

HIGH-INTENSITY INTERVAL TRAINING IMPACTS ON ENDURANCE OF VOLLEYBALL PLAYERS

IMPACTOS DO TREINAMENTO INTERVALADO DE ALTA INTENSIDADE SOBRE A ENDURANCE DOS JOGADORES DE VOLEIBOL

IMPACTO DEL ENTRENAMIENTO POR INTERVALOS DE ALTA INTENSIDAD EN LA RESISTENCIA DE JUGADORES DE VOLEIBOL



ORIGINAL ARTICLE
ARTIGO ORIGINAL
ARTÍCULO ORIGINAL

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ABSTRACT

Introduction: The high-intensity interval training method is believed to improve sports endurance in volleyball players due to its characteristic of alternating short periods of intense aerobic exercise and recovery. **Objective:** Analyze the impact of high-intensity interval training on sports endurance in volleyball players aged 18 to 19 years old. **Methods:** We selected 16 male volleyball athletes, and divided them into control and experimental groups. A high-intensity interval training protocol was added to the experimental group, while the control group remained with standard training. The indices of the effect of intensive interval training were measured through the sports endurance test in the athletes, comparing the results before and after the intervention. **Results:** The exercise index on oblique plates for 30 seconds in the experimental group increased from 58.51 ± 1.06 to 61.17 ± 1.44 ; there was a change in the 800-meter run from 2.39 ± 0.02 to 2.33 ± 0.02 minutes after the experiment, and the 30kg supine weightlifting in 30 seconds was from 49.93 ± 1.99 to 53.58 ± 1.79 . However, the control group data did not change significantly. **Conclusion:** Long-term appropriate high-intensity interval training played an evident role in improving the endurance of volleyball players. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: High-Intensity Interval Training; Endurance Training; Volleyball.

RESUMO

Introdução: Acredita-se que o método de treinamento intervalado de alta intensidade possa desempenhar uma melhoria da resistência esportiva nos jogadores de voleibol devido a sua característica de alternância entre períodos curtos de exercício aeróbico intenso e recuperação. **Objetivo:** Analisar os impactos do treinamento intervalado de alta intensidade sobre a resistência esportiva em jogadores de voleibol com idade entre 18 e 19 anos. **Métodos:** Foram selecionados 16 voluntários masculinos atletas de voleibol, divididos em grupo controle e experimental. Ao grupo experimental foi acrescido um protocolo de treinamento intervalado de alta intensidade, enquanto o controle permaneceu com o treinamento padrão. Os índices do efeito do treinamento intensivo intervalado foram mensurados através do teste de endurance esportiva nos atletas, comparando os resultados antes e após a intervenção. **Resultados:** O índice de exercício nas placas oblíquas por 30 segundos no grupo experimental aumentou de $58,51 \pm 1,06$ para $61,17 \pm 1,44$; houve variação na corrida de 800 metros de $2,39 \pm 0,02$ para $2,33 \pm 0,02$ minutos após o experimento, e o levantamento de peso supino de 30kg em 30 segundos foi de $49,93 \pm 1,99$ para $53,58 \pm 1,79$. Porém, os dados do grupo de controle não sofreram alterações significativas. **Conclusão:** O treinamento intervalado de alta intensidade apropriado à longo prazo desempenhou um papel evidente no aprimoramento sobre a endurance dos jogadores de voleibol. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento Intervalado de Alta Intensidade; Treinamento de Endurance; Voleibol.

RESUMEN

Introducción: Se cree que el método de entrenamiento de intervalos de alta intensidad puede desempeñar un papel en la mejora de la resistencia deportiva en jugadores de voleibol debido a su característica de alternar períodos cortos de ejercicio aeróbico intenso y recuperación. **Objetivo:** Analizar el impacto del entrenamiento de intervalos de alta intensidad sobre la resistencia deportiva en jugadores de voleibol, con edades comprendidas entre los 18 y 19 años. **Métodos:** Se seleccionaron 16 voluntarios varones deportistas de voleibol, divididos en grupo control y experimental. Al grupo experimental se le añadió un protocolo de entrenamiento de intervalos de alta intensidad, mientras que el control permaneció con el entrenamiento estándar. Los índices del efecto del entrenamiento de intervalos de alta intensidad fueron medidos a través del test de resistencia deportiva en los atletas, comparando los resultados antes y después de la intervención. **Resultados:** El índice de ejercicio en planchas oblicuas durante 30 segundos en el grupo experimental aumentó de $58,51 \pm 1,06$ a $61,17 \pm 1,44$; hubo variación en la carrera de 800 metros de $2,39 \pm 0,02$ a $2,33 \pm 0,02$ minutos después del experimento, y el levantamiento de pesas supino de 30 kg en 30 segundos fue de $49,93 \pm 1,99$ a $53,58 \pm 1,79$. Sin embargo, los datos del grupo de control no cambiaron significativamente. **Conclusión:**



INTRODUCTION

Improving endurance is one of the main qualities of volleyball players in training. Among them, the intensive interval training method is the basis for the coaches to complete the established training tasks and successfully carry out the volleyball match, and improving the sports endurance quality is the key to determine the success of the match.¹ When training volleyball players to optimize the metabolic index, we should understand the content data of the development of endurance quality. Volleyball is the leading sport in China, so this study is helpful to improve the overall competitiveness of Chinese volleyball players in the future, and has important significance for the endurance research of volleyball players.² In addition, through the understanding of volleyball training, we can strengthen the interval training method by adjusting the requirements of exercise endurance intensity and interval training time. Volleyball players are always in high load intensity sports, and the adaptive changes that meet the needs of the project can effectively promote the development of the energy supply capacity of the athletes' body anaerobic energy supply, aerobic energy supply, aerobic and anaerobic mixed energy supply system, so as to improve the stability of volleyball sports technology in endurance training intensity.³ Finally, the training time and intensity of volleyball endurance training methods are similar to those of volleyball matches. Using multiple volleyball training methods can effectively promote the development of volleyball players' endurance quality, and significantly improve the progress of volleyball players' skills and strategies.⁴ Reasonable use of interval training methods is an ideal choice for volleyball players to efficiently complete training tasks.

Volleyball training experts believe that in the field of volleyball competitive sports, endurance can have different effects on different sports.⁵ Endurance quality is the leading quality that continuously records the competitive ability of volleyball players in badminton long throw, five run-ups, and half meter movement. Its main content is not long distance running, but to pay attention to the longer duration of the competition.⁶ For this reason, this paper has conducted the following training for volleyball athletes: for example, 800-meter running, 30-second 30kg clean and jerk, 30-second oblique plank sit-ups and other sports, the quality of endurance has a great impact on the performance of volleyball athletes.⁷

METHOD

Research object

The subjects selected in this study are men's volleyball players aged 18-19 years old who are doing aerobic and anaerobic endurance. The study and all the participants were reviewed and approved by Ethics Committee of Gannan Normal University (NO.GNNUF105). At the same time, 8 people are randomly selected as the subjects of the experimental group, and the other 8 people are the subjects of the control group. The basic physical condition of the subject is shown in Table 1. Sixteen professional male volleyball players were randomly divided into two groups, the experimental group and the control group. The control group only received routine volleyball training without any intervention. The experimental group strengthened the interval training on the basis of daily training, and discussed whether the high intensity interval training had obvious effect on improving the endurance of volleyball players.

Experimental method

1. Test of experimental data: the experimental group and the control group were selected according to the basic data of height, age, upper limbs, weight, etc.
2. Time and place of the experiment: The four-month experiment lasted six times a week, and the unit of each week was trained according to the test plan on Tuesday, Thursday and Saturday, and daily ordinary training was conducted on Monday, Wednesday and Friday, and each training lasted three hours. The test site is a volleyball hall.
3. Experimental steps: test the data after the first stage of training, measure the relevant index data again after the second stage of training, and sort out the relevant data before and after the experiment. Before starting the test and experiment, it is necessary to determine the quality of the site and equipment to ensure the normal operation of the experiment. And it is necessary to record the experimental procedures, test data and specific conditions in detail. Report the test progress to the coach at any time. Before the test and experiment, take the athletes to warm up to prevent sports injury and ensure the safety of the subjects in this experiment.

RESULTS

The optimization of volleyball players' metabolic index by strengthening interval training method

It can be seen from Table 2 that the enhanced interval training method compares the data of volleyball athletes' metabolic indexes before and after the experiment. The average value of hemoglobin in the experimental group before the experiment was $13.825 \pm 0.918\text{g/dl}$; The average value of hemoglobin in the control group before the experiment was $14.029 \pm 1.067\text{g/dl}$. After the test of independent sample P ($p>0.05$), there was significant difference between the two groups. After four months of experiment, the data after the experiment increased to $14.148 \pm 0.871\text{g/dl}$, which was 0.323g/dl higher than that before the experiment. The hemoglobin value of the control group decreased to $13.978 \pm 0.968\text{g/dl}$, which was 0.17g/dl lower than that before the experiment. Through the test of independent sample P ($p<0.05$), there was a significant difference between the average hemoglobin values of the two groups.

Table 1. Basic situation of volleyball players in experimental group and control group.

Group	Experience group	Control group
Age	18.739±0.721	19.377±0.985
Upper limb	83.675±4.569	80.809±7.094
Height	180.156±5.615	178.718±5.141
Weight	74.576±19.815	71.306±8.139

Table 2. Optimization of Metabolic Index of Volleyball Players by Strengthening Intermittent Training.

Group		Before experiment	After experiment	P
Hemoglobin (g/dl)	Experience group	13.825±0.918	14.148±0.871	0.0227
	Control group	14.029±1.067	13.978±0.968	0.1816
Red blood cell ($10^{12}/L$)	Experience group	4.592±0.375	4.655±0.359	0.0988
	Control group	4.544±0.469	4.610±0.459	0.0767

Therefore, this paper believes that the four-month interval training method has fully improved the endurance training of 18-19-year-old male volleyball players in volleyball training.

By adjusting the intensity of exercise load, the body's hemoglobin function and red blood cells can produce adaptive changes that match the relevant sports; The application of different types of interval training methods can effectively develop and improve the ability of hemoglobin and the energy supply ability of the erythrocyte metabolic system to have strict control over the interval time. These two groups play a stable role in observing the intense, complex and difficult competition environment of volleyball players in the process of sports. The P value of hemoglobin in the control group was the largest, 0.1816, followed by the red blood cells in the experimental group, 0.0988. The hemoglobin P value of the test group was the lowest, the hemoglobin of volleyball players decreased after interval training, and the hemoglobin of volleyball players without interval training increased. After the interval ability training, the red blood cells of volleyball players were significantly improved, and the improvement of red blood cells was significantly better than that of the control group.

Strengthen the optimization of interval training method on basic sports indexes of volleyball players

Five consecutive run-up touch is a test index reflecting the basic movement of volleyball players. The application of run-up and touch height in volleyball training practice is very extensive.

The mechanism for improving the basic sports indicators of volleyball players is relatively complex. This adaptive change of basic sports involves multiple systems. In the process of experiment, the intensive intermittent training method puts forward strict requirements for training intensity and interval time. In the process of specific experiment implementation, it can be seen from Table 3 on the basic sports indicators of volleyball players, The experimental group found that the value before the experiment was significantly higher than the value after the experiment when comparing the value of five consecutive run-up runs before the experiment with the value of five consecutive run-up runs after the experiment, which reflected that the optimized value of the enhanced interval training method for the basic sports indicators of volleyball players was significantly better than the effect before the experiment.

In the process of half-meter movement, the value of the control group was significantly higher than the data of the experimental group, both before and after the experiment, which reflected that the effect of the enhanced interval training method on the volleyball players' half-meter movement training was better than that of the control group.

Therefore, this paper believes that the effect of four-month interval training on basic sports training is not particularly obvious. This is because during the experiment, the experimental group and the control group used the intensive interval training method to train the basic sports, which was only general training, and the effect was not prominent. Intensive interval training method is used for training with high intensity and insufficient interval.

The optimization of volleyball athletes' sports endurance index by strengthening interval training method

Endurance quality has an important impact on athletes' sports ability. The improvement of the body's endurance quality is always accompanied by the improvement of aerobic and anaerobic metabolic capacity, as well as the psychological fatigue caused by long-term training. Therefore, we should make adequate preparations.

It can be seen from Table 4 that the average score of the 800-meter run in the experimental group was 2.391 ± 0.027 min before the experiment, and the average score of the 800-meter run in the control group

Table 3. The optimization of volleyball players' basic sports indexes by strengthening interval training.

Group		Before experiment	After experiment	P
5 consecutive run-ups to touch the height (s)	Experience group	23.663±0.857	21.816±0.933	0.0000
	Control group	23.788±0.709	22.876±0.506	0.0239
Badminton throw distance (m)	Experience group	11.331±0.595	12.686±0.922	0.0010
	Control group	10.633±0.724	11.337±0.726	0.0807
Half "meter" word move (s)	Experience group	16.968±0.545	15.215±0.926	0.0000
	Control group	17.327±1.069	16.879±1.101	0.5753

Table 4. The Optimization of Volleyball Players' Sports Endurance Indexes by Intensifying Intermittent Training.

Group		Before experiment	After experiment	P
30 seconds inclined plate sit-ups (times)	Experience group	58.510±1.069	61.172±1.448	0.0119
	Control group	60.617±1.350	60.759±1.301	0.1656
800-meter run (min)	Experience group	2.391±0.027	2.335±0.024	0.0367
	Control group	2.338±0.049	2.350±0.044	0.5743
30 seconds 30 kg clean and jerk (times)	Experience group	49.930±1.999	53.588±1.792	0.0060
	Control group	48.092±3.932	49.289±3.703	0.2917

was 60.617 ± 1.350 min. After the independent sample T test ($p > 0.05$), there was no significant difference between the experimental group and the control group in the 800-meter run index; Before the experiment, the average score of the 30-second oblique plate sit-ups in the experimental group was 58.510 ± 1.069 /time, and the average score of the 30-second oblique plate sit-ups in the control group was 60.617 ± 1.350 /time. After the independent sample T test ($p > 0.05$), there was a significant difference between the experimental group and the control group in the index of the 30-second oblique plate sit-ups; Before the experiment, the average result of the 30 second 30 kg clean and jerk in the experimental group was 49.930 ± 1.999 /time, and the average result of the 30 second 30 kg clean and jerk in the control group was 48.092 ± 3.932 /time. After the independent sample T test ($p < 0.05$), there was a small difference between the experimental group and the control group in the index of the 30 second oblique plate sit-ups. To sum up, in the four-month experiment, the experimental group used the intensive interval training method to train the endurance of volleyball players, The 30-second oblique plate sit-ups can effectively promote the improvement of volleyball athletes' sports endurance.

To sum up, according to the practice of sports training, it comes from sports training theory, so sports training is based on the dialectical relationship of training theory. Through expert interviews, according to the training objectives and the level of athletes' competitive ability, interval training is applied to volleyball training. The experimental design of this article effectively tests whether this article effectively improves the endurance in volleyball training through the above training.

DISCUSSION

According to the characteristics of time intensity and energy supply of volleyball training, volleyball requires athletes to maintain fast movement within a certain period of time. Among them, endurance quality is the basic quality of athletes, and endurance quality is the special quality to maintain high intensity competition. In volleyball competition, energy is mainly supplied, endurance training is the special ability to maintain high intensity competition, and volleyball quality is the main energy quality of athletes. In order to ensure the stability of volleyball players in the game, endurance training in volleyball is an important factor.

In the training of endurance quality, the training shall be carried out in accordance with the principle of gradual progress to prevent the injury

caused by excessive intensity. Endurance is an important part of volleyball. In the endurance quality training, the aerobic endurance quality of volleyball players should be trained first, and then the anaerobic endurance quality of athletes should be trained, and then the training should be carried out after they are fully developed. Therefore, the aerobic endurance characteristics of the experimental subjects developed in the first stage of the experiment, and the anaerobic endurance characteristics developed in the second stage of the experiment. According to the analysis of experimental data, the intensified interval training method can effectively improve the endurance of volleyball players aged 18-19. Strengthen the combination of interval training and volleyball endurance training to improve the training intensity of volleyball. Taking the intensified interval training method as the experimental control factor, this paper examines the improvement of the experimental data of volleyball athletes' endurance training, and analyzes the basic situation of volleyball athletes' sports.

CONCLUSION

According to the experimental results of this paper, we can draw the following conclusions: (1) When the intensive interval training method is

used to train the endurance of volleyball players, we should promote the development of the endurance quality of volleyball players, strengthen the training means of the intermittent training method, and promote the development of the endurance quality of volleyball players. (2) When designing the endurance quality training plan for volleyball players, the training content should be hierarchical and sequential according to the characteristics of the development of endurance quality. First, develop aerobic endurance and then develop anaerobic endurance. (3) When determining the endurance training content of the training plan, we should take the intermittent training demand as the guidance, combine the basic training with the intermittent training, combine the intermittent training with the endurance quality training organically, develop the athletes' special endurance quality, and make the training effect the best. Therefore, it is concluded from the above experimental data that the combination of intensified interval training and volleyball training can effectively promote the development of endurance quality.

The author declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Xiuhua Wu: writing and execution.

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