EFFECTS OF LOWER-LIMB RESISTANCE EXERCISE ON BADMINTON PERFORMANCE

EFEITOS DO EXERCÍCIO DE RESISTÊNCIA EM MEMBROS INFERIORES SOBRE O DESEMPENHO NO BADMINTON

EFECTOS DEL EJERCICIO DE RESISTENCIA DE LOS MIEMBROS INFERIORES SOBRE EL RENDIMIENTO EN BÁDMINTON

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Liu Yisi[1]
(Physical Education Professional)

1. Sports Department of Xi'an Aeronautical Institute, Xi'an, Shaanxi, China.

Correspondence:
Liu Yisi
Xi'an, Shaanxi, China. 710077.
liuyisi614198907@163.com

ABSTRACT

Introduction: Badminton is a sport that demands quick decision-making and abrupt changes of direction, demanding high performance in the explosive strength of the players' lower limbs. It is believed that the exercise of resistance in the players' lower limbs may reflect a better performance on the court. Objective: Study the lower limbs resistance exercise effects on badminton players' performance. Methods: 24 active badminton players were selected and randomly divided into control and experimental groups. While the control group continued the practice of existing training methods, the experimental group included lower limb strength exercise, with increased lower limb resistance with an elastic band completing the lower limb resistance exercise. Results: Before the experiment, the execution time of four points at the center of gravity was 16.83 ± 0.75 s in the experimental group and 17.15 ± 0.62 s in the control group, resulting in 15.40 ± 0.21s in the experimental group and 15.82 ± 0. 48s in the control group. The hurdle test period also changed from 10.21 ± 0.65s to 10.02 ± 0.62s in the experimental group, and from 10.82 ± 0.29s to 10.46 ± 0.32s in the control group. Conclusion: The addition of lower-limb resistance training to the daily training of badminton players can effectively improve the training efficiency and fitness of its players. ***Level of evidence II; Therapeutic studies - Investigation of treatment outcomes.***

Keywords: Endurance Training; Physical Fitness; Lower Limbs; Badminton.

RESUMO

Introdução: O badminton é um esporte que exige uma rápida tomada de decisão e mudanças bruscas de direção, demandando alto desempenho na força explosiva dos membros inferiores dos praticantes. Acredita-se que o exercício de resistência nos membros inferiores dos jogadores possa refletir uma melhor performance em quadra. Objetivo: Estudar os efeitos do exercício de resistência de membros inferiores sobre o desempenho dos praticantes de badminton. Métodos: Foram selecionados 24 praticantes ativos de badminton, divididos aleatoriamente em grupo controle e experimental. Enquanto o grupo controle continuou a prática dos métodos existentes de treinamento, ao grupo experimental foi incluído o exercício de força dos membros inferiores, com aumento da resistência dos membros inferiores com uma faixa elástica completando o exercício de resistência dos membros inferiores. Resultados: Antes do experimento, o tempo de execução de quatro pontos no centro de gravidade foi de 16.83 ± 0.75 s no grupo experimental e 17,15 ± 0,62 s no grupo de controle, resultando em 15,40 ± 0,21s no grupo experimental e 15,82 ± 0,48s no grupo controle. O período do teste de salto em obstáculos também sofreu alterações de 10,21 ± 0,65s para 10,02 ± 0,62 s no grupo experimental, e de 10,82 ± 0,29 s para 10,46 ± 0,32 s no grupo controle. Conclusão: A adição do treinamento de resistência para os membros inferiores no treinamento diário dos praticantes de badminton pode efetivamente melhorar a eficiência do treinamento e a aptidão física de seus jogadores. ***Nível de evidência II; Estudos terapêuticos - Investigação dos resultados de tratamento.***

***Descritores*:** *Treino de Resistência; Aptidão Física; Membros Inferiores; Badminton.*

RESUMEN

Introducción: El bádminton es un deporte que exige rapidez en la toma de decisiones y cambios bruscos de dirección, demandando un alto rendimiento en la fuerza explosiva de los miembros inferiores de los practicantes. Se cree que el ejercicio de resistencia en los miembros inferiores de los jugadores puede reflejar un mejor desempeño en la cancha. Objetivo: Estudiar los efectos del ejercicio de resistencia de los miembros inferiores en el rendimiento de los jugadores de bádminton. Métodos: Se seleccionaron 24 practicantes activos de bádminton y se dividieron aleatoriamente en grupo de control y grupo experimental. Mientras que el grupo de control continuó con la práctica de los métodos de entrenamiento existentes, al grupo experimental se le incluyó ejercicio de resistencia de miembros inferiores, con aumento de la resistencia de miembros inferiores con una banda elástica completando el ejercicio de resistencia de miembros inferiores. Resultados: Antes del experimento, el tiempo de ejecución de cuatro puntos en el centro de gravedad fue de 16,83 ± 0,75 s en el grupo experimental y de 17,15 ± 0,62 s en el grupo control, resultando de 15,40 ± 0,21s en el grupo experimental y de 15,82 ± 0. 48s en el grupo control. El período de la prueba de vallas

también cambió de 10,21 ± 0,65 s a 10,02 ± 0,62 s en el grupo experimental, y de 10,82 ± 0,29 s a 10,46 ± 0,32 s en el grupo de control. Conclusión: La adición del entrenamiento de resistencia de las extremidades inferiores al entrenamiento diario de los jugadores de bádminton puede mejorar eficazmente la eficacia del entrenamiento y la forma física de sus jugadores.
Nivel de evidencia II; Estudios terapéuticos - Investigación de los resultados del tratamiento.

Descriptores: *Entrenamiento de Resistencia; Aptitud Física; Miembros Inferiores; Badminton.*

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INTRODUCTION

In recent years, as an important part of physical exercise training, the training of changing direction and moving has been verified by different people in different projects. Changing direction movement training can take the correct route in a short time to carry out movement training, and finally become a training method to improve sports performance.[1] In badminton training, various equipment can be used to increase the fun of boring training. The training methods and means are simple, convenient and flexible, thus improving the enthusiasm of training. According to the recent survey, so far, in badminton mobile training, it can be found that most badminton coaches have little practical application of lower limb resistance exercise in training, so it is necessary to explore the value of lower limb resistance exercise of badminton items.[2] In the process of changing direction movement training, including balance training and foot contact training, it is believed that in the mechanically-assisted training and proprioception training, you should not rely on controlling your own strength for training. This paper proposes that in the non-directional movement training state, you should carry out professional training according to the needs of training and competition training.[3] Under the external stimulation of command information such as various functions and instruments, the training can be induced to make movement training. In order to strengthen training and improve all kinds of non-directional movement ability in the badminton field, it is also necessary to improve the movement ability of trainers.[4] Through observing a large number of documents, this paper found that the movement training in different directions can be divided into two types of teaching methods: the movement route and the angle, so as to form different morphological models for the performance of speed. The movement training direction includes four categories: left and right orientation, front and rear orientation, non-directional movement and oblique orientation.[5] The training target can quickly change direction and stop when moving in multiple directions during the training and actual combat. Up to now, the ability of changing direction movement of badminton can be studied according to the combination of lower limb resistance training methods.[6] As for this, for the purpose of improving the ability of badminton players to change direction and move, this paper integrates and weaves a set of training programs for badminton players. Through the comparison of experiments, it can improve the ability of badminton players to change direction.[7]

METHOD

Research object and research method

According to the form of volunteer recruitment and random sampling, a total of 24 badminton players with middle grades were obtained from the professional badminton players of a professional sports college. The study and all the participants were reviewed and approved by Ethics Committee of Xi'an Aeronautical Institute (NO.XAAI20Z006). They were divided into experimental group and control group according to the form of random sampling. The basic information of the two groups of subjects can be seen from Table 1. They are both about 20 years old, about 1.7 to 1.8 meters tall, 60 to 80 kilograms weight, and 4-5 years of training. There is little difference between them.

Table 1. Basic indicators of subjects.

Index	Experimental group (n=20)	Control group (n=20)	P
Age (yr)	20.717±0.7293	20.411±0.7900	0.58359
Height (cm)	175.031±5.1320	177.889±5.1743	0.19394
Body weight (kg)	71.846±8.0110	70.117±9.0378	0.12661
Years of training (yr)	4.621±0.2074	4.464±0.2785	0.19354

Twenty-four badminton players were randomly divided into experimental group and control group, with 12 subjects in each group. The control group continued the existing badminton teaching and training methods, including lower limb strength exercises, while the experimental group increased the resistance of the lower limb by binding the elastic band to complete the resistance exercise of the lower limb. The experimental group and the control group were basically the same in other sports training except for whether to carry out elastic band resistance training. When determining the resistance strength of the elastic band, 10% of the weight of the athletes was taken as the strength setting of the elastic band by testing their weight, while the control group did not intervene in this aspect. After 6 weeks of training, the changes of the ability of the experimental group and the control group to change direction and move were discussed.

Data acquisition and processing

In the experiment design, the judgment index should be clear. Since the resistance exercise of lower limbs and the ability to change direction of movement are the comprehensive quality training of badminton players in the whole process, the judgment indicators are divided into two stages. First, the indicators such as the height of the vertical jump, the distance of the standing long jump, the time of 30m running and the time of 4 * 10m running are selected to clarify the comprehensive physical quality of badminton players. Then the time for left and right movement, back and forth movement, low center of gravity four-point running, the time for jumping through the hurdle test and the time for touching the side running between the sidelines were selected to focus on the ability of badminton players to change direction.

Before and after the experiment, the relevant indicators of athletes were measured in the same closed stadium. The closed indoor environment is selected to prevent the impact of outdoor climate changes on the athletes' data results after six weeks of training. In the whole process of data testing, in order to reduce the impact of athletes' mistakes on the results, the average of three measurements was selected to further ensure the preciseness of the experimental results. The obtained data are processed by Excel software and SPSS software, and the obtained results are analyzed by independent variance T test.

RESULTS

Effect of lower limb resistance exercise on the physical quality of badminton players

The lower limb resistance exercise can effectively improve the strength of athletes' lower limbs, which has a comprehensive impact on the

improvement of athletes' overall physical quality. Therefore, in this section, we selected the indexes of vertical jump touch height, standing long jump distance, 30m running time and 4 * 10m running time to explore the effect of lower limb resistance exercise on the improvement of comprehensive physical quality.

Table 2 shows the effect of lower limb resistance exercise on the physical quality of badminton players. In the badminton competition, for some higher serve balls, the badminton players need to jump to complete the action of receiving and hitting the ball. Therefore, the stronger the jumping ability of the badminton players, the higher the initiative in the field. Before the experiment, the height of vertical jump touch in the experimental group was 2.805 ± 0.0608m, and that in the control group was 2.795 ± 0.0912m. The difference between the experimental group and the control group was 0.01018m; After the experiment, the experimental group was 2.864 ± 0.0709m, and the control group was 2.814 ± 0.0810m. The experimental group was higher than the control group, with a difference of 0.05011m. The difference was further widened, indicating that the experimental group had a good effect. Before the experiment, the standing long jump distance of the experimental group was 2.626 ± 0.1193m, and that of the control group was 2.585 ± 0.1086m. The difference between the experimental group and the control group was 0.04039m; After the experiment, the experimental group was 2.716 ± 0.0995m, and the control group was 2.636 ± 0.0889m. The experimental group was higher than the control group, with a difference of 0.080791m. The difference was further widened, indicating that the experimental group had a good effect.

The ball may fly from any direction on the field, so the badminton player must run to the designated position in the shortest time, which requires very high personal speed for the badminton player. In this paper, before the experiment, the 30 m running time of the experimental group was 4.236 ± 0.1317 s, and that of the control group was 4.316 ± 0.3029 s. The difference between the experimental group and the control group was 0.08024 s; After the experiment, the experimental group was 4.147 ± 0.1215s, and the control group was 4.237 ± 0.1919s. The experimental group was less than the control group, with a difference of 0.08955s. The difference was further widened, indicating that the experimental group had a good effect. Before the experiment, the 4 * 10m running time of the experimental group was 9.673 ± 0.4937s, while that of the control group was 9.836 ± 0.3382s. The experimental group was less than that of the control group, with a difference of 0.16263s; After the experiment, the experimental group was 9.248 ± 0.4542s, and the control group was 9.593 ± 0.2089s. The experimental group was less than the control group, with a difference of 0.34568s. The difference was further widened, indicating that the experimental group had a good effect.

Effect of lower limb resistance exercise on the ability of badminton players to change direction and move

The improvement of badminton players' ability to change direction on the field has a great effect on the athletes' competitive level, competition ability, winning probability and so on. Therefore, in this section, the time for left and right movement, time for back and forth movement, time for four-point running with low center of gravity, time for jumping through the hurdle frame test and time for touching between the sidelines are selected as the judgment and analysis criteria for badminton players' ability to change direction.

Table 3 shows the effect of lower limb resistance exercise on the ability of badminton players to change direction and move. Moving forward and backward and left and right is the most basic criterion for judging the ability of badminton players to change direction, and is also the basis for composing various complex changes in direction. Through the comparative analysis of the overall data, it can be seen that strengthening the resistance exercise of lower limb strength of badminton players can comprehensively improve the ability of badminton players to change direction and move, and improve the basic changes and upgrade actions. Of course, the existing badminton training program can also improve the ability index of athletes, but the extent of its improvement is not as good as after the increase of lower limb resistance training. Therefore, lower limb resistance training should be added to the existing badminton teaching to improve the training effect.

DISCUSSION

Characteristics of the ability to change direction of badminton

The main feature of badminton is an activity with high intensity, short time and intermittent. In terms of energy metabolism characteristics, badminton wants to maintain a short interval after intense activities, and needs to synthesize energy substances with non-lactic acid and anaerobic metabolism ability. At the same time, it also needs to improve the aerobic metabolism ability of athletes. In training, different exercises can be used to sprint in different directions with the help of equipment, and different exercise methods can meet the needs of players in different forms, different distances and different angles in badminton competitions. From the perspective of physiology, the course of changing direction can provide anaerobic and aerobic respiration for badminton sports, but anaerobic energy supply is the main.

Table 2. Influence of lower limb resistance exercise on physical quality of badminton players.

Index	Before experiment			After experiment		
	Experience group	Control group	Difference	Experience group	Control group	Difference
Vertical jump height (m)	2.805±0.0608	2.795±0.0912	-0.01018	2.864±0.0709	2.814±0.0810	-0.05011
Standing long jump (m)	2.626±0.1193	2.585±0.1086	-0.04039	2.716±0.0995	2.636±0.0889	-0.08079
30m run (s)	4.236±0.1317	4.316±0.3029	0.08024	4.147±0.1215	4.237±0.1919	0.08955
4 * 10m running (s)	9.673±0.4937	9.836±0.3382	0.16263	9.248±0.4542	9.593±0.2089	0.34568

Table 3. Influence of lower limb resistance exercise on the ability of badminton players to change direction and move.

Index	Before experiment			After experiment		
	Experience group	Control group	Difference	Experience group	Control group	Difference
Move left and right (s)	10.005±0.6786	10.556±0.8711	0.55054	9.568±0.5875	10.033±0.2937	0.46480
Move forward and backward (s)	12.461±0.5072	12.572±0.6221	0.11108	11.865±0.4277	12.310±0.4839	0.44432
Low-gravity four-point run (s)	16.836±0.7597	17.156±0.6261	0.32019	15.404±0.2127	15.824±0.4847	0.41928
Drill and jump hurdle test (s)	10.210±0.6517	10.825±0.2984	0.61542	10.027±0.6221	10.462±0.3282	0.43420
Touch and run between sidelines (s)	8.684±0.3433	8.502±0.4254	-0.18239	8.210±0.3130	8.305±0.2633	0.09473

The practice of changing direction movement can be divided into training modes according to the specific flexibility and stability. It is mainly designed around the mathematics and movements on different joints in different dimensions. In order to improve the movement order and height of athletes, pay attention to the role of vision in the training of changing direction movement in badminton, and combine the characteristics of multiple applications to continuously strengthen the discrimination ability of dynamic sense. In the application of badminton, Changing direction movement training can combine the characteristics of the project, including precisely adjusting the strength and speed line amplitude in the action program, and can develop the control ability of the mechanism.

Principle of improving the ability to change direction and move in badminton

With the weight training of the subjects, the strength and speed strength will continue to improve. In order to improve the resistance training level of the level athletes, the trainers have conducted resistance training, and their muscle strength, speed strength and related performance have been significantly improved. From the comparison of the data and results in this paper, it can be seen that adding resistance content in the lower limb training and using the form of elastic band can better improve the muscle strength and speed strength of the lower limb of badminton players, so that in the actual competition, better sports effects can be obtained than the control group of athletes without resistance training.

CONCLUSION

From the research results of this paper, we can see that the addition of lower limb resistance training in the regular badminton practice can effectively improve the training efficiency of badminton players, so that athletes can obtain better training results in a shorter time, and thus improve their competitive level. By analyzing the research process of this paper again, we can see that there are still some omissions in the design and selection of anti-group training. In this paper, only 10% of the body weight is selected as the resistance setting of the elastic band, and this data has not been analyzed in detail. Therefore, in the follow-up study, more forms of resistance training are needed to obtain a more scientific and convincing resistance data, and the experimental effect is better.

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