

# PHYSICAL FITNESS TRAINING OF VOLLEYBALL PLAYERS BASED ON SCIENTIFIC THEORY



ORIGINAL ARTICLE  
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TREINAMENTO DE APTIDÃO FÍSICA DE JOGADORES DE VOLEIBOL BASEADO NA TEORIA CIENTÍFICA

ENTRENAMIENTO FÍSICO DE JUGADORES DE VOLEIBOL BASADO EN LA TEORÍA CIENTÍFICA

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## ABSTRACT

**Introduction:** Athletes' physical fitness is the basis for improving their volleyball skills, and physical training can play an essential role in the whole process of training volleyball players resulting in improving the level of physical function of volleyball players and changing the structure of body conformation. **Objective:** Analyze the effects of physical training on the overall quality of volleyball players. **Methods:** Several volleyball players were randomly selected and submitted to two months of physical training based on scientific theory literature. We used mathematical statistics to analyze the fitness and performance indicators of volleyball players before and after physical training. **Results:** The physical fitness of volleyball players was significantly improved after two months of physical training ( $P < 0.05$ ). The performance of volleyball players improved after physical training ( $P < 0.05$ ). **Conclusion:** Physical agility of volleyball players is improved when submitted to systematic physical training. After physical training, the velocity quality of volleyball players can be significantly improved. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Physical Exercise; Volleyball; Athletes; Sports.

## RESUMO

**Introdução:** A preparação física do atleta é a base para melhorar suas habilidades no vôlei e o treinamento físico pode ter um papel essencial em todo o processo no treino dos jogadores de voleibol resultando na melhora do nível de função física dos jogadores de vôlei e alterar a estrutura da conformação corporal. **Objetivo:** Analisar os efeitos do treinamento físico na qualidade geral dos jogadores de voleibol. **Métodos:** Vários jogadores de voleibol foram selecionados aleatoriamente e submetidos a dois meses de treinamento físico embasado na literatura da teoria científica. Foram utilizadas estatísticas matemáticas para analisar os indicadores de aptidão física e desempenho dos jogadores de voleibol antes e depois do treinamento físico. **Resultados:** A aptidão física dos jogadores de vôlei foi significativamente aprimorada após dois meses de treinamento físico ( $P < 0,05$ ). O desempenho dos jogadores de voleibol melhorou após o treinamento físico ( $P < 0,05$ ). **Conclusão:** A agilidade física dos jogadores de voleibol é aprimorada quando submetida ao treinamento físico sistemático. Após o treinamento físico, a qualidade da velocidade dos jogadores de voleibol pode ser significativamente melhorada. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Treinamento Físico; Voleibol; Atletas; Esportes.

## RESUMEN

**Introducción:** La condición física del deportista es la base para mejorar sus habilidades en el voleibol y el entrenamiento físico puede desempeñar un papel esencial en todo el proceso de formación de los jugadores de voleibol, lo que resulta en la mejora del nivel de la función física de los jugadores de voleibol y el cambio de la estructura de la conformación del cuerpo. **Objetivo:** Analizar los efectos del entrenamiento físico en la calidad general de los jugadores de voleibol. **Métodos:** Se seleccionaron aleatoriamente varios jugadores de voleibol y se los sometió a dos meses de entrenamiento físico basado en la literatura teórica científica. Se utilizó la estadística matemática para analizar la aptitud física y los indicadores de rendimiento de los jugadores de voleibol antes y después del entrenamiento físico. **Resultados:** La aptitud física de los jugadores de voleibol mejoró significativamente tras dos meses de entrenamiento físico ( $P < 0,05$ ). El rendimiento de los jugadores de voleibol mejoró tras el entrenamiento físico ( $P < 0,05$ ). **Conclusión:** La agilidad física de los jugadores de voleibol mejora cuando se los somete a un entrenamiento físico sistemático. Tras el entrenamiento físico, la calidad de la velocidad de los jugadores de voleibol puede mejorar considerablemente. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptorios:** Entrenamiento Físico; Voleibol; Atletas; Deportes.



## INTRODUCTION

Physical fitness is the ability of the skills of various organ systems of the human body to be manifested in sports. It covers essential physical qualities such as strength, speed, endurance, and flexibility. The primary activities of the human body are composed of two parts: walking, running, jumping, throwing, climbing, and supporting. The level of competition determines the athletic level of volleyball players. The competitive level is the all-around performance of an athlete's physical fitness, technical tactics, intelligence, and psychological quality.<sup>1</sup> In modern sports, volleyball, players often have to win the game when the strength of both sides is equal. Therefore, it is more important for coaches to give full play to the solid physical fitness of athletes. In the process of intense competition, athletes not only need to have good technical, tactical, and psychological qualities and need to have excellent physical fitness. In this way, volleyball players can compete tenaciously with their opponents under extraordinarily complex and challenging conditions.

A series of new volleyball rules are being developed and published. Volleyball has gradually developed into a sport with solid confrontation, fierce competition, and attraction to spectators.<sup>2</sup> This puts forward higher requirements for the athletes' technical and tactical skills. Good physical fitness is the basis for technical and tactical training, and it is also the guarantee that athletes can withstand high-intensity sports training. Therefore, physical training is essential in the entire training process of volleyball.

## METHOD

### Research objects and methods

This paper takes 20 high-level female volleyball players from colleges and universities as the research object.<sup>3</sup> This paper reviewed the relevant domestic research results and literature reports in the past ten years. At the same time, this paper analyzes the works of sports training, education, and other aspects related to this research.

This study selected seven physical fitness indicators for testing after extensive literature reading and discussions with experts and coaches. Strength quality includes flexion support, back throwing of a medicine ball, run-up touch, and double-swing rope skipping the test. The speed quality is a 30-meter acceleration run. The agility quality is the movement of rice characters.<sup>4</sup> Aerobic endurance is a 20-meter multi-level return run.

### Mathematical Statistics

This paper uses SPSS for data analysis. This paper mainly uses the paired sample T-test to compare the values of various test indicators before and after training.

### Fusion analysis of training information for volleyball players

Assuming that  $\phi(t)$  represents the fundamental wavelet, the time domain integration is zero. As shown in the formula (1).

$$\int j(t)dt = 0 \quad (1)$$

We get  $\Phi(a, \tau)$  after translating and scaling the  $\phi(t)$  based wavelet.

$$\Phi(a, \tau) = \frac{1}{\sqrt{a}} \phi\left(\frac{y-\tau}{a}\right) \quad (2)$$

In the formula  $a = 0$ , the formula obtained after we replace the wavelet basis with the primary function of the Fourier transform formula is as follows:

$$WT(a, \tau) = \int_{-\infty}^{+\infty} f(t) * \Phi(a, \tau) dt \quad (3)$$

There are several wavelet bases. Content includes Symlets, Meyer, Daubechies, Haar, Morlet, and other wavelets. The essential function of the above formula through basis function characteristic analysis is selected as Daubechies wavelet. We need to identify the athlete's surface EMG signals during exercise. Then we perform feature information extraction on this information.<sup>5</sup> We extract feature vectors from the feature information and input these feature vectors into the neural network. This paper is based on the ability of neural networks to generate the identified signals. We perform multiscale wavelet decomposition on the surface EMG signals. The level of decomposition of each scale is high and low. The stronger the surface EMG signal energy is, the larger the absolute value of the wavelet decomposition coefficient is. The higher the degree of its influence on signal reconstruction. In this paper, the maximum value of the absolute value of each wavelet coefficient is used as the characteristic parameter. This way, we form eigenvectors. Suppose  $E$  is the energy value of the surface EMG signal. We intercept the EMG signal within 1s. The formula for the energy change in  $t$  seconds at a time  $t_0$  is as follows:

$$E = \sum_{t_0}^{t_0+t} |x(t)|^2 \quad (4)$$

There is no need for a code of ethics for this type of study.

## RESULTS

### Analysis of Strength and Quality

Volleyball requires a strong serving force, a high serving point, and a high speed. This requires athletes to have the muscular arm strength and arm explosiveness. Spike technique is closely related to physical strength.<sup>6</sup> It requires a lot of arm whipping action. This shows more power. Blocking technology reflects more power, aggression, and cover-up. The duration of physical training for volleyball players is shown in Table 1.

The flexion bracing mainly evaluates the strength of the athlete's trunk support. The back-throwing medicine ball mainly evaluates the explosive power and coordination of the athlete's entire body. The run-up touch highly evaluates an athlete's jumping ability. Double-rock skipping mainly evaluates athletes' lower body strength and coordination.<sup>7</sup> According to Table 2, the P values of flexion support, back throwing a

**Table 1.** Duration of physical training for volleyball players.

Duration	Three hours or more	Two hours	One hour
Number of people	45	60	102
Percentage	24.20%	34.20%	42.60%

**Table 2.** Strength quality indicators before and after training.

Index	Before training	After training	P
Bent arm support (seconds)	1380.50±61.44	4188.20±52.88	0.01
Back Throwing Medicine Ball (m)	8.88±1.50	10.80±2.45	50.045
Approach height (m)	2.72±0.14	2.88±0.12	0.041
Double rock jump rope test (40s/piece)	28.60±17.50	44.54±18.67	0.085

medicine ball, and running touch height were all less than 0.05. After two months of systematic physical training, female volleyball players' trunk strength, body coordination, and whole-body explosive power have been significantly improved. Physical strength was significantly improved compared to before training. This is of great significance for players to perform technical actions such as serving, spiking, and blocking.

### Analysis of Speed Index

In volleyball competitions, players need to move fast and pass the ball accurately when they organize players to attack and block the net. Therefore, strengthening the speed quality of athletes is very important to improve the combat level of the entire team. The 40-meter acceleration run mainly evaluates the athletes' acceleration running ability.<sup>8</sup> As shown in Table 3, the average performance of the athletes in the 40-meter acceleration run before training was 5.19s. After two months of system training, the score was 4.88s. There was a significant performance improvement compared to pre-training ( $P=0.048$ , which was less than 0.05). This shows that the speed quality of the athletes has been significantly improved after two months of physical training. This ensures that players can react in time and move quickly when blocking and passing the ball.

### Sensitivity quality analysis

In volleyball competitions, technique and tactics are the keys to victory. Different technical and tactical performances need to be based on physical fitness. Volleyball victory requires timely and changeable tactics, flawless technique, and clear air superiority. These winning factors must rely on physical speed, bounce, and agility to support. The movement of rice characters mainly reflects the agility qualities of athletes. According to Table 4, the average value of the athletes' meter movement performance before training is 28.75s. After two months of physical training, the performance improved significantly ( $P=0.005$ , less than 0.01). The average score is 27.84s. This shows that after systematic physical training, the physical agility of athletes has been greatly improved.<sup>9</sup> This allows for the perfect implementation of technical and tactical techniques during the competition for athletes. Physical training can strengthen the team's tacit understanding and competition level.

### Analysis of aerobic endurance index

Aerobic endurance capacity is the fundamental guarantee for athletes to perform long-term, high-intensity training. Good aerobic capacity can support athletes in long-term sports training. This is also an essential guarantee for athletes during the competition.<sup>10</sup> It is not difficult to see that the athlete's aerobic capacity plays a crucial role in the game's outcome.

The 20-meter multi-level return run reflects the aerobic endurance quality of athletes. Table 5 shows that the average performance of the athletes in the 20-meter multi-level reentry running before training is 45.26s. Athletes' performance improved significantly after two months of systematic physical training ( $P=0.005$ , less than 0.01). The data showed that the aerobic endurance level of female volleyball players improved significantly after two months of physical training. This significantly impacts the orderly implementation of related training incidents and athletes' technical and tactical performance during the competition.

**Table 3.** Speed quality indicators before and after training.

Index	Before training	After training	P
40m acceleration run	5.18±0.65	4.88±0.28	0.048

**Table 4.** Sensitivity quality indicators before and after training.

Index	Before training	After training	P
Mi word mobile	28.75±4.40	27.84±1.84	0.005

**Table 5.** Aerobic Endurance Indicators Before and After Training.

Index	Before training	After training	P
20-meter multi-level turnaround run	45.26±6.89	45.85±7.17	0.005

## DISCUSSION

The Ministry of Education needs to build multifunctional venues suitable for volleyball players to train and compete. This lays the foundation for the physical training of volleyball players.<sup>11</sup> This will provide a good guarantee for the physical training of volleyball players. We need to purchase sports equipment suitable for the physical training of volleyball players.

Before each physical training, the coaches should give ideological education to the volleyball players. Coaches should take athletes as the main body and formulate training plans that conform to the physical training of volleyball players. Coaches should practice teaching following their aptitude. Coaches need to develop different physical training plans for different athletes.<sup>12</sup> The formulation of the training plan pays attention to gender and group. We formulate and implement effective physical training plans according to the differences in physical fitness of different volleyball players. This can scientifically promote the improvement of the physical fitness of volleyball players.

The Ministry of Education uses modern information technology and expert lectures to teach athletes about physical training. This enables volleyball players to take physical training seriously.<sup>13</sup> This can further strengthen the volleyball player's physical fitness.

Volleyball coaches have a high ability to coach volleyball techniques and tactics. Volleyball coaches should actively master and absorb advanced physical training knowledge. We want to organize some exchange and academic conferences on physical training in sports disciplines. In this way, the coaches' coaching ability has been dramatically improved in breadth and depth.

## CONCLUSION

The rapid development of volleyball has higher and higher requirements on volleyball players' physical fitness and technical and tactical abilities. Good physical fitness is the premise of technical and tactical play. This requires that higher requirements be put forward for the training of athletes. Physical training should play an essential role in the entire training process. After two months of systematic physical training, the volleyball players' strength, speed, agility, and aerobic endurance improved significantly.

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

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