

# INFLUENCES OF COMPOUND EXERCISES ON JUMPING IN VOLLEYBALL



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INFLUÊNCIAS DE EXERCÍCIOS COMPOSTOS SOBRE O SALTO NO VOLEIBOL

INFLUENCIA DE LOS EJERCICIOS COMPUESTOS EN EL SALTO EN VOLEIBOL

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## ABSTRACT

**Introduction:** Volleyball requires athletes to have high global sport capacity. Compound exercises require more than one muscle group to complete a given movement. They are ideal for jump development in volleyball because they replicate how the athlete's body moves naturally. However, the attributes relevant to this technique are not fully understood. **Objective:** Study compound exercise's effects on volleyball players' jumping ability. **Methods:** The controlled experiment method was used in 30 volunteers equally distributed in two groups, with a duration of 8 weeks. The control group received traditional training. The experimental group received training sessions directed by compound exercises. The sessions were applied twice a week, lasting 80 minutes per session, including 15 minutes of warm-up and 10 minutes of cool-down. The indicators were collected individually before and after the experiment, and the data were analyzed and statistically confronted. **Results:** The experimental group showed better results on standing vertical jump height, touch height, and blocking height after the compound exercise. **Conclusion:** The proposed compound exercise can improve players' physical quality, impacting their professional quality, to ensure sporting interest. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Exercise Training; Volleyball; Physical Fitness.

## RESUMO

**Introdução:** O voleibol exige que os atletas tenham alta capacidade esportiva global. Os exercícios compostos requerem mais de um grupo muscular trabalhando em conjunto para completar um determinado movimento, sendo ideal para o desenvolvimento de salto no esporte do voleibol por replicar a maneira como o corpo do atleta move-se naturalmente. Porém, os atributos relevantes para essa técnica não estão totalmente esclarecidos. **Objetivo:** Estudar os efeitos do exercício composto na capacidade de salto dos jogadores de voleibol. **Métodos:** Utilizou-se o método de experimento controlado em 30 voluntários igualmente distribuídos em dois grupos, com duração de 8 semanas. O grupo controle recebeu o treinamento tradicional. Treinamentos direcionados foram direcionados por exercícios compostos ao grupo experimental. As sessões foram aplicadas duas vezes por semana, com duração de 80 minutos por sessão, incluindo 15 minutos de aquecimento e 10 minutos resfriamento. Os indicadores foram coletados individualmente antes e depois do experimento, os dados foram analisados e confrontados estatisticamente. **Resultados:** O grupo experimental apresentou melhores resultados sobre a altura do salto vertical em pé, altura de toque e altura de bloqueio após o exercício composto. **Conclusão:** O exercício composto proposto pode melhorar a qualidade física dos jogadores, impactando na qualidade profissional, com a premissa de garantir o interesse esportivo. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Treinamento Físico; Voleibol; Aptidão Física.

## RESUMEN

**Introducción:** El voleibol exige que los atletas tengan una alta capacidad deportiva global. Los ejercicios compuestos requieren más de un grupo muscular trabajando en conjunto para completar un movimiento determinado, siendo ideal para el desarrollo del salto en el deporte del voleibol por replicar la forma en que el cuerpo del atleta se mueve naturalmente. Sin embargo, los atributos relevantes para esta técnica no se conocen del todo. **Objetivo:** Estudiar los efectos del ejercicio compuesto sobre la capacidad de salto de los jugadores de voleibol. **Métodos:** Se utilizó el método de experimento controlado en 30 voluntarios distribuidos equitativamente en dos grupos, con una duración de 8 semanas. El grupo de control recibió formación tradicional. El grupo experimental recibió sesiones de entrenamiento dirigidas por ejercicios compuestos. Las sesiones se aplicaron dos veces por semana, con una duración de 80 minutos por sesión, incluidos 15 minutos de calentamiento y 10 minutos de enfriamiento. Los indicadores se recogieron individualmente antes y después del experimento, se analizaron los datos y se confrontaron estadísticamente. **Resultados:** El grupo experimental mostró mejores resultados en la altura de salto vertical de pie, la altura de toque y la altura de bloqueo tras el ejercicio compuesto. **Conclusión:** El ejercicio compuesto propuesto puede mejorar la calidad física de los jugadores, repercutiendo en la calidad profesional, con la premissa de garantizar el interés deportivo. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptor:** Entrenamiento Físico; Voleibol; Aptitud Física.



## INTRODUCTION

In the process of volleyball sports, athletes need to have sufficient comprehensive sports ability.<sup>1</sup> It includes a series of sports related attributes such as speed, strength, bounce, explosive force and endurance. Because there are many sports links involved in volleyball jumping, the relevant attributes of jumping ability are particularly important.<sup>2</sup> It is necessary to improve the performance of volleyball events to cultivate athletes' excellent jumping ability. Jumping is the basic technical action of volleyball, so the training of jumping ability also lays a good foundation for volleyball players.<sup>3,4</sup> At present, the fast telescopic compound exercise is an advanced training method, which can improve the jumping ability of athletes. Therefore, the related research on the rapid expansion and contraction compound exercise is helpful to the development of Chinese volleyball, and can effectively improve the sports performance of Chinese volleyball.<sup>5</sup>

## METHOD

After fully informing the experimental precautions, relevant instructions and the key points that the athletes need to pay attention to, this paper selected some volleyball athletes from the sophomores and juniors of a university as the research objects. The study and all the participants were reviewed and approved by Ethics Committee of Chongqing Normal University (NO.2019CQNU-265). After certain inclusion and exclusion, 30 subjects were finally obtained. As shown in Table 1, they are divided into the experimental group and the control group according to the form of random sampling. The number of people in the experimental group is 15, whose age is  $(22.32 \pm 1.0674)$  years, height is  $(176.51 \pm 3.2262)$  cm, weight is  $(71.16 \pm 3.3983)$  kg, and ball age is  $(5.99 \pm 0.3471)$  years. The number of control group was 15, whose age was  $(22.81 \pm 1.3939)$  years, height was  $(183.99 \pm 2.6378)$  cm, weight was  $(73.24 \pm 7.5172)$  kg, and ball age was  $(5.04 \pm 0.6942)$  years. The P value calculation of the basic situation of the two groups of subjects is greater than 0.05, indicating that there is no significant difference.

This experiment adopts the method of control experiment. The experimental group uses the rapid expansion and contraction compound exercise method during the exercise, while the control group uses the traditional frog jump, squat and other movements to exercise the jumping ability. The experiment lasted for 8 weeks, and related training was carried out twice a week, each training time was 80 minutes, including 15 minutes of warm-up training and 10 minutes of relaxation training, to reduce the occurrence of sports injuries and ensure the best physical condition of athletes. The experimental group and the control group kept basically the same in other volleyball specific exercises and physical training, except for jump exercises, so as to minimize the interference of irrelevant variables on the experimental results.

The observation indicators in this paper are divided into two categories. One is the change of volleyball players' physical fitness, which is related to the basic sports ability of the players, including 30-meter accelerated run, 20 m timed single foot jump, standing long jump, standing triple jump and other options. The second is the change of athletes' jumping skills, which is related to the actual needs of volleyball, including the options of standing jump, three-step run-up and block

**Table 1.** Basic information of subjects in two groups (experimental group=15 persons, control group=15 persons).

Group	Experimental group	Control group	P
Age/Year	22.32±1.0674	22.81±1.3939	0.18544
Height/cm	176.51±3.2262	183.99±2.6378	0.15350
Weight/kg	71.16±3.3983	73.24±7.5172	0.14453
Ball age/year	5.99±0.3471	5.04±0.6942	0.67264

height. In order to minimize the impact of variables such as weather and surrounding environment on athletes' performance, several data measurements in this paper are all conducted in the venue. Data were measured before and after the experiment for 8 weeks.

## RESULTS

### Changes of physical fitness of volleyball players before and after the experiment

The physical fitness of the athletes represented by the indicators such as 30-meter accelerated run, 20-meter timed single foot jump, standing long jump and standing triple jump can not only reflect the training effect of the sport, but also show the improvement of the athletes' physical fitness and physical fitness. These indicators can also be integrated into the process of volleyball, so as to increase the physical basis of athletes, so that athletes can improve their speed and jumping skills in the process of volleyball training and competition, so as to gain more initiative in the field.

Table 2 shows the changes of physical fitness of volleyball players in the experimental group. The performance of the 30 meter acceleration race increased from  $(4.31 \pm 0.2338)$  s before the experiment to  $(4.14 \pm 0.2190)$  s after the experiment, with an increase of 1.86431%; The result of single foot jump with 20 m timing increased from  $(3.99 \pm 0.4264)$  s before the experiment to  $(3.92 \pm 0.2479)$  s after the experiment, with an increase of 3.79435%; The standing long jump performance increased from  $(2.75 \pm 0.7609)$  m before the experiment to  $(2.89 \pm 0.6493)$  m after the experiment, with an increase of 2.57183%; The standing triple jump performance increased from  $(8.04 \pm 0.4492)$  m before the experiment to  $(8.09 \pm 0.4779)$  m after the experiment, with an increase of 4.57017%. From the comparison results of data, it can be seen that the fast telescopic compound exercise can improve the jumping distance of athletes and shorten the time required for running and jumping, so that athletes can obtain stronger jumping ability and faster speed in the competition field.

Table 3 shows the changes of physical fitness of volleyball players in the control group. The performance of the 30 meter acceleration race increased from  $(4.33 \pm 0.2033)$  s before the experiment to  $(4.19 \pm 0.1991)$  s after the experiment, with an increase of 0.92224%; The result of single foot jump at 20 m timing increased from  $(3.91 \pm 0.1983)$  s before the experiment to  $(4.10 \pm 0.3768)$  s after the experiment, with an increase of 2.75953%; The standing long jump performance increased from  $(2.77 \pm 0.8522)$  m before the experiment to  $(2.80 \pm 0.9131)$  m after the experiment, with an increase of 1.47397%; The standing triple jump performance increased from  $(7.99 \pm 0.4492)$  m before the experiment to  $(7.91 \pm 0.4381)$  m after the experiment, with an increase of 2.97842%. It can be seen from this that the traditional jumping exercise, represented

**Table 2.** Changes in physical fitness of volleyball players in the experimental group.

Index	Before	After	Increase range	P
30 meter acceleration run/s	4.31±0.2338	4.14±0.2190	1.86431%	0.27446
20m time single hop/s	3.99±0.4264	3.92±0.2479	3.79435%	0.03967
Standing long jump/m	2.75±0.7609	2.89±0.6493	2.57183%	0.03044
Standing triple jump/m	8.04±0.4492	8.09±0.4779	4.57017%	0.09765

**Table 3.** Changes in physical fitness of volleyball players in the control group.

Index	Before	After	Increase range	P
30 meter acceleration run/s	4.33±0.2033	4.19±0.1991	0.92224%	0.41678
20m time single hop/s	3.91±0.1983	4.10±0.3768	2.75953%	0.04958
Standing long jump/m	2.77±0.8522	2.80±0.9131	1.47397%	0.04058
Standing triple jump/m	7.99±0.4492	7.91±0.4381	2.97842%	0.03906

by squatting and frog jumping, can also shorten the time for running and jumping and improve the jumping distance, but its increase is not obvious compared with the experimental group. This shows that the training efficiency of the existing volleyball jumping training strategy is lower than that of the fast expansion compound training method, so it should be improved in the subsequent practical training.

### Changes in jumping skills of volleyball players before and after the experiment

The jumping skills of volleyball players represented by the indicators of standing jump, three-step run-up and block height have the most direct connection with the training effect of athletes on the volleyball court. On the volleyball court, the higher the athletes jump, the more they can catch the ball within a wider range, so as to grasp more initiative in the volleyball court, improve their coping ability, enhance their competitive level and improve their sports performance.

Table 4 shows the changes of jumping skills of volleyball players in the experimental group. The result of standing vertical jump touch height was increased from ( $51.23 \pm 0.2745$ ) cm before the experiment to ( $53.05 \pm 0.4182$ ) cm after the experiment, with an increase of 5.89101%; The result of the three-step run-up touch height is increased from ( $324.02 \pm 1.1870$ ) cm before the experiment to ( $338.25 \pm 0.8928$ ) cm after the experiment, with an increase of 1.86662%; The blocking height is increased from ( $312.85 \pm 1.0753$ ) cm before the experiment to ( $320.97 \pm 1.3867$ ) cm after the experiment, with an increase of 1.42885%.  $P < 0.01$ , indicating a very significant difference. It can be seen from the data that the jumping height of the athletes on the volleyball court has been significantly improved after the fast telescopic composite exercise, which is very helpful to the improvement of the athletes' competitive level and sports performance.

Table 5 shows the changes of jumping skills of volleyball players in the control group. The results of standing vertical jump touch height increased from ( $51.36 \pm 0.4981$ ) cm before the experiment to ( $51.32 \pm 0.6671$ ) cm after the experiment, with an increase of 2.21369%; The result of the three-step run-up touch high is increased from ( $320.92 \pm 2.2928$ ) cm before the experiment to ( $332.66 \pm 2.4044$ ) cm after the experiment, with an increase of 1.14023%; The blocking height is increased from ( $308.70 \pm 1.5731$ ) cm before the experiment to ( $319.57 \pm 1.2500$ ) cm after the experiment, with an increase of 0.54361%. From the data results, it can be seen that the traditional jumping exercise also has a certain optimization effect on improving the jumping skills of athletes, but there are still some deficiencies compared with the increase range of the experimental group in Table 4. Therefore, the rapid telescopic composite exercise proposed in this paper has a stronger role in improving the jumping skills of athletes on the volleyball court.

### DISCUSSION

The principle of rapid expansion and contraction compound exercise is through the interaction of nervous system and muscle system. The function of producing extra force for the body. There are many forms of rapid expansion compound exercise. The first is the basic jumping exercise. The basic single jump can be practiced through a jump or a group during training. The number of jumps in each group can be planned according to your physical ability. Basic multi jump, complete the repetitions of your training plan through your own continuous take-off movements. Multi jump can increase the training difficulty by setting certain obstacles during the jump. The training purpose of the rapid expansion and contraction compound exercise is to comprehensively improve the explosive force of your own jumping. Through the combination of various skills in the training

**Table 4.** Changes in jumping skills of volleyball players in the experimental group.

Index	Before	After	Increase range	P
Vertical jump height in situ/cm	51.23±0.2745	53.05±0.4182	5.89101%	0.00000
Three step run-up touch height/cm	324.02±1.1870	338.25±0.8928	1.86662%	0.00000
Blocking height/cm	312.85±1.0753	320.97±1.3867	1.42885%	0.00000

**Table 5.** Changes in jumping skills of volleyball players in the control group.

Index	Before	After	Increase range	P
Vertical jump height in situ/cm	51.36±0.4981	51.32±0.6671	2.21369%	0.00000
Three step run-up touch height/cm	320.92±2.2928	332.66±2.4044	1.14023%	0.00000
Blocking height/cm	308.70±1.5731	319.57±1.2500	0.54361%	0.02930

link, the training can be more targeted. It can improve its own speed, jumping height, sensitivity, coordination, speed and other related motion attributes. After a certain number of consecutive bounces, accelerate quickly. With the help of auxiliary equipment, advanced training can be carried out by continuously jumping boxes. These methods can improve their own motion attributes. The more common practice method is the original jump. When training, fix your body in a certain position, and fall back to the takeoff position by taking off in situ. This method is helpful to improve the landing technique during the movement. And through the incremental take-off method, you can effectively improve your own jumping explosive force. The second is standing jump. During training, you can determine a moving direction by taking a single jump or multiple jumps, and move towards the target by bouncing. The standing jump exercise can be carried out underground on the training ground with a certain slope, and the training difficulty can be increased by adjusting the angle of the slope. After a long time of training, it can effectively improve the athletes' jumping height, jumping speed, endurance, explosive power and other important sports abilities. When the athletes have reached a certain level of jumping ability through training, they can carry out intensive exercise by means of weight bearing exercise. Coaches conduct ability assessment for athletes to guide them and select appropriate weight bearing.

### CONCLUSION

The training of athletes' jumping ability has always been a key point of volleyball players' training. After studying the existing literature and interviewing some volleyball teachers on the spot, the author found that the jumping ability of volleyball players was not scientific enough at present, and many colleges and universities chose traditional training forms such as squatting and frog jumping. Although these training activities can also improve the jumping skills of athletes, the training effect is not significant enough, and it is easy to appear boring, which needs to be optimized and improved. The research results show that the rapid expansion and contraction compound exercise proposed in this paper can improve the physical quality of volleyball players, enhance their jumping skills, and make them master more initiative on the volleyball court on the premise of ensuring sports interest. Therefore, in the actual volleyball teaching and training, we should consciously increase the relevant ways of rapid expansion and contraction composite exercise to improve the training efficiency of athletes' jumping training.

All authors declare no potential conflict of interest related to this article

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