

**ICPESK 2017**  
**International Congress of Physical Education, Sport and**  
**Kinetotherapy**

**WAYS TO IMPROVE VERTICAL JUMPS USING VERT DEVICE**

Germina Cosma (a)\*, Marian Dragomir (b), Eliana Lică (c), Florin Voinea (d), Alexandru  
Cosma (e)

\*Corresponding author

(a) University of Craiova, 13 Al. I. Cuza Street, Craiova, Romania, germinacosma@yahoo.com

(b) University of Craiova, 13 Al. I. Cuza Street, Craiova, Romania, dragomirfefs@yahoo.com

(c) University of Craiova, 13 Al. I. Cuza Street, Craiova, Romania, eliana.lică@yahoo.ro

(d) "Ovidius" University of Constanța, 124 Mamaia Blvd, Constanța, Romania, voineafloirin09@yahoo.com

(e) University of Craiova, 13 Al. I. Cuza Street, Craiova, Romania, alexandrucosma\_78@yahoo.com

***Abstract***

The volleyball game involves multiple vertical jumps needed for performing technical procedures – the attack, block or serve. All of these require explosive strength in the lower limbs. The aim of the study was to identify the influence of plyometric exercises included in the technical structures specific to the volleyball game. Thus, a group of 12 volleyball players (male, aged  $17 \pm 1.5$  years) participated for 6 months in a training program that included plyometric exercises performed 3 times per week during the precompetitive period. In order to determine the progress of the jump, two specific tests (the attack and block jumps) and the Vert device were used. The Vert device is an accelerometer found at the Human Motricity Research Centre of the Faculty of Physical Education and Sport in Craiova, and designed in the USA. The subjects were tested before and after applying the work program. Following the application of the work program, significant progress has been identified in terms of attack and block jumps, but also in the vertical jump measured by Vert device, the mean difference being statistically significant at a threshold of  $p < 0.05$ . The Vert instrument has become extremely important in the sports training economy and is also a motivational factor, the individual progress being monitored in real time.

© 2018 Published by Future Academy [www.FutureAcademy.org.UK](http://www.FutureAcademy.org.UK)

**Keywords:** Volleyball, vertical jump, Vert device.



This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## **1. Introduction**

The volleyball game is a sport characterized by repetitive maximal and submaximal jump and land effort followed by short recovery periods (Sheppard, Gabbet, & Stanganelli, 2009). The volleyball player is required to produce repeatedly maximal efforts (during blocking or spiking) over an extended period of time - approximately 90 minutes (Kaynak et al., 2017; Polglaze & Dawson, 1992; Vittasalo et al., 1987). This requires good training, and the repetitions of jumps involve muscular strength in the lower limbs. The usual method of training in the volleyball game is the plyometric one. Applying plyometric exercises during the training of a volleyball team playing in Turkey, Gokhan and Aktas (2013) showed a significant improvement in speed, vertical jump, long jump, but also flexibility. Several studies have demonstrated that plyometric training can improve vertical jump in volleyball players (Newton, Kraemer, & Häkkinen, 1999; Maffiuletti et al., 2002).

Traditional means of counting the number of jumps in volleyball include video analysis. Lately, there have been created accelerometers that count and measure the jumps in real time (Gageler, Eearing, & James, 2015; Jarning et al., 2015). Such a device is VERT, an accelerometer found at the Human Motricity Research Centre of the Faculty of Physical Education and Sport within the University of Craiova, through which it is possible to measure vertical jump in real time, both during training and match play.

## **2. Problem Statement**

Studies related to new technologies that measure vertical jump of the volleyball player are limited. This study involves junior volleyball players who will participate in a 3-week plyometric training program using Vert device as an assessment and training method. It is possible for these athletes to improve their vertical jump after participating in the proposed training program.

## **3. Research Questions**

Our study design will allow us to compare the results pre- and post-training program to determine changes in the vertical jump, in relation to our first research question. On the other hand, the evolution of results with the Vert device will help us determine the effect of using this modern technology in the training process, in relation related to our second research question.

## **4. Purpose of the Study**

The purpose of the research was to validate a junior volleyball training program designed for their muscular training, with plyometric means as main elements, and to track the evolution of vertical jump through the Vert device.

## **5. Research Methods**

### **5.1. Participants**

The research subjects were the volleyball team players of “Nicolae Titulescu” National College of Craiova. The 12 participants aged 16-18 years, with a competition experience of 5-7 years and competing in the junior category, volunteered for the study. All athletes/tutors signed an informed consent form.

### **5.2. Design**

The research was conducted over 6 months and consisted in introducing plyometric means in the training of athletes, 3 times per week, depending on the period, the allocated time being 20 minutes. The development of the experimental program did not change the structure of the training itself, which was carried out according to the schedule and plan established for each period and stage of preparation, the authors' intervention occurring during the program time. The program was monitored via the Vert device, which was used both as an assessment and training method. The athletes were measured before and after the plyometric program, each volleyball player performing VERT (to determine changes in the vertical jump) and two specific tests (the attack and block jumps). From the spike, a vertical jump is performed by touching a high point with the hand. Two jumps are awarded and the best value is scored.

Vert device is a non-invasive, miniature inertial measurement unit that allows athletes to perform in games and practices without creating discomfort. The device works with an iOS application, through which coaches can monitor a number of jumping issues. VERT Jump Wearable Jump Rate Monitor is a device worn near the waist of an athlete, either by the VERT clip (quick testing) or integrated into the clothing, such as the VERT belt (for training and games).

The Vert device: can record jumping to prevent injuries; measures vertical jump to improve performance and increase motivation; results can be seen in real time; jump Rate™ is a brand new exciting feature that offers a whole new value in the workout; this feature is an interesting tool for plyometric exercises; provides the possibility of name sessions and statistical comparisons. The multiplayer allows viewing the best jumps, the jumping average and the last jump during each training lesson.

For this research, there were evaluated 12 successive jumps to block using Vert device.

### **5.3. Statistical analysis**

Descriptive statistics (mean, standard deviation, minimum and maximum values) was calculated using the SPSS program, version 21. We also calculated the differences between the first and second assessments ( $D_{21}$ ) and the progress ( $D_{21}\%$ ).

To determine the effect of plyometric intervention on the vertical jump improvement, the Paired T-test was applied. The level of significance was set at  $p < 0.05$ .

## 6. Findings

### 6.1. Results of the spike and block jumps

**Table 01.** Statistical parameters for the spike and block jumps – Pre- and post-training program

Parameters	Spike jump		Block jump	
	T1	T2	T1	T2
Mean	307.67	313.75	298.42	302.92
Standard Deviation	7.09	7.62	7.91	8.68
Minimum	320.00	328.00	315.00	320.00
Maximum	298.00	306.00	288.00	290.00
T-test	-8.30		-9.28	
P	0.001		0.001	

The spike jump test records an average of 307.67 cm ( $S \pm 7.09$ ) in the initial test, with values ranging from 298 to 320 cm. In the final test, the average jump to touch a fixed point with one hand was 313.75 cm, with an increase of 6.08 cm, representing a progress of 1.97%. By applying the Paired T-test, a value of  $t=8.30$  is recorded at a threshold of  $p = 0.001$  ( $p < 0.05$ ), the means used leading to an increase in the jump.

The block jump test records an average of 298.42 cm ( $S \pm 7.91$ ) in the initial test, with values ranging from 288 to 315 cm. In the final test, the average jump to touch a fixed point with two hands was 302.92 cm, with an increase of 4.5 cm, representing a progress of 1.50%. By applying the Paired T-test, a value of  $t=9.28$  is recorded at a threshold of  $p = 0.001$  ( $p < 0.05$ ), the means used leading to a statistically significant increase in the vertical jump.

### 6.2. Results with the VERT assessment

**Table 02.** Statistical parameters for Vert device – Pre- and post-training program

Parameters	Spike jump	
	T1	T2
Mean	51.00	53.75
Standard Deviation	5.15	6.19
Minimum	62.00	67.00
Maximum	43.00	44.00
T-test	10.06	
P	-6.48	

The vertical jump measured via the Vert device recorded 51 ( $SD \pm 5.15$ cm), the average of the 12 jumping values ranging from 43 to 62 cm. The applied work programs increased the average jumping to 53.75 ( $SD \pm 6.19$  cm) in final testing. The difference in the average of the two tests was 2.75 cm, the progress being 5.39%. By applying the Paired T-test, a value of  $t=6.48$  is recorded at a threshold of  $p = 0.01$ , which statistically validates the effectiveness of work schedules and the use of Vert device in the training of junior volleyball players.



Figure 01. VERT Coach multiplayer

Table 03. Differences between T1 and T2

Tests	T <sub>1</sub>	T <sub>2</sub>	D <sub>21</sub>	D <sub>21</sub> (%)
Spike jump	307.67	313.75	6.08	1.97
Bock jump	298.42	302.92	4.5	1.50
Vert Test	51.00	53.75	2.75	5.39

## 7. Conclusion

The aim of this study was to examine the influence of plyometric training on changes in the vertical jump, which were assessed using Vert device.

Designed to be small and discreet, Vert device is worn by the athlete and allows the user to track the vertical jump in real time, through a wireless device via a smart phone or tablet. Thus, this tool has become extremely important in the sports training economy and is also a motivational factor, the individual progress being monitored in real time.

Vert device has proven to be valid for measuring vertical displacement and jump count in volleyball players during training and match play, thus improving current practices (Charlton et al., 2017). Through the Vert device, it was possible to directly demonstrate the evolution of vertical jump within the plyometric program for athletes. Still, there are studies that show that sessions of plyometric exercise tend to decrease balance and postural control in volleyball players (Asadi, 2016). This means that the plyometric method should not be abused, being some possibility of injury.

The design of training programs based on concrete data provided by specific tests and assessments, complemented by those recorded with modern technical equipment, ensures that the means of training are properly targeted, giving certainty to the expected results. This working direction applied to sports training in the lower echelons will put the national championship performances in line with those in the international competitions.

## References

Asadi, A. (2016). Plyometric type neuromuscular exercise is a treatment to postural control deficits of volleyball players: A case study. *Revista Andaluza de Medicina del Deporte*, 9(2), 75-79.

- Charlton, P., Kenneally-Dabrowski, C., Sheppard, J., & Spratford, W. (2017). A simple method for quantifying jump loads in volleyball athletes. *Journal of Science and Medicine in Sport*, 20(3), 241-245.
- Gageler, W., Eearing, S., & James, D. (2015). Automatic jump detection method for athlete monitoring and performance in volleyball. *Int J Perform Anal Sport*, 15(1), 284-296.
- Gokhan, I., & Aktas, Y. (2013). Plyometric exercises' effect on some particular physical and physiological parameters in volleyball players. *International Educational e-Journal*, 2(4), 8-14.
- Jarning, J. M., Mok, K.-M., Hansen, B. H., & Bahr, R. (2015). Application of a tri-axial accelerometer to estimate jump frequency in volleyball. *Sports Biomech.*, 14(1), 95-105.
- Kaynak, K., Eryilmaz, S., Aydogan, S., & Mihailov, D. (2017). The effects of 20-m repeated sprint training on aerobic capacities in college volleyball players. *Biomedical Human Kinetics*, 9, 43-50.
- Maffiuletti, N. A., Dugnani, S., Folz, M., Di Pierno, E., & Mauro, F. (2002). Effect of combined electrostimulation and plyometric training on vertical jump height. *Med Sci Sports Exerc.*, 34(10), 1638-1644.
- Newton, R. U., Kraemer, W. J., & Häkkinen, K. (1999). Effects of ballistic training on preseason preparation of elite volleyball players. *Med Sci Sports Exerc.*, 31(2), 323-330.
- Polglaze, T., & Dawson, B. (1992). The physiological requirements of the positions in state league volleyball. *Sports Coach*, 15, 32-37.
- Sheppard, J. M., Gabbet, T. J., & Stanganelli, L. C. (2009). An analysis of playing positions in elite men's volleyball: Considerations for competition demand and physiologic characteristics. *J Strength Cond Res.*, 23(6), 1858-1866.
- Vittasalo, J., Rusko, H., Pajala, O., Rahkila, P., Ahila, M., & Montonen, H. (1987). Endurance requirements in volleyball. *Can J Appl Sports Sci.*, 12, 194-201.