what means if coach matched insufficient load, training session would not be effective [3]. Furthermore, plyometric session process requires to be monitored and in case of any fatigue symptoms should be discontinued forthwith. It may be found to be

stop-sign when ground-contact time is extended during given drills. Only if human organism is fully rested and at disposal can it achieve intentional outcomes [2].

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