PHYSICAL STRENGTH TRAINING METHODS IN BADMINTON TEACHING AND TRAINING

MÉTODOS DE TREINAMENTO DE FORÇA FÍSICA NO ENSINO E TREINAMENTO DE BADMINTON

MÉTODOS DE ENTRENAMIENTO DE FUERZA FÍSICA EN LA ENSEÑANZA Y EN EL ENTRENAMIENTO DEL BÁDMINTON

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ABSTRACT

Introduction: In badminton performance, athletes need to precisely manage the movements of mastered techniques to quickly complete the swing and regroup the strength of the upper and lower limbs to hit the ball quickly. Objective: Study the effect of strength exercise on the physical performance of badminton players according to training. Methods: 24 badminton players were randomly divided into lower limb, upper limb, and control groups. The lower limb group and upper limb group were trained for eight weeks. The final test was conducted, and the data were properly compared and analyzed. Results: After eight weeks of intense strength training, the badminton throwing ability of the upper limb group was significantly improved; In the lower limb group, the effect of improving the CVM contraction ability of bilateral knee extensors was not evidenced, and the centrifugal contraction ability of the bilateral knee extensors was significantly improved. Conclusion: The experiment shows that strength training can help athletes' physical performance, positively impacting their performance. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Badminton; Physical Education and Training; Exercise; Resistance Training.

RESUMO

Introdução: Na atuação de badminton, os atletas precisam gerir precisamente os movimentos das técnicas dominadas para completar rapidamente o balanço e reagrupar a força dos membros superiores e inferiores para bater a bola rapidamente. Objetivo: Estudar o efeito do exercício de força no desempenho físico de jogadores de badminton de acordo com o treinamento. Métodos: 24 jogadores de badminton foram divididos aleatoriamente em grupo de membros inferiores, grupo de membros superiores e grupo controle. O grupo membro inferior e o grupo membro superior foram treinados por 8 semanas. O teste final foi realizado e os dados foram devidamente comparados e analisados. Resultados: Após 8 semanas de treinamento intenso de força, a habilidade de arremesso de badminton do grupo membro superior foi significativamente aprimorada. No grupo de membros inferiores, o efeito de melhorar a capacidade de contração CVM dos extensores bilaterais do joelho não ficou evidenciada e a capacidade de contração centrífuga dos extensores bilaterais do joelho foi significativamente melhorada. Conclusão: O experimento mostra que o treinamento de força pode ajudar o desempenho físico dos atletas, tendo um impacto positivo no desempenho de suas atuações. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Badminton; Educação e Treinamento Físico; Exercício físico; Treinamento de Força.*

RESUMEN

Introducción: En el rendimiento del bádminton, los atletas necesitan gestionar con precisión los movimientos de las técnicas dominadas para completar rápidamente el balanceo y reagrupar la fuerza de los miembros superiores e inferiores para golpear la pelota con rapidez. Objetivo: Estudiar el efecto del ejercicio de fuerza en el rendimiento físico de los jugadores de bádminton según el entrenamiento. Métodos: 24 jugadores de bádminton fueron divididos aleatoriamente en el grupo de las extremidades inferiores, el grupo de las extremidades superiores y el grupo de control. El grupo de la extremidad inferior y el grupo de la extremidad superior se entrenaron durante 8 semanas. Se llevó a cabo la prueba final y los datos se compararon y analizaron adecuadamente. Resultados: Después de 8 semanas de entrenamiento de fuerza intenso, la capacidad de lanzamiento de bádminton del grupo de extremidades superiores mejoró significativamente; en el grupo de extremidades inferiores, el efecto de la mejora de la capacidad de contracción CVM de los extensores bilaterales de la rodilla no se evidenció y la capacidad de contracción centrífuga de los extensores bilaterales de la rodilla mejoró significativamente. Conclusión: El experimento muestra que el entrenamiento de fuerza puede ayudar al rendimiento físico de los atletas, teniendo un impacto positivo en su desempeño. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Badminton; Educación y Entrenamiento Físico; Ejercicio Físico; Entrenamiento de Fuerza.*

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INTRODUCTION

With the continuous promotion and development of badminton, the competitive state of badminton competition has gradually become fierce. Modern badminton has a higher demand for the strength and quality of athletes, emphasizes active attack, and obtains advantages and victory in the competition.[1] To strengthen strength training, on the one hand, we should strengthen the training of important power generating parts under the condition of warm-up preparation. For example, in badminton, special exercises will be conducted for wrist strength, upper arm strength and elbow joint. On the other hand, we should respect the principle of scientific training, formulate appropriate training amount, gradually increase the intensity of limb exercise, and integrate a number of technologies and instruments for strength training, so as to achieve good training results.[2] Badminton is a game that focuses on skills and pays attention to the confrontation between nets. It has the characteristics of fast rhythm and non periodic skills, fast attack and defense conversion and constantly changing tactics.[3] In the process of competition, every swing of an athlete is very important. The quality of the return ball determines the outcome of a ball or even a game. The hitting force of upper limbs directly affects the technical characteristics of badminton, such as flight speed, strength and angle.[4] In the actual game, if the special strength of the upper limb is not enough, it will show weakness in attack on the court. In the multi shot stalemate, it is easy to consume physical energy and deform the action, resulting in low return quality. In addition, there are also phenomena such as a large amount of physical waste caused by uncoordinated hitting movements, resulting in a variety of injuries to the body.[5] Badminton technology consists of two parts: the basic footwork of the lower limbs and the hitting skills of the upper limbs.[6]

METHOD

Experimental objective: to prove that fast strength training and fast telescopic compound training can more effectively improve the strength quality of athletes' upper and lower limbs than standard training methods. The study and all the participants were reviewed and approved by Ethics Committee of Lv Liang University (NO. 2019LLUNIS04). The experimental period was two months and eight weeks. Experimental location: Badminton Hall of a sports college; Experimental subjects: 24 boys were recruited. The subjects were in good physical condition, without major injuries affecting the experiment such as muscle strain and fracture, and were not affected by other experiments. They had never received similar training experiments before and were willing to accept the experiment. Upper and lower limb strength tests were performed before the grouping experiment. Then, 24 badminton players were randomly divided into upper limb group, lower limb group and control group. The independent sample t-test found that P > 0.05. It was concluded that there was no significant difference between the lower limb group and the control group under the baseline conditions such as age, height, weight and training years before the experiment. The next test can be carried out.

Among them, the control group only used dumbbells, elastic bands and other traditional training methods, while the upper limb group used the upper limb rapid strength training method proposed in this paper for strength training, as shown in Table 1.

The lower limb group adopted the lower limb rapid telescopic compound training, as shown in Table 2.

Word and excel tables were used to collect and organize data, and IBM SPSS statistics21 statistical software was used to select independent t-sample test and paired t-sample test for user-defined statistical processing of the initial lower limb data group, control group and post test data. (P > 0.05 means the difference is not significant; P < 0.05 means the difference is significant; P < 0.01 means the difference is very significant); Compare the data before and after training, and pay attention to the strength of upper and lower limbs and kinematic parameters of badminton players participating in the experiment.

RESULTS

Results and analysis of upper limb strength test of badminton players

In situ throwing is an important index of badminton players' upper limb strength test. Badminton requires athletes to have good upper limb strength, and reflects the overall quality of athletes' upper limbs in some aspects. The upper limb group and the control group were tested before and after training, and then compared with paired sample t-test and independent sample t-test respectively.

(Table 3) shows that the throwing distance of the upper limb group and the control group before training is 7.01 ± 0.26 m and 6.95 ± 0.31 m respectively, so there is no significant difference between the two groups before the experiment (P = 0.69 > 0.05). After 8 weeks of rapid strength training in the upper limb group, the distance of in-situ badminton throwing increased to 7.44 ± 0.38 m, P = 0.00 < 0.01, indicating that there was a significant difference in the experimental data.

Comparison of MVC test between lower limb group and control group

After 8 weeks of intervention with rapid telescopic compound training, subjects in lower limb group and control group were tested for MVC. The test results are summarized as follows:

It can be seen from Table 4 that, although eight weeks of rapid telescopic compound training improved the ability of knee extensor contraction MVC of subjects in the lower limb group, the P values of all indicators after t-pairing test were greater than 0.05. Therefore, the improvement effect was not significant.

Table 1. Upper limb fast strength training means and methods in upper limb group.

Option	Weight (%)	Frequency	Number of groups	Practice speed	Component interval (component)	Weekly practice (Times)
Shot with dumbbells	40%-60%	10-15	4-6	Second limit speed	2-4	2-4
Holding a dumbbell wrist wind ring	40%-70%	10-15	3-6	Second limit speed	2-4	2-4
Positive drawing	Deadweight	10-15	3-6	Extreme speed	2-4	2-4
Fall back	Deadweight	25	2-3	Second limit speed	2-4	2-4
Globes	40%-60%	10-15	3-6	Extreme speed	2-4	2-4
Continuously	40%-60%	10-15	3-5	Extreme speed	2-4	2-4
Hit a push-up	Deadweight	15-20	3-5	Extreme speed	2-4	2-4
Fast flexion dumbbell	40%-60%	15-20	3-6	Extreme speed	2-4	2-4
Continuously pushing the barbell	20%-40%	10-15	3-6	Extreme speed	2-4	2-4

Table 2. training plan of lower limb group.

Time	Training action	Number of training groups	Training intensity touch
First stage 1-2 weeks	Fast rapid jump	20 repeats in each group	Low intensity
	Single leg original vertical jump	10 sets per side repeat 2	180 times
	Left and right hurdles (40cm)	10 sets 10 times each group	Take a break in the group 90-120S
	Left and right single hurdle (40cm)	10 sets per side repeat 2	----
The second stage 3-6 weeks	Double rope	20 repeats in each group	----
	Stent jump	30 sets of 30 times each group	Medium intensity
	Skating skating	30 sets of 30 times each group	270 times
	Single leg jump	10 sets per side	Take a break in the group 90-120S
	45cm deep jump	10 sets of 3 groups per group	----
The third stage 7-8 weeks	Stent jump	40 sets of 4 groups per group	high strength
	Skating skating	40 sets of 4 groups per group	390 times
	Rogue	20 sets of 20 times each group	Take a break in the group 90-120S
	60cm deep	10 sets of 3 groups per group	---
	Jumping rope	20 repeats in each group	---

Table 3. Test results of difference in distance throw of in-situ badminton between upper limb group and control group (unit: m).

Group	Before experiment	After the experiment	P value
Upper limb group	7.01±0.26	7.44±0.38	0.00
Control group	6.95±0.31	7.04±0.29	0.01
P value	0.69	0.04	---

Table 4. Comparison of MVC test between lower limb group and control group (n = 16).

---	Control group	Lower limb group	P value
MVC peak torque right (nm)	172±16	189±19	0.083
MVC peak torque left (nm)	155±12	164±14	0.096
MVC peak torque weight ratio right	2.6±0.3	2.8±0.2	0.211
MVC peak torque weight ratio left	2.3±0.1	2.4±0.2	0.112

After 8 weeks of intervention in the lower limb group with rapid telescopic compound training, the subjects in the lower limb group and the control group were tested for centrifugal contraction ability. The results are as follows:

It can be seen from Table 5 that after the intervention, the peak moment of right knee extensor eccentric contraction was 226 ± 16nm, the peak moment of left knee extensor eccentric contraction was 216 ± 13nm, the peak moment weight ratio of right knee extensor eccentric contraction was 3.5 ± 0.3, and the peak moment weight ratio of left knee extensor eccentric contraction was 3.3 ± 0.2. After the intervention experiment, the peak moment of eccentric contraction of the right knee extensor in the lower limb group was 259 ± 17nm, an increase of 33nm compared with the control group; The peak moment of eccentric contraction of left knee extensor was 256 ± 15 nm, which was 40 nm higher than that of the control group; The ratio of peak moment of eccentric contraction of right knee extensor to body weight was 3.9 ± 0.3, which was 0.4 higher than that of the control group. The ratio of peak moment of eccentric contraction of left knee extensor to body weight was 4.0 ± 0.3, which was 0.7 higher than that of the control group. It can be seen from the data that after 8 weeks of rapid telescopic compound training, all indexes of knee extensor eccentric contraction ability in the lower limb group were improved. SPSS was used to conduct paired sample t-test on the centrifugal contraction test data of bilateral knee extensors in the lower limb group after the intervention. The results showed that after the intervention, the p value of the centrifugal contraction peak torque of the right knee extensor was 0.001, the p value of the left knee was 0.001, the weight ratio of the centrifugal contraction peak torque of the right knee extensor was 0.001, and the left p value was 0.006. The P values of the above four indexes are less than 0.05, indicating that there are significant differences in the centrifugal contraction ability of bilateral knee extensors in the lower limb group after the intervention. Therefore, rapid telescopic compound training can significantly improve the centrifugal contraction ability of bilateral knee extensors in the lower limb group.

Table 5. Comparison of centrifugal contractility test results between lower limb group and control group (n = 16).

---	Control group	Lower limb group	P value
Peak moment of right centrifugal contraction (Nm)	226±16	259±17	0.001
Left centrifugal contraction peak torque (Nm)	216±13	256±15	0.001
Right centrifugal systolic peak torque to body weight ratio	3.5±0.3	3.9±0.3	0.001
Left eccentric systolic peak torque to body weight ratio	3.3±0.2	4.0±0.3	0.006

DISCUSSION

The stability of the core part of the human body can be strengthened through strength training. Through strength (stability) training, athletes can more effectively master their own center of gravity, so as to improve the control ability of muscles and make the limbs force more smoothly. Strength training has been introduced into the field of badminton training because of its effectiveness. Badminton competition often lasts for a long time. In this time, due to the polygon of athletes' technical action and the rapidity of badminton flight, it is difficult to effectively predict their trajectories. Based on this point, compared with other strength qualities, core strength has stronger control and can assist athletes to better control their bodies, so as to effectively complete technical movements. In the competition, athletes need to move frequently, and there is a high demand for their mobility. If an athlete's core strength is insufficient, his ability to control his body is poor, so it is difficult to adapt to such intense and frequent movement, so he can't give full play to his technical movements. This point can be supplemented by strength training, so as to promote the rapid improvement of their performance.

Long duration competition will make athletes physically and mentally tired and have a high test on their physical condition. High consumption and long race distance are just the main characteristics of badminton competition. The core area is the largest muscle group of the human body. This muscle group not only stores a lot of energy, but also plays a role of coordination and stability. In the actual competition process, the competitive state of badminton is unstable. We must constantly change the position and complete various technical movements, such as swing, turn, take-off, extension and step. If a certain movement is blocked and cannot be completed effectively, it will lead to the injury of athletes due to improper force. For example, if the opponent sends a long pass from the backcourt, the speed of badminton will increase sharply, so as to make higher requirements for the athlete's response ability. If the athlete does not respond effectively in time, it is easy to lead to disharmony and failure to hit the ball normally. If an athlete forcibly hits the ball to save the ball in this case, it will further lead to the loss of balance of the body and various sports injuries, such as sprains, strains, abrasions, etc., which will affect his own sports state. This point can also be supplemented through core strength training to make their own center of gravity more stable and balanced, and reduce the imbalance caused by improper force. In addition, core strength training can also effectively enhance the control ability of body muscles and make the force more natural and smooth, so as to improve the effectiveness and appreciation of technical movements and avoid sports injuries.

CONCLUSION

Badminton is developing rapidly in the modern world. Fast break has become the main technical project in many countries, and the requirements for athletes' physical quality are becoming higher and higher. Athletes need to have good speed quality to meet the needs of modern fast-paced competition, so speed is very important in badminton. The explosive upper limbs and flexible and fast lower limbs are one of the important factors for athletes to win in the competition. Therefore, it is difficult to study how to improve the strength of upper and lower limbs of badminton players. Based on such problems, this paper investigates the impact of badminton strength training on upper and lower limbs, hoping to be helpful to athletes and scientists.

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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. LZ: writing and execution.

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