

LOWER LIMB STRENGTH TRAINING AND MOBILITY IN TABLE TENNIS



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TREINAMENTO DA FORÇA DOS MEMBROS INFERIORES E MOBILIDADE NO TÊNIS DE MESA

ENTRENAMIENTO DE LA FUERZA EN LOS MIEMBROS INFERIORES Y MOVILIDAD EN EL TENIS DE MESA

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ABSTRACT

Introduction: Between the existing fast movement ability training program and the real situation of the athletes, there is a discrepancy, which needs to be solved. **Objective:** Study the effects of lower limb strength training on fast movement ability in table tennis. **Methods:** A total of 40 volunteers were recruited and divided into the experimental and control groups, with 20 people in each group. The control group followed the traditional table tennis fast-movement training program. In contrast, the experimental group added lower limb strength training based on the traditional table tennis fast movement training program. The experimental and control groups conducted training experiments twice a week, one hour at a time, for a total of 8 weeks. **Results:** In the specific fast movement fitness test, the number of upper stages before training in the experimental group was 55.91, and after training was 61.25 ($P < 0.01$). In the whole platform turning speed test, the number in the experimental group before training was 61.40, and after training was 64.28 ($P < 0.01$). **Conclusion:** Fitness in the rapid movement ability of table tennis players was optimized after the addition of the lower limb strength training program. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Resistance Training; Lower Limbs; Physical Fitness; Racquet Sports.

RESUMO

Introdução: Entre o programa de treinamento de habilidade de movimento rápido existente e a situação real dos atletas, existe uma discrepância, que precisa ser solucionada. **Objetivo:** Estudar os efeitos do treinamento de força dos membros inferiores sobre a habilidade de movimento rápido no tênis de mesa. **Métodos:** Um total de 40 voluntários foram recrutados e divididos no grupo experimental e no grupo de controle, com 20 pessoas em cada grupo. O grupo de controle seguiu o programa tradicional de treinamento de movimento rápido do tênis de mesa, enquanto ao grupo experimental foi adicionado o treinamento da força dos membros inferiores com base no programa tradicional de treinamento de movimento rápido do tênis de mesa. O grupo experimental e o grupo de controle conduziram experiências de treinamento duas vezes por semana, uma hora de cada vez, por um total de 8 semanas. **Resultados:** No teste específico de aptidão física para movimentação rápida, o número de estágios superiores antes do treinamento no grupo experimental foi 55,91, e após o treinamento foi 61,25 ($P < 0,01$). Em todo o teste de velocidade de giro da plataforma, o número do grupo experimental antes do treinamento foi de 61,40, e após o treinamento foi de 64,28 ($P < 0,01$). **Conclusão:** A aptidão física na capacidade de movimentação rápida dos jogadores de tênis de mesa foi otimizada após a adição do programa de treinamento de força dos membros inferiores. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento de Força; Membros Inferiores; Aptidão Física; Esportes com Raquete.

RESUMEN

Introducción: Entre el programa de entrenamiento de la capacidad de movimiento rápido existente y la situación real de los atletas, existe una discrepancia que es necesario resolver. **Objetivo:** Estudiar los efectos del entrenamiento de la fuerza de las extremidades inferiores sobre la capacidad de movimiento rápido en el tenis de mesa. **Métodos:** Se reclutó a un total de 40 voluntarios que se dividieron en el grupo experimental y el grupo de control, con 20 personas en cada grupo. El grupo de control siguió el programa tradicional de entrenamiento de movimientos rápidos de tenis de mesa, mientras que al grupo experimental se le añadió el entrenamiento de fuerza de las extremidades inferiores basado en el programa tradicional de entrenamiento de movimientos rápidos de tenis de mesa. El grupo experimental y el grupo de control realizaron experimentos de entrenamiento dos veces por semana, una hora cada vez, durante un total de 8 semanas. **Resultados:** En la prueba específica de aptitud física de movimientos rápidos, el número de fases superiores antes del entrenamiento en el grupo experimental fue de 55,91, y después del entrenamiento fue de 61,25 ($P < 0,01$). En la prueba de velocidad de giro en plataforma completa, el número del grupo experimental antes del entrenamiento fue de 61,40, y después del entrenamiento fue de 64,28 ($P < 0,01$). **Conclusión:** La aptitud en la capacidad de movimiento rápido de los jugadores de tenis de mesa se optimizó tras la adición del programa de entrenamiento de fuerza de las extremidades inferiores. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Entrenamiento de Fuerza; Miembros Inferiores; Aptitud Física; Deportes de Raqueta.



INTRODUCTION

With the rapid development of modern sports, table tennis has been very popular in China.¹ In mass sports, table tennis is very popular, and various universities have also set up table tennis related courses. A large number of students and sports enthusiasts are willing to participate in table tennis.² The basic movements of table tennis are very simple and easy to master. Moreover, table tennis has no special requirements for the field, and can be played in any open field.³ The reason why table tennis is popular is that it has special interest. Regular participation in table tennis can improve your health, improve your physical quality and cultivate your strong will. Table tennis is a sport that can benefit you for life.⁴ In the process of table tennis, due to too many horizontal links, it puts forward higher requirements for their own lower limbs. The sport level of table tennis is directly related to its own moving speed, coordination and responsiveness.⁵ Through training to improve their own value quality, we can effectively improve the technical level of table tennis. Therefore, in-depth study of lower limb training methods suitable for table tennis is beneficial to the positive development of table tennis.⁶

METHOD

Research objects and methods

In this paper, students are selected as research objects from the student athletes of table tennis in a university sports major.

After defining the experimental requirements, the two groups of athletes were divided into two groups according to the form of random sampling. The study and all the participants were reviewed and approved by Ethics Committee of Chengdu University of Traditional Chinese Medicine (NO.CDUTC20-DT022). A total of 40 volunteers were recruited and divided into the experimental group and the control group, with 20 people in each group. The basic indicators are shown in Table 1, $P > 0.05$, indicating that there is no significant difference to ensure the preciseness of the experimental results.

In the aspect of experimental design, the control group followed the traditional fast moving training program of table tennis, including actual training, high leg running, changing direction running, etc; On the basis of the traditional table tennis fast moving training program, the experimental group added lower limb strength training forms such as weight bearing squat, weight bearing heel lift, step jump, box jump, etc., so as to increase the proportion of lower limb strength training in fast moving ability training. The experimental group and the control group carried out the training experiment twice a week with a frequency of one hour each time for a total of 8 weeks. In addition to this training, the two groups of athletes are completely consistent in other curriculum arrangements, and there is no additional training after class.

Index test and data processing

In the aspect of the determination of table tennis's fast moving ability, the paper chooses three aspects as the main modules of the research: moving sensitivity, moving speed and comprehensive training effect of table tennis's fast moving ability. Among them, the number of 30s double jump rope, the number of 1 minute exchange jump, the time of 20 m turn back run, and the standing triple jump distance were selected to explore the athletes' mobility sensitivity; This paper discusses the moving speed of athletes by selecting 10 times of low center of gravity four point

Table 1. Basic indicators of two groups of subjects.

Basic indicators	Experimental group (n=20)	Control group (n=20)	P
Height	169.655±6.049	167.593±5.378	0.55335
Weight	65.783±5.551	66.975±4.509	0.60700

running, 5 times of left and right side running, 5 times of straight forward and backward running, and 30 m running; This paper discusses the actual effect of the fast moving ability of the athletes by selecting two indicators, namely, the number of the push block sidekick on the right platform and the number of the full platform swing speed on the platform.

RESULTS

Effect of lower limb strength training on athletes' mobility sensitivity

In this section, some basic indicators are selected, including the number of 30s double jump rope, the number of 1 min exchange jump, the time for 20m turn back running, and the distance of standing triple jump. The main research purpose is whether the athletes can adjust their bodies in a short time, which exercises the athletes' body coordination and mobility sensitivity, which can be used as a preliminary indicator for judgment. The specific data results are shown in Table 2.

In the 30s double jump rope test, the number of jump ropes in the control group before training was (57.517 ± 2.668) , the number of jump ropes after training was (59.362 ± 1.755) , $P=0.04165 < 0.05$, the number of jump ropes in the experimental group before training was (56.525 ± 3.325) , and the number of jump ropes after training was (61.879 ± 2.462) , $P=0.00592 < 0.01$.

In the 1-minute exchange jump test, the number of exchange jumps before training in the control group was (136.306 ± 7.463) , and after training was (143.374 ± 8.578) , $P=0.07765 > 0.05$. The number of exchange jumps before training in the experimental group was (139.202 ± 7.434) , and after training was (156.488 ± 6.246) , $P=0.00099 < 0.01$.

In the test of 20 m turn back run, the turn back run time of the control group before training was (22.370 ± 0.671) s, the turn back run time after training was (22.484 ± 0.739) s, $P=0.06178 > 0.05$, the turn back run time of the experimental group before training was (22.907 ± 0.848) s, and the turn back run time after training was (19.576 ± 0.851) s, $P=0.00000 < 0.01$.

In the standing triple jump test, the jumping distance before training in the control group was (5.399 ± 0.244) m, and after training was (5.466 ± 0.197) m, $P=0.06507 > 0.05$. The jumping distance before training in the experimental group was (5.375 ± 0.159) m, and after training was (5.506 ± 0.133) m, $P=0.00000 < 0.01$.

The comparison between the experimental group and the control group shows that the optimization range of the experimental group for the relevant indicators is greater than that of the control group, indicating that the current traditional table tennis fast moving training program is deficient, and the effect is better after the lower limb training module is supplemented.

Effect of lower limb strength training on athletes' moving speed

In this section, some indicators are selected, including 10 low center of gravity four point runs, 5 left and right side runs, 5 straight forward and backward runs, and 30 m runs. The main research purpose is whether

Table 2. Effect of lower limb strength training on athletes' mobility sensitivity.

Option	Group	Before training	After training	P
30s double jump rope (piece)	Control group	57.517±2.668	59.362±1.755	0.04165
	Experience group	56.525±3.325	61.879±2.462	0.00592
1min switching jump (pcs.)	Control group	136.306±7.463	143.374±8.578	0.07765
	Experience group	139.202±7.434	156.488±6.246	0.00099
20m turn back run (s)	Control group	22.370±0.671	22.484±0.739	0.06178
	Experience group	22.907±0.848	19.576±0.851	0.00000
Standing triple jump (m)	Control group	5.399±0.244	5.466±0.197	0.06507
	Experience group	5.375±0.159	5.506±0.133	0.00000

the athletes can quickly adjust the direction of movement after reaction, and maintain a faster moving speed, which is very important for table tennis. The relevant results are shown in Table 3.

In 10 low gravity four point running tests, the running time of the control group was (39.322 ± 1.468) s before training, (38.794 ± 0.496) s after training, P=0.07041 > 0.05, the running time of the experimental group was (39.102 ± 1.411) s before training, and (36.999 ± 0.777) s after training, P=0.00395 < 0.01.

In the five left and right side running tests, the running time of the control group was (13.536 ± 0.498) s before training, (13.292 ± 0.417) s after training, P=0.08787 > 0.05, the running time of the experimental group was (13.976 ± 0.375) s before training, and (11.949 ± 0.227) s after training, P=0.00789 < 0.01.

In the five straight forward and backward running tests, the running time of the control group before training was (18.561 ± 0.681) s, the running time after training was (18.997 ± 0.564) s, P=0.07899>0.05, the running time of the experimental group before training was (18.696 ± 0.685) s, and the running time after training was (17.493 ± 0.415) s, P=0.00694<0.01.

In the 30 m running test, the running time of the control group was (5.480 ± 0.305) s before training and (5.395 ± 0.217) s after training, P=0.15658 > 0.05; the running time of the experimental group was (5.415 ± 0.188) s before training and (4.845 ± 0.103) s after training, P=0.0000 < 0.01.

After eight weeks of training, the running time of the experimental group was shortened and the moving speed was increased after the experiment, which proved the effectiveness of the scheme proposed in this paper. Although the control group has also obtained certain optimization on some indicators, the effect is not obvious enough. The time used for five straight forward and backward runs has even increased slightly, and the optimization range of the other items is not obvious enough, indicating that the effect of the current traditional table tennis fast moving training program is not significant enough, and needs further improvement.

Training effect of fast moving ability of table tennis

In this section, two indicators are selected, namely, the number of sidekicks on the right platform and the number of the whole platform at an indefinite swing speed, as the application effect of the fast moving ability of table tennis in the actual table tennis game. The basic indicators above are combined and finally displayed in the game. The specific results are shown in Table 4.

In the test of pushing and blocking sidekick on the right platform, the number of people on the platform before training in the control group was (55.504 ± 3.173), the number of people on the platform after training was (56.159 ± 3.669), P=0.06049 > 0.05, the number of people on the platform before training in the experimental group was (55.911 ± 3.296), and the number of people on the platform after training was (61.259 ± 4.812), P=0.00691 < 0.01.

Table 3. The influence of lower limb strength training on athletes' moving speed.

Option	Group	Before training	After training	P
10 low center of gravity four point runs (s)	Control group	39.322±1.468	38.794±0.496	0.07041
	Experience group	39.102±1.411	36.999±0.777	0.00395
5 left and right side runs (s)	Control group	13.536±0.498	13.292±0.417	0.08787
	Experience group	13.976±0.375	11.949±0.227	0.00789
5 straight forward and backward runs (s)	Control group	18.561±0.681	18.997±0.564	0.07899
	Experience group	18.696±0.685	17.493±0.415	0.00694
30m run (s)	Control group	5.480±0.305	5.395±0.217	0.15658
	Experience group	5.415±0.188	4.845±0.103	0.00000

Table 4. Training effect of fast moving ability in table tennis.

Option	Group	Before training	After training	P
Pushing to the right (piece)	Control group	55.504±3.173	56.159±3.669	0.06049
	Experience group	55.911±3.296	61.259±4.812	0.00691
Set up the whole station at an indefinite swing speed (piece)	Control group	63.467±3.996	65.575±3.887	0.06539
	Experience group	61.403±5.570	64.280±5.121	0.00395

In the whole platform swing speed test, the number of people on the platform before training in the control group was (63.467 ± 3.996), the number of people on the platform after training was (65.575 ± 3.887), P=0.06539 > 0.05, the number of people on the platform before training in the experimental group was (61.403 ± 5.570), and the number of people on the platform after training was (64.280 ± 5.121), P=0.00395 < 0.01.

It can be seen from the comparison of data that although the control group has improved in two indicators, namely, the number of push block sidekick on the right platform and the number of full platform swing speed on the platform, the extent of improvement is relatively general, and the expected goal in the training plan is not reached. However, the experimental group had a large increase in the number of push block sidekick and the number of full set swing speed on the right platform, which was significantly compared with the control group, and could complete the expected goal arrangement in the training plan. Therefore, adding the content of lower limb training in the traditional fast moving training can better improve the fast moving ability of table tennis players.

DISCUSSION

Lower limb strength training methods of table tennis

The first is the training for thigh muscles and hip muscles. In the training of thigh muscles and hip muscles, barbell squatting exercises can be carried out with the help of auxiliary equipment. Squat room is a traditional lower limb strength training method. And this method is simple and efficient, and the training intensity can be controlled by the weight of the load. You can also use the Smith machine for squatting training. The equipment can create a safe environment for training and avoid accidents. For the training of calf muscles, it is mainly to exercise the explosive power of calf muscles. In the process of movement, strengthening the explosive force of the movement will help to improve the energy given to the ball when hitting. With excellent explosive power of lower limbs, you can play a higher level in the competition. Explosive force can provide sufficient jumping ability. It helps to hit the ball more accurately during the movement. For the training of lower leg explosive force, the box jumping method can be used for training. This method can help the lower leg develop strength quickly. After a long time of training, you can have the ability to exert maximum force instantly. The training method of box jumping is to stack boxes to different heights, and jump up from low to high during training. When their own quality reaches a certain level, they can increase their height and carry out intensive training.

Precautions for lower limb strength training in table tennis

Sufficient warm-up activities should be done before the training session. Adequate warm-up activities can help open joints in all parts of the body. Improve flexibility and flexibility. Warm up according to your physical ability. Warm up activity is the basic link of all training contents. Secondly, professional sports protective equipment should be worn during training. Professional sports protective equipment can protect the fragile joint tissues. And in the event of sports accidents, it can effectively reduce the severity of injury. The selection of sports protective equipment should be based on your own physical condition to avoid discomfort caused by too large or too small protective equipment during training.

CONCLUSION

In the process of table tennis match, players need to move constantly to complete the fierce competition, so the ability of fast movement is an important magic weapon for players to win. The existing fast moving ability training program is out of touch with the actual situation of the athletes. The program is relatively traditional and backward, and cannot meet the current training needs of the athletes, so it needs to be rectified. In this paper, the lower limb strength training program is

added. The research results show that after the lower limb strength training program is added, the fast moving ability of table tennis players is improved, and the optimization effect is greater than the traditional fast moving training program. Therefore, the training program in this paper is worth promoting.

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