

RELAXATION EFFECTS ON FATIGUE AND PHYSICAL FITNESS IN BADMINTON ATHLETES



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EFEITOS DO RELAXAMENTO NA FADIGA E APTIDÃO FÍSICA EM ATLETAS DE BADMINTON

EFFECTOS DE LA RELAJACIÓN SOBRE LA FATIGA Y LA APTITUD FÍSICA EN ATLETAS DE BÁDMINTON

Li Shubao¹ 
(Physical Education Professional)
Han Dong² 
(Physical Education Professional)

1. Mudanjiang Normal University, School of Physical Education and Health Sciences, Mudanjiang, Heilongjiang, China.
2. Harbin Sport University, School of Sports and Human Sciences, Harbin, Heilongjiang, China.

Correspondence:

Han Dong
Harbin, Heilongjiang, China.
150000.
18249788222@126.com

ABSTRACT

Introduction: Badminton is characterized by a high amount of exercise and high intensity of work. Muscle pain and discomfort often occur throughout the game, so some relaxation training is necessary. **Objective:** Study the effect of relaxation training on recovery from sports fatigue and fitness recovery during badminton. **Methods:** Badminton training was conducted three times a week. The duration of the exercises of the experimental and control group students was the same. The experimental group adopted the relaxation training form, including stretching, aerobic, and other relaxation actions. The duration of relaxation training was 15 minutes, while the control group continued to use the traditional relaxation method. **Results:** Lactate in the experimental group showed a continuous downward trend, from 2.09 to 1.93 and then to 1.62; heart rate increased from 84.73 to 85.48, then decreased to 81.57, and finally increased to 85.62. The optimization effect was greater than in the control group. In the experimental group, the speed and strength of the athletes improved considerably. **Conclusion:** Relaxation training can improve athletes' fatigue, promoting body development and improving strength and speed in physical fitness. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Relaxation; Badminton; Muscle Fatigue; Muscle Strength.

RESUMO

Introdução: O Badminton tem como características uma alta quantidade de exercícios e uma elevada intensidade de trabalho. A dor muscular e o desconforto ocorrem frequentemente durante todo o jogo, portanto, algum treinamento de relaxamento é necessário. **Objetivo:** Estudar o efeito do treinamento de relaxamento sobre a recuperação da fadiga esportiva e a recuperação da aptidão física durante a prática de badminton. **Métodos:** O treinamento no badminton foi realizado três vezes por semana. A duração dos exercícios dos alunos do grupo experimental e do grupo de controle foi a mesma. O grupo experimental adotou a forma de treinamento de relaxamento, incluindo alongamento, aeróbico e outras ações de relaxamento. A duração do treinamento de relaxamento foi de 15 minutos, enquanto o grupo de controle continuou a usar o método tradicional de relaxamento. **Resultados:** O ácido láctico no grupo experimental apresentou uma tendência contínua de queda, de 2,09 para 1,93 e depois para 1,62; a frequência cardíaca aumentou de 84,73 para 85,48, e em seguida diminuiu para 81,57, e finalmente aumentou para 85,62. O efeito de otimização foi superior ao do grupo de controle. No grupo experimental, a velocidade e a força dos atletas melhoraram consideravelmente. **Conclusão:** O treinamento de relaxamento pode melhorar a fadiga dos atletas, promovendo o desenvolvimento do corpo e melhorando a força e velocidade na preparação física. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Relaxamento; Badminton; Fadiga Muscular; Força Muscular.

RESUMEN

Introducción: El bádminton tiene como características una gran cantidad de ejercicio y una elevada intensidad de trabajo. A menudo se producen dolores y molestias musculares a lo largo del partido, por lo que es necesario realizar algún entrenamiento de relajación. **Objetivo:** Estudiar el efecto del entrenamiento de relajación en la recuperación de la fatiga deportiva y la recuperación de la forma física durante el bádminton. **Métodos:** El entrenamiento en bádminton se realizó tres veces por semana. La duración de los ejercicios de los alumnos del grupo experimental y del grupo de control fue la misma. El grupo experimental adoptó la forma de entrenamiento de relajación que incluía estiramientos, ejercicios aeróbicos y otras acciones de relajación. La duración del entrenamiento de relajación fue de 15 minutos, mientras que el grupo de control siguió utilizando el método de relajación tradicional. **Resultados:** El ácido láctico en el grupo experimental mostró una tendencia descendente continua, de 2,09 a 1,93 y luego a 1,62; la frecuencia cardíaca aumentó de 84,73 a 85,48, luego descendió a 81,57 y finalmente aumentó a 85,62. El efecto de optimización fue mayor que en el grupo de control. En el grupo experimental, la velocidad y la fuerza de los atletas mejoraron considerablemente. **Conclusión:** El entrenamiento de relajación puede mejorar la fatiga de los atletas, favoreciendo el desarrollo corporal y mejorando la fuerza y la velocidad en el acondicionamiento físico. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Relajación; Badminton; Fatiga Muscular; Fuerza Muscular.



INTRODUCTION

Badminton is a popular sport. It is not only an advantageous event in China's competition field, but also a popular sports activity with high national popularity.¹ Badminton has the characteristics of large amount of exercise and high intensity. After entering the court, players compete with each other across the net, move quickly, and complete the stroke, serve and other actions.² In the whole process, players from both sides should concentrate. The whole game often leads to muscle soreness and discomfort, which requires some relaxation training.³ It can be seen from the interview and survey that, at present, in a university, ordinary badminton enthusiasts often choose to take a slow walk to relieve exercise fatigue after finishing badminton sports.⁴ After breathing evenly, they go back to rest, and rarely carry out special relaxation training. Many college badminton club enthusiasts also only carried out relatively simple relaxation training.⁵ In the long run, the muscles can not be relaxed after sports, muscle fatigue can not be eliminated, and the recovery of sports ability is relatively slow, which can not improve the effect.⁶ For students, the negative impact is particularly serious. Therefore, the relaxation training required after badminton can promote the recovery of sports fatigue and improve physical fitness.⁷

METHOD

Design of experimental ideas

1. Literature research method: sorting out and analyzing the mechanism of sports fatigue and recovery principle of athletes, especially badminton athletes, in the course of sports, and discussing the theoretical concept of excessive recovery, so as to lay a solid foundation for this study.
2. Interview and investigation: The author visited the students, teachers, students, athletes and coaches of badminton elective classes of badminton clubs in colleges and universities. This paper sorts out and analyzes the current situation of badminton training in this university and the relaxation methods that students like after training, lists the shortcomings in the relaxation methods, obtains the existing relaxation training programs, optimizes and summarizes them, and designs the optimal relaxation training strategies that are suitable for this paper.
3. Expert review and pre experiment: the obtained optimized relaxation training strategy is submitted to the expert team represented by professional physical education teachers and sports doctors for review, who point out the shortcomings in the strategy and make improvements, and finally obtain the relaxation training action system that can be applied in this experiment. Then a pre experiment team composed of non sports professional badminton elective students, non sports professional badminton association sports enthusiasts, and badminton special college students will conduct the test.
4. Implementation of exercise program: the method of control experiment was used to complete the relevant practical operation and data collection within 8 weeks.
5. Data sorting and analysis: Excel software and spss software are used to sort out the acquired data to obtain relevant trend charts and data comparison tables for the convenience of subsequent research.

Selection of research objects

Through sorting out the data of the pre experiment, it can be seen that most of the students in the badminton sports elective class of non sports majors are beginners. The study and all the participants were reviewed and approved by Ethics Committee of Mudanjiang Normal University (NO.MDNU20-FZ056). They do not have a clear grasp of badminton skills, and they do not invest enough in the whole sports process. Therefore, it is often difficult to generate enough sports fatigue after sports training, so these candidates are eliminated. Badminton

students have many years of experience in badminton training, and professional coaches also carry out systematic badminton teaching. They will have a clear set of badminton relaxation training programs after the sports. Their personal relaxation training habits are good, and the program optimization is not effective in a short time, so this part of the population is excluded. Finally, the research object selected in this paper is the sports enthusiasts of non sports professional badminton association. They have a certain sports foundation and are enthusiastic about badminton, but they lack the long-term guidance of professional coaches. Although they know some knowledge of relaxation training, they do not do enough. This part of the population is also a relatively easy to ignore part of the current badminton teaching.

Table 1 shows the basic characteristics of the two groups of research objects. Each group has 6 students, numbered ABCDEF, who are selected from the university badminton association. The age, height, weight and years of exercise of students are shown in Table 1, with little difference.

Experiment implementation

The article adopts the method of controlled experiment. The experimental group and the control group form a badminton sports group, and each other is the opponent to play badminton. Badminton training is carried out three times a week. The exercise duration of the students in the experimental group and the control group is the same, and their fatigue degree is roughly the same. After the sports training, the experimental group adopted the form of relaxation training, including stretching, aerobic and other relaxation actions, and the duration of relaxation training was 15 minutes. The control group continued to use the traditional relaxation method, and chose the form of walking slowly along the campus road, also walking for 15 minutes. In addition, other movements of the two groups of subjects were basically consistent, thus reducing the interference of irrelevant variables.

RESULTS

Effect of Relaxation Training on the Recovery of Sports Fatigue of Badminton Athletes

As shown in Figure 1, the recovery of badminton sport fatigue by relaxation training is shown. When selecting indicators, the common lactic acid indicators of fatigue are taken as the observation object. After sports training, there is always a feeling of muscle soreness, which is the discomfort caused by the high content of lactic acid in the body. After relaxation, lactic acid is gradually decomposed, and the muscle

Table 1. Basic characteristics of the two groups of subjects.

Experience group	Age (years)	Height (cm)	Weight (kg)	Years of exercise (years)
A	20.77	171.91	73.99	1.71
B	21.74	174.48	72.41	1.65
C	21.92	178.28	66.50	2.58
D	21.95	180.22	65.04	2.22
E	21.46	179.91	65.96	2.22
F	21.28	177.50	65.01	1.60
Average value	21.52	177.05	68.15	2.00
Control group	Age (years)	Height (cm)	Weight (kg)	Years of exercise (years)
A	22.02	180.08	63.93	2.27
B	22.31	180.74	65.33	1.58
C	22.12	180.05	62.78	2.12
D	21.66	181.10	68.21	2.40
E	21.85	172.49	72.93	2.46
F	21.60	180.88	69.66	1.93
Average value	21.93	179.22	67.14	2.13

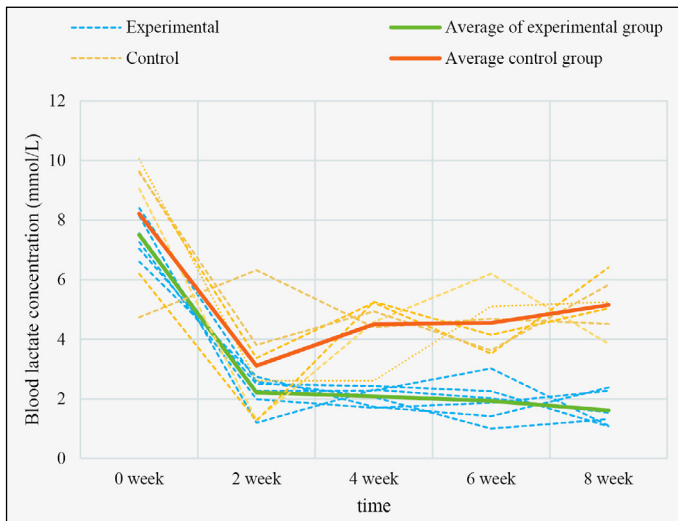


Figure 1. The Effect of Relaxation Training on the Recovery of Sports Fatigue in Badminton -- A Case Study of Lactic Acid Index (mmol/L).

soreness gradually disappears. It can be seen from Figure 1 that at week 0, just before the start of the experiment, the lactic acid indexes of the experimental group and the control group were both high. The average lactic acid index of the experimental group was 7.51, and the average lactic acid index of the control group was 8.22. In the second week of the test, the lactic acid index of the experimental group and the control group decreased significantly 15 minutes later, indicating that both the relaxation training program proposed in this paper and the slow walking training program commonly used by badminton enthusiasts can achieve the goal of reducing the lactic acid content in a short time, which is effective. It can be seen from the data results that the average lactic acid index of the experimental group is 2.22, and the average lactic acid index of the control group is 3.11, which shows that the effect of the relaxation training program proposed in this paper is better than that of the slow walking. In the following six weeks, the experimental group showed a continuous downward trend, from 2.09 to 1.93 and then to 1.62. Although the decline rate fluctuated, it always showed a downward trend. The control group slightly increased from 3.11 to 4.50 from the 2nd week to the 4th week; The data in the fourth and sixth weeks are almost unchanged, 4.50 in the fourth week and 4.55 in the sixth week; From the 6th week to the 8th week, the lactic acid index even increased, from 4.55 to 5.15. This shows that although the way of walking, walking and relaxing commonly used by badminton enthusiasts is effective, the effect is not stable and scientific, so it is not as good as the relaxation training proposed in this paper.

As shown in Figure 2, the influence of relaxation training on heart rate index. After the excessive badminton training, many athletes have the experience of "heart pounding", which is the problem caused by high heart rate. Before the beginning of the experiment, the heart rate of the athletes immediately after badminton exercise was measured. It can be seen that the initial heart rate of the 12 athletes in the experimental group and the control group after exercise had little difference, with an average of about 140; In the second week, the heart rate of the experimental group decreased to 84.73 and the control group decreased to 87.42, indicating that the heart rate optimization effect of the experimental group was slightly better than that of the control group at this time, but there was no difference between the two groups. Both schemes were effective. In the following 6 weeks, the heart rate of the experimental group had little difference between 2 and 4 weeks, even slightly increased, from 84.73 to 85.48; From the 4th week to the 6th week, it was reduced from 85.48 to 81.57, which achieved good optimization effect; From the 6th

week to the 8th week, the data increased slightly, from 81.57 to 85.62, indicating that the heart rate index was in a fluctuating state throughout the experiment. For the control group, in the following six weeks, it showed a rising state of fluctuation, from 87.43 to 87.22 in the second week to 87.66, and finally 88.70. The curve of the experimental group is always lower than that of the control group after 2 weeks, which shows that the relaxation training scheme adopted in this paper has a better effect on heart rate optimization than that of walking slowly, but the difference between the two is not significant.

Effect of relaxation training on badminton players' physical fitness

This section makes a comparative analysis of the improvement effect of badminton players' physical fitness before and after the experiment. Physical fitness is divided into strength physical fitness and speed physical fitness, both of which are indispensable in badminton.

As shown in Table 2, the influence of relaxation training on the improvement of strength and physical fitness can be seen from the data comparison that the experimental group is superior to the control group in terms of the maximum strength of squatting, the number of 60s sit ups, the number of 30s barbell jerks, and the long distance badminton throw in situ, which shows that the control group has also improved, whether it is the relaxation training method used in this paper or the walking relaxation method commonly used by athletes, To a certain extent, it alleviates exercise fatigue, achieves excessive recovery, and improves strength and physical fitness.

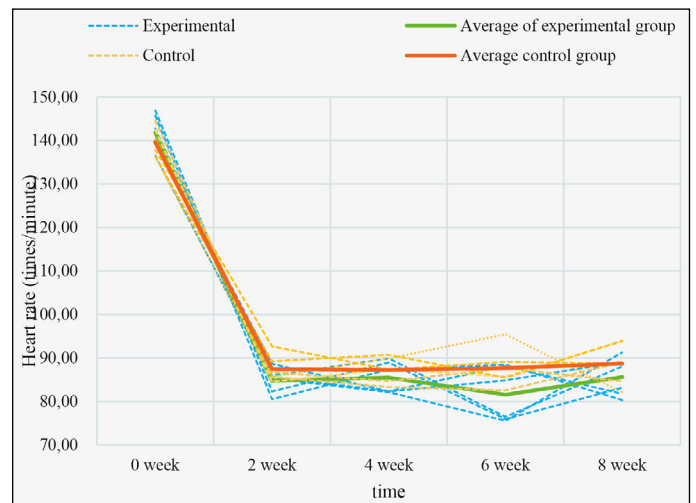


Figure 2. Relaxation Training for the Recovery of Badminton Sports Fatigue -- Taking Heart Rate Index as an Example (Times/Minute).

Table 2. The Influence of Relaxation Training on the Strength and Physical Ability of Badminton Players.

Option	Maximum squatting force (kg)	60s sit-ups (one)	30s barbell fast (a)	Badminton Throw Far in Place (cm)
Before the experiment in the experimental group	167.50 ±12.039	46.42 ±0.989	13.91 ±1.009	827.09 ±68.364
After the experiment in the experimental group	190.00 ±13.044	50.46 ±6.055	18.25 ±0.993	858.85 ±69.227
Before the experiment in the control group	159.28 ±9.186	44.71 ±1.014	13.85 ±1.014	790.70 ±66.309
After the experiment in the control group	167.92 ±10.210	47.65 ±1.987	16.15 ±0.989	821.25 ±64.476

As shown in Table 3, in order to improve the speed and physical fitness of badminton players through relaxation training, it can be seen from the data that in the 400 meter run, the time of the experimental group and the control group has been shortened, but the optimization effect is not obvious enough, and the data of the control group is slightly better than the experimental group; In the 30 meter sprint, the time of the experimental group was shortened significantly, while the time of the control group was increased. In terms of t running, the duration of the experimental group was significantly shortened, while that of the control group was slightly improved, indicating that relaxation training can improve the speed and physical fitness of athletes to a certain extent, and it has obvious effects on high-intensity and short distance sprints and directional changes. The form of walking and relaxation commonly used by traditional badminton enthusiasts, in addition to a slight advantage in the 400 meter run, has played a negative role in the 30 meter sprint and t type run required on the sports field, which shows that the relaxation training form proposed in this paper can better optimize the speed and physical fitness of athletes.

DISCUSSION

In addition to the participation of students majoring in sports, badminton associations in colleges and universities also have many non sports majors who have a good foundation in badminton sports. They are professional organizations second only to badminton majors in colleges and universities. Therefore, strengthening the systematic teaching of this part of the population can not only improve students' badminton level, but also better stimulate students' enthusiasm for badminton, play a role in promoting publicity, and promote the promotion of badminton in colleges and universities.

Table 3. The Effect of Relaxation Training on the Speed and Physical Ability of Badminton Players.

Option	400m run (s)	30 meter dash (s)	T-run (s)
Before the experiment in the experimental group	65.17 ±5.964	4.20 ±0.069	9.63 ±0.283
After the experiment in the experimental group	65.11 ±5.261	3.65 ±0.081	8.44 ±0.129
Before the experiment in the control group	64.21 ±8.010	4.08 ±0.081	9.48 ±0.268
After the experiment in the control group	63.90 ±7.509	4.16 ±0.070	9.53 ±0.223

CONCLUSION

College sports associations are often established spontaneously by students, so their sports standardization cannot be guaranteed. School physical education teachers should pay attention to this aspect of training, and provide more systematic teaching guidance for college badminton enthusiasts. This paper studies the effect of relaxation training in college badminton from the point of view that sports enthusiasts' relaxation is not standardized enough. The results show that effective relaxation training can improve exercise fatigue, promote body development, and improve strength and speed physical fitness. Therefore, in the badminton training in colleges and universities, we should pay attention to relaxation training, and do a good job of relaxation after each training, so as to reduce the body discomfort caused by fatigue and improve sports fitness.

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