PODIUM
Journal of Science and Technology in Physical Culture
SCIENTIFIC PUBLICATIONS DEPARTAMENT

Volumen 16
Issue 2
2021

University of Pinar del Río "Hermanos Saíz Montes de Oca"

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ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, *May-August 2021; 16(2):17-30*

UNIVERSIDAD DE PINAR DEL RÍO
HERMANOS SAÍZ MONTES DE OCA

PODIUM
REVISTA DE CIENCIA Y TECNOLOGÍA
EN LA CULTURA FÍSICA

Translated from the original in spanish

Original article

Influence of physical speed capacity on jumping power in volleyball, school category

Influencia de la capacidad física de velocidad en la potencia de salto del voleibol escolar

Influência da capacidade física da velocidade no salto em potência no voleibol escolar

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Received: 08/02/2021.
Approved: 20/03/2021.

How to cite ítem: Zapata Cuaspa, M., Ayala Vega, K., & Quintanilla Ayala, L. (2021). Influencia de la capacidad física de velocidad en la potencia de salto del voleibol escolar/Influence of physical speed capacity on jumping power in volleyball, school category. *PODIUM - Revista de Ciencia y Tecnología en la Cultura Física, 16*(2), 553-563. https://podium.upr.edu.cu/index.php/podium/article/view/1086

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, *May-August 2021; 16(2):17-30*

ABSTRACT

Integrated training demonstrates the need to implement various components of preparation to achieve higher performance. The importance of the plyometric method to enhance jumping ability is known, but other capacity such as speed could have a direct or indirect influence. In this sense, the objective is to determine whether the physical capacity for speed influences the jumping power of the school-class volleyball player. Quasi-experimental research of a correlative order that study the population of volleyball players from the "La Salle" Educational Unit, (Experimental Group 1: 26 students) and the "Oswaldo Lombeyda" Educational Unit (Control Group 2: 25 students), male gender, category 13-14 years. The groups underwent the same training, except that in the experimental group it was implemented a work strategy with physical stimuli, prioritizing speed loads for lower limbs. The means in jumping ability were significantly increased for the related samples (p = 0.000) in both groups (Group 1: ?4.38cm to ?6.23cm; Group 2: ?4.40cm to ?6.04cm) as part of posttest, there were no differences between independent groups (Pretest: k = 0.894; Posttest: k = 0.605), while the speed capacity for related groups increased significantly (p = 0.000) in posttest favor, there were no pretest differences (k = 0.183), with differences in the posttest in favor of the experimental group (k = 0.009). It is demonstrated a potentiation of the school volleyball player's jump, given the application of the plyometric method, repetition method and performance assessment test.

Keywords: Speed; Power; Jump; School volleyball.

RESUMEN

El entrenamiento integrado evidencia la necesidad de implementar varios componentes de la preparación para lograr mayores rendimientos. Es conocido la importancia que reviste el método pliométrico para potenciar la habilidad motriz salto, pero otras capacidades como la velocidad pudieran influir directa o indirectamente. En tal sentido, se planteó como objetivo determinar si la capacidad física de velocidad influye en la potencia de salto del voleibolista de categoría escolar. Esta investigación es de tipo cuasi-experimental, de orden correlativa, que estudia la población de voleibolistas de la Unidad Educativa *La Salle*, (grupo 1 experimental: 26 estudiantes) y la Unidad Educativa *Oswaldo Lombeyda* (grupo 2 control: 25 estudiantes), género masculino y categoría 13-14 años. Los grupos se sometieron al mismo entrenamiento, excepto el grupo experimental que se le implementó una estrategia de trabajo con estímulos físicos, que prioriza cargas de velocidad para miembros inferiores. Las medias en la habilidad de salto se incrementaron significativamente para las muestras relacionadas (p=0.000) en ambos grupos (grupo 1: ☐4.38 cm. a ☐6.23 cm.; grupo 2: ☐4.40 cm. a ☐6.04 cm) como parte del postest, lo cual no muestra diferencias entre grupos independientes (pretest: k=0.894; postest: k=0.605), mientras que la capacidad de velocidad para grupos relacionados se incrementaron significativamente (p=0.000) a favor del postest, no existiendo diferencias en el pretest (k=0.183) y sí en el postest, a favor del grupo experimental (k=0.009). Se demuestra una potenciación del salto del voleibolista escolar, dada la aplicación del método pliométrico, método de repeticiones y *test* de valoraciones de rendimiento.

Palabras clave: Velocidad; Potencia; Salto; Voleibol escolar.

ISSN: 1996–2452 RNPS: 2148
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RESUMO

O treino integrado mostra a necessidade de implementar vários componentes da preparação para alcançar um maior desempenho. É conhecida a importância do método pliométricos para melhorar a habilidade motora de salto, mas outras capacidades como a velocidade podem influenciar direita ou indiretamente. Neste sentido, o objectivo é determinar se a capacidade física da velocidade e sua influência no poder de salto do jogador de voleibol da categoria escolar. Esta investigação é de tipo quase experimental, de ordem correlativa, que estuda a população de jogadores de voleibol da Unidade Educativa La Salle (grupo experimental 1: 26 estudantes) e da Unidade Educativa Oswaldo Lombeyda (grupo de controlo 2: 25 estudantes), sexo masculino e categoria 13-14 anos de idade. Os grupos foram submetidos à mesma formação, exceto para o grupo experimental que foi implementado uma estratégia de trabalho com estímulos físicos, que dá prioridade às cargas de velocidade para os membros inferiores. Os meios em capacidade de salto aumentaram significativamente para as amostras relacionadas (p=0,000) em ambos os grupos (grupo 1: 4,38 cm. a 6,23 cm.; grupo 2: 4,40 cm. a 6,04 cm.) como parte do pós-teste, que não mostra diferenças entre os grupos independentes (pré-teste: k=0. 894; posttest: k=0,605), enquanto a capacidade de velocidade para grupos relacionados aumentou significativamente (p=0,000) a favor do posttest, sem diferenças no pré-teste (k=0,183) e no posttest, a favor do grupo experimental (k=0,009). Demonstra-se uma potenciação do salto do jogador de voleibol escolar, dada a aplicação do método pliométrico, método de repetições e teste de avaliação do desempenho.

Palavras-chave: Velocidade; Potência; Salto; Voleibol escolar.

INTRODUCTION

The training of volleyball players to achieve the highest sports performances requires a series of conditions and factors that the field of theory and methodology of applied sports training intend to manage in an integral way. The integrating aspect of the content of sports preparation is, without a doubt, a primary objective to achieve a successful sports team that achieves the supreme desired end, (Morales., 2018) which is none other than to achieve a stable performance in any of the championships where it participates.

Generally, in volleyball sport, physical preparation plays a decisive role in the sports results of any professional team, and even, of initiation categories, (Morales, 2013; Forte, Ceciliani, Izzo, & Altavilla, 2019; Yerlan, Iosif, Bauyrzhan, Dinara, & Mart, 2020). Therefore, highly professionalized coaches use a series of general and special physical capacities to develop overall sport performance.

The development of the jumping motor skill in a volleyball player is one of the fundamental components of specific training most developed by successful coaches, (Martinez-Rodriguez, Mira-Alcaraz, Cuestas-Calero, Pérez-Turpín, & Alcaraz, 2017; Gonçalves, Lopes, Marinho, & Neiva, 2019). This essentially emphasizes the related work between conditioning and determining physical fitness capacities, oriented to specific performance, as would be the development of a greater range for the game with the ball, based on the multilateral development of the athlete.

In the national and international literature, numerous training methods and techniques are highlighted to enhance jumping as a determining skill in volleyball players, where plyometric work is included to develop muscle power (Martínez-Rodríguez, Mira-Alcaraz, Cuestas-Calero, Pérez-Turpín, & Alcaraz, 2017; Gjinovci, Idrizovic, Uljevic, & Sekulic,

2017; Mroczek, *et al.*, 2017). In them, related factors such as the position of the player or the body parts to be prioritized in such type of training are taken into account, (Gonçalves, Lopes, Nunes, Marinho, & Neiva, 2019). On the other hand, the more general development of strength capacity work has been taken into account, (Martínez, 2017) bearing in mind various factors, including the age range of each player (Kitamura, *et al.*, 2017).

Although plyometric work is usually the most commonly used to develop jumping ability, as can be established by the number of works consulted on this subject, there are alternatives to jumping training. These, directly or indirectly, could enhance explosive strength and general skills. In this context and from the technical-tactical point of view, it is suggested that the alternatives influence the specific performance of the athlete, as could be the development of speed or quickness as a physical capacity.

Conceptually, speed is defined as a magnitude by which an object or phenomenon changes position. In sports training theory, it is defined as the capacity for movement of a limb or part of the body's lever system or the whole body, with the highest possible speed in a given time. (Weineck, 2019) Therefore, its relationship with speed follows, a definition that addresses the speed of the movement itself, its frequency and speed of motor reaction.

Combined or comprehensive sports training programs have been considered to be more effective in practical terms. Similarly, strength and speed training at high intensities, in the ability to run and jump in players of different sports such as soccer, behaves in the same way (Kotzamanidis, Chatzopoulos, Michailidis, Papaiakovou, & Patikas, 2005). In the study, no works related to this field of study are specified in sports such as volleyball, in initiation categories, an aspect that aims to justify the object of study of the present research.

In this work, it is necessary to demonstrate the influences that directly and indirectly can have a specialized training of the speed capacity on the jumping skill in school volleyball players. This demonstration demands, given the need to develop integrative alternatives in the sports training of school volleyball categories, that essential components of the sports preparation such as the motor skill of jumping are enhanced. This is an aspect that facilitates optimized training alternatives that can be methodologically modeled in school sports initiation training plans. Therefore, the purpose of the research was to determine whether the physical capacity of speed influences the jumping power of school volleyball players.

MATERIALS AND METHODS

The research applied is of a quasi-experimental type, of correlative order. The population of volleyball players of the La Salle Educational Unit (experimental group 1: 26 students) and the population of volleyball players of the Oswaldo Lombeyda Educational Unit (Control Group 2: 25 students), both groups with an age range of 13-14 years (school category) and with a similar sports performance (male gender) are studied. The study is complemented for its selection with five inclusion criteria (being a student of the mentioned schools, having the mentioned age range, not presenting any type of disability or health problem that prevents the textual application of the intervention

proposals, at least two previous years of systematic training in the studied sport and signing of a consensual biomedical agreement).

For the evaluation process of the speed capacity and the motor skill of jumping, three volleyball specialists were selected, based on two inclusion criteria (university degree in Physical Activity and Sport Sciences or similar and experience of at least ten years working in the study category), in order to achieve reliability in the recording and processing of the data.

The independent groups studied were subjected to the same training in the general preparation period (four mesocycles: 24 weeks) in terms of intensity, volume, density, work time and content of the sports preparation with the same technical direction (although in different schedules). For the case of jumping ability potentiation, an approved plyometric training was applied for the formation categories under study. Additionally and only for the experimental group, a work strategy was implemented with physical stimuli that prioritized speed loads adapted to the lower limbs, which included physical stimuli without auxiliary implements such as weights (with ball and without ball), prioritizing the repetition method.

The performance assessment tests applied include the following tests: 1) Vertical jump with impulse run (SVCI in Spanish): A dynamographic platform will be used, with a control software and the so-called Counter Movement Jump test is applied, jumping upwards and activating a stretch-shortening cycle, using the hands as a take-off pendulum, the take-off time is calculated in the software and, therefore, the height in centimeters. 2) Speed in 20 meters: Athletes are positioned at the end line of the ground in mid-start and move at maximum speed up to the distance of 20 m. Two repetitions will be performed and the shortest time recorded is selected.

To compare related data, the Wilcoxon signed ranks test ($p \leq 0.05$) was used and to compare data for two independent samples, the Mann-Whitney U ($k \leq 0.05$) will be used as there is no normal distribution of the data.

RESULTS AND DISCUSSION

Table 1 shows the results obtained in the two moments of the vertical jump test (SVCI), as part of the pretest in the experimental group (group 1). A mean of *X*4.38 cm was obtained, increasing as part of the post-test to *X*6.23 cm, this is shown for the case of the control group as an initial mean of *X*4.40 cm and increases as part of the post-test to *X*6.04 cm (Table 1).

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, May-August 2021; 16(2):17-30

Table 1. - Results of the Jumping tests

No	Group 1		Group 2	
	Pretest	Postest	Pretest	Postest
1	5	7	4	6
2	4	7	4	6
3	6	8	5	6
4	4	5	6	6
5	5	8	5	6
6	4	6	5	6
7	4	5	4	6
8	5	6	3	5
9	3	5	5	7
10	4	7	4	5
11	4	7	4	5
12	5	7	5	6
13	4	5	4	7
14	4	5	6	7
15	3	5	4	8
16	5	6	5	7
17	6	6	3	5
18	4	5	4	5
19	6	8	4	5
20	5	7	4	6
21	4	6	5	7
22	3	5	4	6
23	4	6	5	6
24	4	6	4	6
25	5	8	4	6
26	4	6		
□	**4,38**	**6,23**	**4,40**	**6,04**

The comparison of the data obtained in the two moments of the vertical jump test shows significant differences in both independent groups studied, where the experimental group presented significant differences (p=0.000). This behaves in favor of the post-test, as well as the control group (p=0.000), which indicates that the plyometric training applied significantly improved the jumping ability of the volleyball player under study.

The above evidences the importance of the plyometric method to achieve power in the jumping skill, especially in lower limbs. This is an aspect theorized by Verkhoshansky (2006) and demonstrated, from praxis, by numerous researches as in Mroczek, *et al.*, (2017). These studies evaluated a plyometric intervention program on the jumping capacity of volleyball players, with positive effects between week three to six, as does

the work of Vilela, Caniuqueo, Campillo, Hernández-Mosqueira, & da Silva (2021), in different groups, with different levels of biological maturation. Here, different significant or non-significant adaptive responses related to jumping power are obtained.

On the other hand, in the analysis of the results, it was evident that both independent groups, before beginning the sports training process, presented similar performances in their jumping ability (group 1: 4.38 cm; group 2: 4.40 cm). These are slightly higher in the control group, although not significant (k=0.894). It is shown that both groups were correctly selected as they presented similar levels of jumping power. When comparing the data obtained as part of the post-test in both independent groups, it was also shown that there were no significant differences (k=0.605). Even so, the experimental group evidenced a higher average range (27) than the control group (24.96), data that are in correspondence with the means obtained in both cases. These data indicated that the specialized speed training did not significantly influence the development of jumping ability, although slight improvements were evident in the experimental group.

For the case of the results recorded with the 20 m speed test, Table 2 shows similar averages as part of the pretest, where the average of group 1 or experimental obtained, as part of the initial test, an average of 4.09 m/s. Corresponding to this, group 2 or Control group obtained an initial mean or average of 4.10 m/s. On the other hand, Group 1's mean as part of the post-test stood at 3.80 m/s. In group 2, the average was 4.00 m/s, improving both independent groups' speed capacity as part of the training to which they were subjected (Table 2).

Table2. Results of the speed tests

No	Grupo 1		Grupo 2	
	Pretest	Postest	Pretest	Postest
1	4,08	4,04	4,05	4,03
2	4,02	3,08	4,08	4,06
3	4,02	3,09	4,08	4,04
4	4,09	4,04	4,05	4,01
5	4,07	4,06	4,03	3,08
6	4,06	4,04	4,06	4,04
7	4,05	4,01	4,09	4,04
8	4,07	4,05	4,08	4,05
9	5	4,6	4,07	4,04
10	4,09	4,04	4,08	4,05
11	4,08	4,04	4,06	4,04
12	4,02	4	4,07	4,05
13	4,05	4,01	4,07	4,05
14	4,05	4,01	4,04	4,02

15	4,09	4,02	4,06	4,02
16	4,06	4,01	4,05	4,01
17	4,04	4,01	4,09	4,04
18	4,07	4,03	4,08	4,05
19	4,08	4,02	4,06	4,03
20	4,07	4,03	4,05	4,02
21	4,03	3,08	4,09	4,05
22	4,05	3,09	4,06	4,03
23	4,04	3,08	4,04	4,01
24	4,05	3,09	4,09	4,05
25	4,02	3,07	5	4,07
26	4,06	4,03		
□	**4,09**	**3,80**	**4,10**	**4,00**

When comparing the data obtained in terms of related samples, the experimental group showed significant differences (p=0.000) in the speed achieved as part of the post-test, as did the control group (p=0.000); therefore, the training of four mesocycles made it possible to enhance this capacity. Although both independent groups presented a similar level in their speed performance (k=0.183) at the beginning of the intervention program, only the experimental group presented a better performance at the end of said program (k=0.009), by presenting a lower average range (538.50) than that evidenced in the control group (720.00), an aspect that is in correspondence with the mean values reached (Table 2).

In this sense, the present study demonstrates a better potentiation of the physical capacity of speed in the experimental group. This is an aspect expected by the authors, when presenting a group of specialized physical stimuli as part of their sports training. While there is agreement on the importance of speed training in volleyball players, (Kotzamanidis, Chatzopoulos, Michailidis, Papaiakovou, & Patikas, 2005; Martinez, 2017; Yerlan, Iosif, Bauyrzhan, Dinara, & Mart, 2020) and despite the physical stimuli applied, the training program implemented in the experimental group, this did not present a noticeable improvement in the jumping skill of the studied volleyball player, as can be deduced by analyzing the data presented as part of Table 1.

In this sense, it is agreed with Calero (2019) and Gjinovci, Idrizovic, Uljevic, & Sekulic (2017) on the need to combine different components of the volleyball player's preparation, such as the capacity to accelerate, jump and throw, indispensable components of plyometric conditioning, together with volleyball skills. Therefore, the authors consider it necessary to carry out further studies that control the effects of combining certain capacities such as speed with the application of methods such as plyometrics, in order to evaluate the scope and limitations of an integrated training.

CONCLUSSIONS

Conclusively, this study shows a potentiation of the jumping ability of the volleyball player studied, regardless of the group researched, largely due to the application of the plyometric method. However, there is no evidence of a significant influence on the potentiation of the jumping skill, when implementing specialized speed stimuli in lower limbs as part of the training of the experimental group; however, it is estimated that speed can function as a complementary technique that facilitates the acquisition of an integral improvement in the potentiation of the jumping ability of school volleyball.

It is recommended to deepen the studies, assessing implementation alternatives when applying other methods to develop the capacity of speed, even, assessing the applications of such physical stimuli for a longer period of time.

AKNOWLEDGEMENTS

To the AFIDESA Research Group (Physical Activity, Sports and Health) of the University of the Armed Forces ESPE, for the advice and implementation of the intervention proposal.

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Conflict of interests:
The authors declare not to have any interest conflicts.

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, *May-August 2021; 16(2):17-30*

Authors' contribution:

Miguel Alexander Zapata Cuaspa: Conceptualization, acquisition of funds, resources, drafting.

Karla Paola Ayala Vega: Data curation, research, methodology.

Leonardo Xavier Quintanilla Ayala: Conceptualization, Project management, Supervision.