

Entrenamiento de la fuerza explosiva en voleibolistas universitarios

Training of explosive force in university volleyball players

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RESUMEN

El estudio tiene como objetivo comprobar el efecto de 8 semanas de entrenamiento sobre el tren inferior utilizando el método pliométrico y el método combinado con sobrecarga y su relación con la capacidad de salto. La muestra es de 16 jugadores de voleibol universitarios, distribuidos en dos grupos, el pliométrico y el de sobrecargas. La potencia del tren inferior es evaluada con contra movimiento y Abalakov. Se utilizó la prueba de significancia de Shapiro-Wilk y la prueba de T-student para muestras independientes. El método pliométrico fue más eficaz que el método con sobrecargas.

Palabras clave: Voleibol universitario; Saltos; Pliometría; Sobrecargas

ABSTRACT

The objective of the study is to verify the effect of 8 weeks of training on the lower train using the plyometric method and the combined method with overload and its relation with jumping ability. The sample is of 16 university volleyball players, divided into two groups, the plyometric and the overload. The power of the lower train is evaluated with counter movement and Abalakov. The Shapiro-Wilk significance test and the T-student test were used for independent samples. The plyometric method was more effective than the overload method.

Key words: University volleyball; Jumps; Plyometric; Overloads

INTRODUCTION

The jump in volleyball is of vital importance, and is present in almost all the actions of game, either in attack, in the pass with jump, in defense through the block and in the serve with offensive jump. For this it is necessary to improve biomechanical variables, such as flight height, flight time, jump speed and power, that is, combination of speed and force, in which the benefits of a plyometric program for the athlete have been demonstrated in the scientific literature. Plyometrics is one of the most efficient training methods available over time, and it could be said that it offers the greatest possibility of transfer for its application in sport (Marín, V.L. & Melgarejo, V.M. 2016).

Cujilema, A. & Patricio, F. (2017), define saltability as *"...the ability to express in an explosive way the muscular effort to perform an effective action without support in the air, that is, saltability is a complex quality composed of strength, speed and skill."* The jump, is a physical activity that is characterized by short muscular efforts, explosive character and that has many styles, where the technique acquires importance.

In the work of force for the legs, its development has always been fundamentally worked by the influence of the weights. It is no less true that to develop strength in different muscular planes, the use of weights is among the most effective, not to be absolute. The truth is that with the passage of time has become fashionable a concept that is based mainly on the use of jumps, in its various forms, for the development of strength and preferably the saltability in the volleyball players. As we expressed earlier we refer to the so-called plyometric exercises, or simply plyometrics.

"The jumps exert a positive influence on the extensor and flexor muscles of the legs, which are fundamental for the achievement of a good power in the jump, fundamental ability to obtain good results in the shot and block."

Volleyball, as a competitive sport, is not the exception, since its characteristics depend on the good physical condition that the player has to combine moments of great explosiveness and power with small moments of relative rest, (Acosta Rodríguez, E.R. 2013). The explosive strength in lower limbs is expressed through

saltability, and this capacity developed optimally, represents a great advantage in the athlete, and therefore this must be an objective to be efficiently developed by the coaches.

There are different training methods, which allow the development of the explosive force in jumping ability. However, the coach must lead in the search for appropriate methods, understood as the planned way to achieve a purpose, which includes intentional actions such as planning, systematization and appropriate evaluations, as well as means that can increase the level and maintain it throughout the cycle.

At present, the relevance of strength training is accepted within the sports planning programs, in order that the athlete can develop their maximum potential (Sánchez-Sánchez, J., Pérez, S., Yagüe, J.M., Royo, J.M. & Martín, J.L. 2015). For this reason, the strength training with overloads is considered a primordial activity, to guarantee an adequate physical performance applied to any sport (Naclerio Ayllón, F. & Jiménez Gutiérrez, A. 2007) Likewise, having an optimal level of maximum force is vital, in order to develop high gradients of explosive force (Juárez, D., Navarro, F., Aceña, R.M., González, J.M., Arijá, A. & Muñoz, V. 2008).

Taking into account the importance of the jump, and the high demands made on the neuromuscular system during constant races, jumps (blocking and finishing) and the high-intensity movements on the court, which occur repeatedly throughout the competition, evidence that development, for volleyball players, should focus specifically on the explosive force for the demands of the game, (Gabbett, T., Georgieff, B., Anderson, S., & Cotton, B. 2006). Therefore, the methodologies implemented should have as their main objective the development of it.

Precisely, plyometrics participates as the most effective method reported in the literature, and that develops the gain in saltability. Having this consideration, it was another of the methods selected as part of the study, as well as the method of overloads or accumulation of overloads, which is currently used for high performance athletes, due to its boom with the maintenance of concentration of loads at the lower train level. These are cutting-edge sports trends in training, which were selected to compare and determine the effects on jumping ability in

young university volleyball players, analyzing the benefits in the development of explosive force.

On the other hand, the relationships between jumping ability and performance in explosive actions within the volleyball game are conditioned by factors such as the level of training of the subjects and the measures analyzed (Juárez, D., Navarro, F., Aceña, R.M., González, J.M., Arija, A. & Muñoz, V. 2008), so, with the purpose of making thematic contributions, the objective of this study is to verify the effect of 8 weeks of training on the train lower in university volleyball players, using the plyometric method and the method of overloading, as well as its relationship with jumping ability.

METHODS

The present study is an experimental design of quantitative type. The sample selected intentionally, is composed of 16 college volleyball players, with an average age of 20 to 25 years. It is divided into two groups, each with 8 players. The body weight was made with a scale, and the stature with a self-made stadiometer.

The training program applied to the two groups lasted 8 weeks. It was distributed in 3 weekly sessions, lasting 2 hours on the capacity of the explosive force. This was evaluated with the Bosco or Squat Jum test (SJ), the vertical jump against movement test (CMJ) and the Abalakov test (ABK), to measure the jump, representing in this the explosive force, (Bosco, C., Komi, PV, Tihanyi, J., Fekete, G., & Apor, P. 1983).

- Bosco test or Squat Jump test (SJ): this examines the explosive force of the lower train without the use of counter movement, therefore the modality of muscular activation is of the concentric type (Bosco, C. 1996). The subject must perform a vertical jump, starting from the position of half squat (knee flexioned to 90 °), with the trunk straight and hands on the hips. After three attempts with a break of 40 seconds, the best attempt is recorded (Luarte, C; González, M. & Aguayo, O. 2014).
- Vertical jump test with counter movement (CMJ): this evaluates the explosive force of the lower train, from a vertical jump with counter movement, in which

the concentric activation is preceded by an eccentric activity (against movement). The use of the myotatic reflex has an important role, which is reflected in the better performance compared to the previous test. The recommendations made by Bosco (1996) are followed. After three attempts with a break of 40 seconds, the best value reached is recorded (Luarte, C; González, M. & Aguayo, O. 2014).

- Abalakov test (ABK): this test is similar to the vertical jump test with counter movement. The fundamental difference lies in the fact that this test allows the free use of arms, therefore it evaluates the influence of these on the vertical jump. After making three attempts, after a break between each of them, the best performance is noted. (Luarte, C; González, M. & Aguayo, O. 2014).

The arithmetic mean (X) and the standard deviation (SD) are used as the main measures of the descriptive statistics. For the analysis of the normal distribution of the sample, the Shapiro-Wilk normality test is used. To verify the significant differences between the groups of each of the variables, one-way ANOVA and Tukey's specificity test were used ($p < 0.05$). The database is built with the Excel version 2007 program, and the statistical program SPSS, version 15.0 for Windows is used.

For the statistical analysis and to determine the effectiveness of the program, the "t" test was used for equality of means in independent samples, with a 95% confidence interval, and for the hypothesis testing t-student test for independent samples in order to determine if the average (average) differences between the two methods are significant.

RESULTS

The descriptive data of the sample are presented in Table 1, as Average and Standard Deviation, and correspond to an age of 20 ± 5 years; a weight of $83.1 \pm 3.8\text{kg}$ and $77.7 \pm 8.1\text{kg}$ for the group plyometric method and the group with overload respectively; and the size of $1.876 \pm 0.04\text{m}$ and $1.843 \pm 0.04\text{m}$ for the plyometric group and 0.02m for the group with overload respectively.

Table 1. Descriptive data of the sample.

Data	Age (a)	Weight (kg)	Size (m)
Pliometry group (n=8)	20±5	83.1 ± 3.8	1.876 ± 0.04
Overload group (n=8)	20±5	77.7 ± 8.1	1.843 ± 0.02

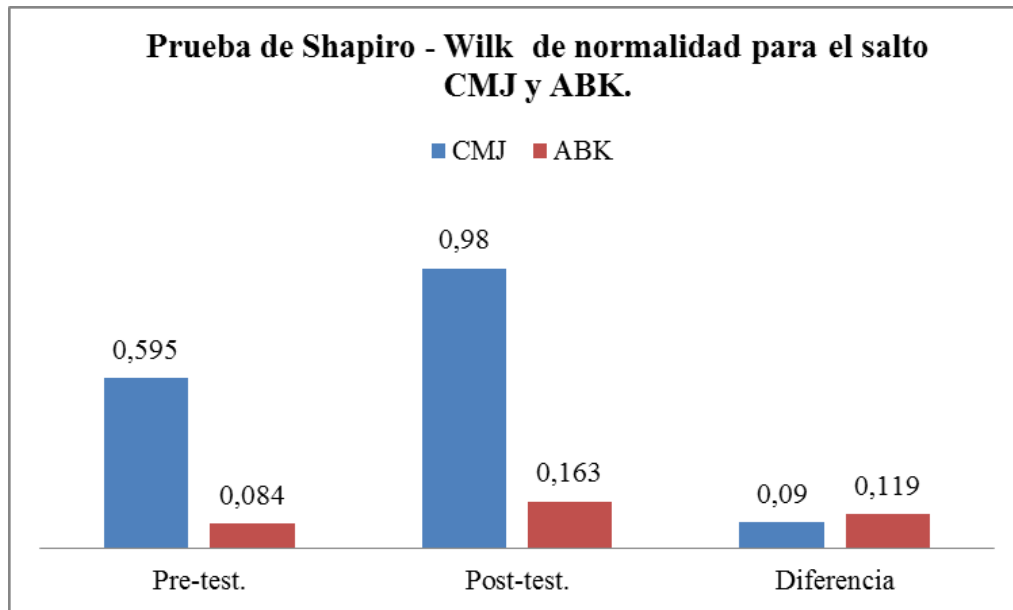
The pre-test and post-test results of the trained groups with the plyometrics method and with the overload method are presented below, for the CMJ and ABK jump tests, pre-program and post 8-week training program; Average and Standard Deviation.

Table 2. Results of CMJ and ABK pre and post program in the Plyometrics and Group Overloads Group.

GROUP	CMJ		ABK	
	Pre-test (cm)	Post-test(cm)	Pre- test (cm)	Post-test (cm)
Plyometric (n=8)	30.5±3,9	34.3±3.8	34.09± 4.01	36.3±4.35
Overloads (n=8)	30.08±3,08	31.94±3.4	33.55±4.29	34.33±4.30

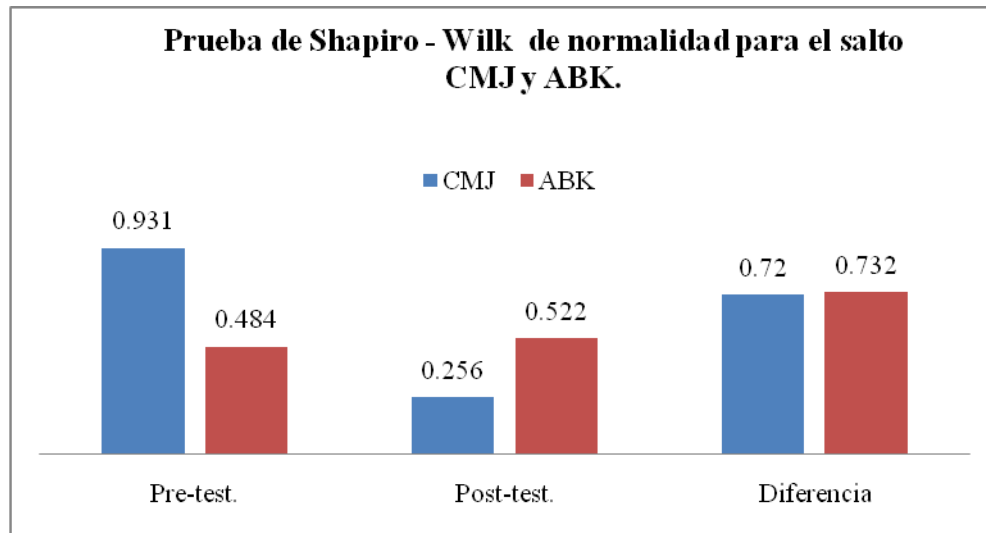
The compliance of the normality assumption for the CMJ and ABK variables, pre-test and post-test for the difference is examined. The results of the Shapiro-Wilk test, in which it is observed that the P-value (Sig) for the data (jumps) of the CMJ variable pre-test is 0.595, while for Abalakov pre-test 0.084, which are greater than 0.05, therefore, this variable is normally distributed. Similarly, the P-value (Sig) for the data of the post-test CMJ variable is 0.98 and ABK is 0.163, which is greater than 0.05, therefore this variable is also normally distributed. Finally, the P-value (Sig) for the variable data CMJ and ABK, for the overload method is 0.09 which is greater than 0.05, therefore the variable Difference presents a normal distribution. These previous data are shown in Figure 1.

Figure 1. Shapiro-Wilk normality test for the CMJ and ABK jump in pre-test and post-test, in the Overload method.



The results of the Shapiro-Wilk test (Figure 2), it is observed that the P-value (Sig) for the data (jumps) of the variable CMJ pre-test is 0.931, and for ABK pre-test is 0.484, which are greater than 0.05, therefore, this variable is normally distributed. Similarly, the P-value (Sig) for the data of the post-test CMJ variable is 0.256, and for the ABK post-test it is 0.522, which is greater than 0.05, so this variable is also distributed usually. Finally, the P-value (Sig) for the data of the variable in the difference CMJ and ABK, for the plyometric method, is 0.72 which is greater than 0.05, therefore the variable Difference presents a normal distribution.

Figure 2. Shapiro-Wilk normality test for the CMJ and ABK jump in the pre-test and post-test. In the method by plyometrics.



The T-student test was applied for independent samples, due to the assumption of both normality and independence if they exist. In addition, equal variances and different variances were considered.

In Table 3, for the Plyometrics Group it is observed that the significance of the CMJ was 0.219 and the ABK was 0.128; the P-value of the test (Sig 2-tailed) is 0.000 (both for equality of variances and for different variances), which is less than 0.05, which indicates that the differences are significant. Consequently, it can be concluded that the plyometric method, developed by the 8 volleyball players belonging to the University of Computer Sciences, on average is better than the method of overloads applied to the other 8 players and evaluated through height. average of the CMJ jump.

Table 3. T-student test, Significance and 2-tailed test of the CMJ and ABK test for the Plyometric and overload groups.

DATA	Sig.	Sig. (2-tailed)
CMJ	0.219	0
ABK	0.128	0

It is deduced that the differences of the CMJ and ABK jumps by means of the plyometric method (Plyometric Group) are greater than their corresponding ones of the CMJ and ABK jumps of the overload method (Overload Group), which allows to deduce that the plyometric method is more efficient than the overload method. This statement was verified by a T-student test for independent samples, determining that the average (average) differences between the two methods are significant.

DISCUSSION

Taking into account the two fields that were reviewed in the study, for the development of the explosive force, and the training methods in the 16 volleyball players belonging to the University of Computer Sciences, the following evaluations were made.

To assess the explosive strength of the lower train in the sport of volleyball, we find several types of jumps in literature, among which the most used by coaches are the vertical jump or sergeant, the horizontal jump and the battery of counter movement (Bosco, C. & Riu, J.M.P. 1994), squat jump, drop jump and Abalakov, (Blasco, H., Ormazábal, V., Armijo, R., Pavez-Adasme, G., Fernandes Da Silva, S., Hernández-Mosqueira, C. & Arcay Montoya, R. 2017).

In relation to the jumps used in this study, (the counter movement and the Abalakov), we find Luarte, C., González, M. & Aguayo, O. (2014), who with spanish youngsters reported a similar jump, both in the CMJ and ABK, although in the latter it was done by playing positions. Additionally, Flores, A., Araya, S., Guzmán, R. & Montecinos, R. (2015), with young chileans, recorded these two jumps very similar to those of the present study.

On the other hand, studies conducted with young Brazilians, Levandoski, G. (2007) and chilean youth, Flores, A., Araya, S., Guzmán, R. & Montecinos, R. (2015), reported higher jumps than of this study, taking into account that they report similar size, weight and age characteristics, which may be due to the training times, which were greater than those of this study.

Olmo Rubio, V.D. (2017), makes a list of training methods for the development of explosive force in the lower train. The most used by the technicians and physical

trainers, according to this author, are plyometric and multi-jump methods, electro stimulation, and exercises with sub-maximum loads.

Among the studies that used the plyometric method, we want to highlight (Flores, A., Araya, S., Guzmán, R. & Montecinos, R. 2015), who with chilean youth and after a 7-week training, managed to improve in significant increase in the jumps of squat jump, against movement and Abalakov. Another study by Velasco, J.M.I., Castan, J.C.R., Da Silva, L.O., Lopez, L.M.M., Marcolin, E. & Campo, S.S. (2016), with young players of collective sports, combined the plyometric method and electro stimulation in two months of training, achieving a significant increase with plyometric training; however, it produced a stagnation of the athletes.

On the other hand, García, L. (2005), with young Argentines combined the plyometric method with the multi jumps in 8 weeks of training, significantly increasing the manifestation of power strength with the Abalakov and Squat Jump test.

In the work of Becerra, R. (2012), with Honduran youth, he also used the plyometric method for 8 weeks in the youth category, producing significant increases in the improvement of the group's saltability, both in the Abalakov test and in the CMJ.

In the present study, the plyometric and overload methods were used for 8 weeks in the groups studied, observing a significant increase in the strength of the lower train with the plyometric method, which was not homogeneous as in the overload method. Regarding the overload method, although there was an increase, this was not significant. One of the probabilities is due to the level of previous training that the group had, where apparently, the accumulation phase in these players was not assimilated adequately, due to a poor recovery. In addition, the exercises had enough demands in relation to the weight, so that in the training they could not finish in some occasions in the most efficient way.

Within the studies carried out with the overload method, Floody, P.D., Poblete, A.O., Fuentes, R.M., & Mayorga, D.J. (2012) and Sixto, A.S., & Martín, P.F. (2017), show through the method of overloading, the quick way to take athletes to high preparation peaks, due to the amount of competition and the time that exists

between one and the other. In addition, it was evidenced that in one of the meso accumulation cycles, maximum strength exercises were used as the basis of the specialized training program, which improved the explosive strength and strength resistance.

For his part, Verjoshansky, Y. (1979), provides the model by overloads, conceived in the idea of developing a model whose structure allows to develop strength in the best possible way, especially in sports of explosive force, which is evidenced by Campos, R. (2003), significantly with triple jump jumpers. Similarly, Forteza De la Rosa, A. (2000) and Forteza De la Rosa, A., & Farto, E.R. (2017), work with sportsmen of soccer the method by overloads, based on the force work, concentrated in a block of training, increasing significantly the power of the players. The plyometrics method, applied in the 16 volleyball players belonging to the University of Computer Science, on average is better than the overload method, evaluated through the average height of the high jump. This is evident both in the CMJ jump and in the Abalakov jump, that is, there was greater average increase (gain) in the jump height in the training. With a significance level of 5%, it is concluded that the training methods with overloads and plyometrics, developed in the 16 volleyball players belonging to the University of Information Sciences, if they increase the explosive force.

It was found that the plyometric method applied to the 16 volleyball players belonging to the University of Information Sciences, increases the explosive strength of the lower train more than the method with overloads.

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