

EFFECT OF VOLLEYBALL TRAINING ON PHYSICAL FITNESS AND CARDIOPULMONARY ENDURANCE OF COLLEGE STUDENTS



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EFEITO DO TREINAMENTO DE VÔLEI SOBRE A APTIDÃO FÍSICA E A RESISTÊNCIA CARDIOPULMONAR DE ESTUDANTES UNIVERSITÁRIOS

EFFECTO DEL ENTRENAMIENTO DE VOLEIBOL EN LA APTITUD FÍSICA Y LA RESISTENCIA CARDIOPULMONAR DE ESTUDIANTES UNIVERSITARIOS

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ABSTRACT

Introduction: Volleyball consists mainly of aerobic activities, causing positive impacts on cardiopulmonary resistance and the physical fitness of college students. Studying scientifically the training impacts of this sport can provide a scientific reference to support student training. **Objective:** Study the effects of volleyball training on college students' physical fitness and cardiopulmonary endurance. **Methods:** Second-year physical education students at a university were randomly selected for the experiment (n=50). Divided into the experimental group - adopting volleyball training and practice and control - with traditional athletics, they underwent a full semester of targeted physical activities. Physical fitness and cardiopulmonary endurance tests were performed before and after the experiment, and the results of the test batteries were cataloged and statistically confronted. **Results:** The experimental class students' results were superior in the physical fitness tests (P<0.05). The difference in the impact on final inter-group cardiopulmonary resistance was not so evident, demonstrating that both interventions resulted in good conditioning. **Conclusion:** Volleyball training positively impacted college students' physical fitness and cardiopulmonary endurance. It also increased the students' interest in the sport, optimizing the college students' physical quality and improving their cardiopulmonary resistance. **Level of evidence II; Therapeutic studies - investigating treatment outcomes.**

Keywords: Volleyball; Physical Education and Training; Physical Fitness; Students.

RESUMO

Introdução: O voleibol é constituído principalmente por atividades aeróbicas, causando impactos positivos sobre a resistência cardiopulmonar e aptidão física dos estudantes universitários. Estudar cientificamente os impactos do treinamento desse esporte pode fornecer uma referência científica para embasar o treinamento estudantil. **Objetivo:** Estudar os efeitos do treinamento de voleibol sobre a aptidão física e a resistência cardiopulmonar dos estudantes universitários. **Métodos:** Alunos do segundo ano de educação física em uma universidade foram selecionados aleatoriamente para o experimento (n=50). Divididos em grupo experimental – adotando treinamento e prática de voleibol e controle – com atletismo tradicional, foram submetidos a um semestre completo de atividades físicas direcionadas. Testes de aptidão física e resistência cardiopulmonar foram executados antes e após o experimento, os resultados das baterias de testes foram catalogados e confrontados estatisticamente. **Resultados:** Os resultados dos alunos da classe experimental foram superiores nas provas de aptidão física (P<0.05). A diferença no impacto sobre a resistência cardiopulmonar final inter-grupo não foi tão evidente, demonstrando que ambas intervenções acarretaram em um bom condicionamento. **Conclusão:** O treinamento de vôlei apresentou impactos positivos sobre a aptidão física e a resistência cardiopulmonar dos estudantes universitários. Também aumentou o interesse dos alunos pelo esporte, otimizando a qualidade física dos estudantes universitários e melhorando a sua resistência cardiopulmonar. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Voleibol; Educação Física e Treinamento; Aptidão Física; Estudantes.

RESUMEN

Introducción: El voleibol está constituido principalmente por actividades aeróbicas, causando impactos positivos en la resistencia cardiopulmonar y en la aptitud física de los estudiantes universitarios. Estudiar científicamente los impactos del entrenamiento de este deporte puede proporcionar una referencia científica en la que basar el entrenamiento de los alumnos. **Objetivo:** Estudiar los efectos del entrenamiento de voleibol sobre la aptitud física y la resistencia cardiopulmonar de estudiantes universitarios. **Métodos:** Para el experimento se seleccionaron aleatoriamente estudiantes de segundo curso de educación física de una universidad (n=50). Divididos en grupo experimental -que adoptó entrenamiento y práctica de voleibol- y control -con atletismo tradicional-, se sometieron a un semestre completo de actividades físicas dirigidas. Se realizaron pruebas de aptitud física y resistencia cardiopulmonar antes y después del experimento, se catalogaron los resultados de las baterías de pruebas y se confrontaron



estadísticamente. Resultados: Los resultados de los alumnos de la clase experimental fueron superiores en las pruebas de aptitud física ($P < 0,05$). La diferencia en el impacto sobre la resistencia cardiopulmonar final intergrupos no fue tan evidente, lo que demuestra que ambas intervenciones dieron lugar a un buen acondicionamiento. Conclusión: El entrenamiento de voleibol presentó impactos positivos sobre la aptitud física y la resistencia cardiopulmonar de los estudiantes universitarios. También aumentó el interés de los alumnos por el deporte, optimizando la calidad física de los universitarios y mejorando su resistencia cardiopulmonar. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Voleibol; Educación y Entrenamiento Físico; Aptitud Física; Estudiantes.

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INTRODUCTION

Volleyball has been popularized to a very high degree in China's major universities, and college students have a strong interest in participating in volleyball events. Therefore, the development of volleyball in colleges and universities has a certain scale.^{1,2} In addition, relevant courses are also constantly improving. Compared with other sports, volleyball not only puts forward certain requirements for college students' sports ability, but also has certain requirements on the skill level.³ Therefore, participating in volleyball is of great help to improve the overall quality of college students. Moreover, volleyball is mainly participated by aerobic exercise, and volleyball exercise has the most obvious effect on improving college students' cardiopulmonary endurance.⁴ There is a big difference between the aims of volleyball courses in colleges and universities and those in professional sports colleges.⁵ But they all have the function of improving the overall physical quality of college students. Daily volleyball training can effectively improve the quality of life of college students, benefit their mental health, improve their social adaptability, and temper their will quality.⁶ By studying the influence of college volleyball course on college students' physical quality, we can help improve the college volleyball course. It plays a vital role in the development of college sports, and can also provide sufficient reference for college students' training.

METHOD

Objective: To study the effect of volleyball training on college students' physical fitness and cardiopulmonary endurance.

Subjects: The sophomores of a university who are not majoring in physical education have 4 classes. Small class teaching is adopted for the boy experimental class and girl experimental class for volleyball elective, and the boy control class and girl control class for ordinary track and field elective. The number of students in each class is 25. The study and all the participants were reviewed and approved by Ethics Committee of China JiLiang University(NO.2020CJLU074D).

Experiment period: The experiment period of this experiment is one semester, and the class hours are arranged according to the design of the syllabus. The teaching frequency and duration of the experimental class and the control class are consistent.

Training plan: The curriculum design is carried out according to the teaching outline of sports elective courses. The experimental class adopts volleyball training teaching, including volleyball skills, volleyball related physical training, volleyball confrontation and other forms. The control class is a traditional track and field elective course, including long jump, javelin, aerobics and other forms.

Observation indicators: The observation indicators include three aspects: first, the impact of volleyball training on college students' volleyball sports ability. Only the experimental class is measured. The measurement indicator is the number of volleyball service, pass and cushion, so as to analyze the impact of volleyball training on college students' related

skills. The second is the influence on the physical quality of college students, including the sitting forward bending and standing long jump commonly used by men and women, as well as the pull up of boys and the sit up of girls. The third is the impact of volleyball training on college students' cardiopulmonary endurance. The selected indicators are the 50-meter run for men and women, the 1 kilometer run for boys and the 800-meter run for girls. Through the comparison of data results, this paper analyzes the influence of volleyball training on college students' physical fitness and cardiopulmonary endurance.

RESULTS

The influence of volleyball training on college students' volleyball ability

When studying the influence of volleyball training on college students in all aspects, we should first analyze the promotion of volleyball elective courses on college students' volleyball skills, so as to prove the effectiveness of volleyball teaching. Because the control class did not carry out volleyball training, only the experimental class was tested in terms of the improvement of volleyball sports ability.

Table 1 shows the improvement of volleyball in the experimental class after training. Within one minute, the number of boys' serves increased from 3.182 ± 1.072 to 4.576 ± 0.595 , the number of passes increased from 13.090 ± 14.383 to 43.288 ± 11.056 , and the number of balls set increased from 15.879 ± 15.639 to 58.467 ± 22.588 , making some progress, $P < 0.01$, indicating that there is a significant difference. In one minute, the number of girls' serve increased from 2.634 ± 1.697 to 3.984 ± 1.179 , the number of girls' pass increased from 6.530 ± 5.230 to 39.214 ± 10.071 , and the number of girls' cushion increased from 11.720 ± 9.778 to 55.765 ± 13.738 , making some progress, $P < 0.01$, indicating that there is a very significant difference. From the numerical results, it can be seen that after a semester of volleyball elective training, the students' mastery of volleyball skills has been greatly improved, indicating that the volleyball training in this paper is effective.

The influence of volleyball training on college students' physical quality

In order to study the influence of volleyball training on college students' physical fitness, the physical fitness of students in the four

Table 1. Improvement of volleyball sports ability of college students in experimental class.

Project	Gender	Before	After	t	p
Service (unit)	Boys	3.182±1.072	4.576±0.595	-12.9617	0.0000
	Girls	2.634±1.697	3.984±1.179	-13.9506	0.0000
Handoff (unit)	Boys	13.090±14.383	43.288±11.056	-7.9170	0.0000
	Girls	6.530±5.230	39.214±10.071	-15.0094	0.0000
Cushion (unit)	Boys	15.879±15.639	58.467±22.588	-4.6987	0.0000
	Girls	11.720±9.778	55.765±13.738	-3.1669	0.0092

classes of the experimental class and the control class was measured. Common physical testing options were used, including sitting forward bending, standing long jump, pull up for boys and sit up for girls. The specific values are shown in Table 2 and Table 3 below.

Table 2 shows that the physical quality of college students in the experimental class has been generally improved after training. The results of sitting forward bending of boys increased from 9.994 ± 7.215 cm to 14.792 ± 7.255 cm, the results of standing long jump increased from 219.189 ± 23.579 cm to 233.378 ± 23.549 cm, and the results of pulling up in one minute increased from 4.158 ± 3.329 to 8.223 ± 4.922 . The results of female students' forward bending in sitting position increased from 10.565 ± 2.480 cm to 18.845 ± 5.804 cm, the results of standing long jump increased from 161.271 ± 24.300 cm to 176.687 ± 16.792 cm, and the results of one minute sit ups increased from 27.429 ± 6.058 to 38.392 ± 3.524 . It can be seen that the flexibility, jumping level and muscle strength of college students have improved, $P < 0.01$, indicating that there is a very significant difference, which proves the effectiveness of volleyball training on college students' physical quality.

Table 3 shows that after a semester of track and field teaching and training, the physical quality of students in the control group has also been significantly improved. From the comparison in the control class, it can be seen that the flexibility, jumping quality and core strength of college students have made some progress, $P < 0.05$, indicating that there are significant differences. However, a comprehensive comparison between the experimental class and the control class shows that volleyball training has a better effect on improving college students' physical quality than ordinary track and field teaching. From the gender perspective, it can be seen that the optimization range of boys is smaller than that of girls, which is also related to the higher frequency of daily sports activities of boys than girls. Therefore, for girls who do not often engage in sports activities, effective volleyball training can improve their physical fitness more.

Effect of volleyball training on college students' cardiopulmonary endurance

In this section, the indexes selected to study the influence of volleyball training on college students' cardiopulmonary endurance are also the common 50 meter running events in sports, the 1000 meter running for boys and the 800-meter running for girls. These running activities are directly related to cardiopulmonary endurance. The better the cardiopulmonary endurance and physical function are, the shorter the running time is.

Table 4 shows that after a semester of volleyball teaching, the running time of students in the experimental class has been shortened. The 50 meter running time of boys was shortened from 9.446 ± 0.814 seconds to 7.870 ± 0.794 seconds, and the 1000 meter running time was shortened from 296.993 ± 24.055 seconds to 258.132 ± 29.265 seconds. The 50-meter running time of female students was shortened from 11.079 ± 1.077 seconds to 9.243 ± 0.610 seconds, and the 800 meter running time was shortened from 264.019 ± 12.288 seconds to 240.001 ± 21.256 seconds, $P < 0.01$, indicating that there was a very significant difference. The numerical results show that the cardiopulmonary endurance of the students in the experimental class has been improved to a certain extent.

It can be seen from Table 5 that after a semester of track and field teaching, the running performance of students in the control class has also been improved. The 50 meter running time of boys was shortened from 9.051 ± 0.983 seconds to 8.079 ± 0.764 seconds, and the 1000 meter running time was shortened from 286.002 ± 31.456 seconds to 269.387 ± 25.943 seconds. The 50 meter running time of female students was shortened from 11.211 ± 1.372 seconds to 9.420 ± 0.508 seconds, and the 800 meter running time was shortened from 272.547 ± 27.926 seconds to

Table 2. Improvement of physical quality of experimental class students.

Project	Gender	Before	After	t	p
Forward bending of sitting body (cm)	Boys	9.994±7.215	14.792±7.255	-4.3458	0.0000
	Girls	10.565±2.480	18.845±5.804	-5.2699	0.0000
Standing Long Jump (cm)	Boys	219.189±23.579	233.378±23.549	-3.9011	0.0010
	Girls	161.271±24.300	176.687±16.792	-4.1304	0.0020
Pull up/sit ups (pcs.)	Boys	4.158±3.329	8.223±4.922	-6.5656	0.0000
	Girls	27.429±6.058	38.392±3.524	-6.9163	0.0000

Table 3. Improvement of physical quality of control class students.

Project	Gender	Before	After	t	p
Forward bending of sitting body (cm)	Boys	8.498±7.473	11.522±7.681	-3.7533	0.0020
	Girls	9.519±4.269	17.981±3.253	-7.5475	0.0000
Standing Long Jump (cm)	Boys	220.757±26.651	232.553±22.405	-3.7090	0.0020
	Girls	158.998±27.998	173.739±22.083	-3.9548	0.0020
Pull up/sit ups (pcs.)	Boys	4.357±2.291	8.856±8.118	-2.8480	0.0123
	Girls	24.796±9.219	35.941±4.770	-6.9103	0.0000

Table 4. Improvement of cardiopulmonary endurance of experimental students.

Project	Gender	Before	After	t	p
50m-run (s)	Boys	9.446±0.814	7.870±0.794	10.5768	0.0000
	Girls	11.079±1.077	9.243±0.610	6.0223	0.0000
1000m-run/800m-run (s)	Boys	296.993±24.055	258.132±29.265	6.1342	0.0000
	Girls	264.019±12.288	240.001±21.256	3.1449	0.0091

Table 5. Improvement of cardiopulmonary endurance of control class students.

Project	Gender	Before	After	t	p
50m-run (s)	Boys	9.051±0.983	8.079±0.764	4.4156	0.0000
	Girls	11.211±1.372	9.420±0.508	4.8189	0.0000
1000m-run/800m-run (s)	Boys	286.002±31.456	269.387±25.943	2.3632	0.0337
	Girls	272.547±27.926	248.039±16.445	2.3350	0.0366

248.039 ± 16.445 seconds, $P < 0.05$, indicating that there were significant differences. It can be seen from the comprehensive comparison of the increase range that the difference between the two is not obvious, but volleyball training has a more significant effect on the improvement of cardiopulmonary endurance than track and field training.

DISCUSSION

Volleyball is mainly participated by aerobic exercise, which has a strong positive effect on the cardiorespiratory endurance of college students. Cardiopulmonary endurance is mainly manifested in the functional ability of the human respiratory system during aerobic exercise. According to scientific research, long-term participation in volleyball can significantly improve the vital capacity of the human body. Although the volleyball course in ordinary colleges and universities has certain intensity restrictions. However, the existing volleyball course training content is sufficient to maintain the physical health of college students. It can even significantly improve students' physique. Secondly, volleyball training can also help college students improve their muscle mass and muscle strength. After participating in daily volleyball training for a certain period of time, the muscle strength of college students will change qualitatively. Daily volleyball with reasonable diet. It can effectively increase the muscle content in the body. The increase of muscle mass will be accompanied by the improvement of basic metabolism. After the metabolism is improved, it can effectively maintain the physical activity, so that the physical function can reach the level of college students. Moreover, after the increase of muscle mass, the strength attribute of college students is correspondingly enhanced, and the increase of strength can effectively avoid the occurrence of sports risks such as muscle strain and joint sprain. And the improvement of muscle

strength is often accompanied by the improvement of body control ability. Having excellent body control ability can effectively avoid some injuries caused by imbalance.

CONCLUSION

To optimize and upgrade the physical quality and cardiopulmonary endurance of college students is an important teaching goal of college physical education. But the traditional track and field teaching method has some defects, such as the learning process is too boring. For some non-sports major college students, the goal of taking elective sports courses is to earn credits, and it is difficult to raise their interest in some boring training projects, so there are some shortcomings in the training effect. Choosing volleyball training as an elective physical education can make students realize the fun of sports training in the confrontation, improve their enthusiasm for training, and earnestly complete relevant training activities. The training effect is better than that of ordinary track and field training. In order to prove this point, this paper takes the non

sports major students in an ordinary class of a university as an example, selects two volleyball elective classes and two ordinary track and field elective classes as the research objects, and takes the physical test results as the observation indicators to conduct an experimental evaluation study on the physical fitness and cardiopulmonary endurance of college students. The results show that volleyball training can improve students' training interest, optimize college students' physical quality and improve their cardiopulmonary endurance. Therefore, in the optimization process of college physical education teaching, we should choose more types of sports activities that are both interesting, antagonistic and training value, optimize students' sports teaching activities, provide more optional courses for college students, so that ordinary college students can better enjoy sports elective courses, and improve their physical quality.

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REFERENCES

1. Salci Y, Kentel BB, Heycan C, Akin S, Korkusuz F. Comparison of landing maneuvers between male and female college volleyball players. *Clin Biomech (Bristol, Avon)*. 2004;19(6):622-8.
2. Ikeda Y, Sasaki Y, Hamano R. Factors influencing spike jump height in female college volleyball players. *J Strength Cond Res*. 2018;32(1):267-73.
3. Brumitt J, Mattocks A, Loew J, Lentz P. Preseason functional performance test measures are associated with injury in female college volleyball players. *J Sport Rehabil*. 2020;29(3):320-5.
4. Savithiri D. Effect of Step Aerobics Training On Cardio Respiratory Endurance Among Volleyball Player. *Ganesar College Of Arts and Science*. 2018:324.
5. Taware GB, Bhutkar MV, Surdi AD. A profile of fitness parameters and performance of volleyball players. *Krishna Inst Medical Sci Univ*. 2013;2(2):48-59.
6. He J, Bai YL. Fuzzy analytic hierarchy process based volleyball quality evaluation for college teaching. In: 2018 International Conference on Intelligent Transportation. *Big Data & Smart City (ICITBS)*. 2018. p. 669-72.