

INFLUENCES OF STRENGTH TRAINING ON ATHLETES' SKILLS IN TABLE TENNIS



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INFLUÊNCIAS DO TREINAMENTO DE FORÇA NAS HABILIDADES DOS ATLETAS EM TÊNIS DE MESA

INFLUENCIAS DEL ENTRENAMIENTO DE FUERZA EN LAS CAPACIDADES DE LOS DEPORTISTAS EN EL TENIS DE MESA

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ABSTRACT

Introduction: The progressive advance of table tennis athletes' competitive level demands restructuring the traditional strength training program to readjust itself to the current athletic abilities. **Objective:** Explore a strategy based on strength training to improve table tennis athletes' physical capacity and hitting ability. **Methods:** Thirty table tennis students from a physical education college were selected as research volunteers. A strength training protocol was added to the traditional protocol in the experimental group. The duration of the exercises in the experimental group and the control group was the same, with a frequency of 3 times a week, totaling 9 weeks. **Results:** The optimization scheme of the strength training combination proposed in this paper revealed an improved effect on table tennis players' performance of hitting skills and fitness. Its range of improvement was greater than the traditional strength training scheme of the control group. **Conclusion:** The optimization scheme combining strength training proposed in this paper can be adjusted to the training according to the athletes' situation and benefit the athletes' training efficiency. It can also prevent repetitive injuries caused by the standard training mode in the long run, increasing the athletes' enthusiasm. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Racquet Sports; Resistance Training; Physical Fitness.

RESUMO

Introdução: O progressivo avanço do nível competitivo dos atletas de tênis de mesa demanda uma reestruturação do programa de treinamento de força tradicional para readaptar-se às atuais habilidades atléticas. **Objetivo:** Explorar uma estratégia com base no treinamento de força para o aprimoramento da capacidade física e habilidade de acertos dos atletas em tênis de mesa. **Métodos:** Trinta alunos de tênis de mesa de uma faculdade de educação física foram selecionados como voluntários da pesquisa. Adicionou-se um protocolo de treino de força ao protocolo tradicional no grupo experimental. A duração dos exercícios do grupo experimental e do grupo de controle foi a mesma, com frequência de 3 vezes semanais, totalizando 9 semanas. **Resultados:** O esquema de otimização da combinação de treinamento de força proposto neste trabalho revelou um efeito melhor no desempenho das habilidades de acerto e da aptidão física dos jogadores de tênis de mesa. Sua faixa de aprimoramento foi maior do que o esquema tradicional de treinamento de força do grupo de controle. **Conclusão:** O esquema de otimização combinando o treinamento de força proposto neste artigo pode ser ajustado ao treinamento de acordo com a situação dos atletas e beneficiar a eficiência no treinamento dos atletas. Também pode evitar, a longo prazo, as lesões repetitivas ocasionadas pelo modo de treinamento padrão, aumentando o entusiasmo dos esportistas. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

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

RESUMEN

Introducción: El progresivo avance del nivel competitivo de los deportistas de tenis de mesa exige una reestructuración del programa tradicional de entrenamiento de la fuerza para readaptarse a las capacidades atléticas actuales. **Objetivo:** Explorar una estrategia basada en el entrenamiento de fuerza para la mejora de la capacidad física y la habilidad de golpeo de los atletas de tenis de mesa. **Métodos:** Se seleccionaron treinta estudiantes de tenis de mesa de una escuela de educación física como voluntarios para la investigación. Se añadió un protocolo de entrenamiento de fuerza al protocolo tradicional en el grupo experimental. La duración de los ejercicios en el grupo experimental y en el grupo de control fue la misma, con una frecuencia de 3 veces por semana, en total 9 semanas. **Resultados:** El esquema de optimización de la combinación de entrenamiento de fuerza propuesto en este trabajo reveló un mejor efecto sobre el rendimiento de las habilidades de golpeo y la condición física de los jugadores de tenis de mesa. Su rango de mejora fue superior al esquema de entrenamiento de fuerza tradicional del grupo de control. **Conclusión:** El esquema de optimización que combina el entrenamiento de fuerza propuesto en este trabajo puede ajustarse al entrenamiento según la situación de los atletas y beneficiar la eficiencia del entrenamiento de los mismos. También puede evitar, a largo plazo, las lesiones repetitivas causadas por el modo de entrenamiento estándar, aumentando el entusiasmo de los atletas. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

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



INTRODUCTION

Table tennis is China's national game, with a high popularity and is loved by the public. With the development of China's sports, table tennis, which is deeply loved by students, is also rapidly popularized and growing.¹ Most colleges and universities in China have set up table tennis courses, which exist as public elective courses of physical education. In a table tennis match, the players of both sides need to play games and check each other. In the process of confrontation, the movement state of the ball will be affected by rotation, striking force, landing point, speed and radian, and the physical quality, intelligence, thought, technology and tactical level of the players will ultimately be reflected in the time and space characteristics of the hitting.² Through the characteristics of the practice items and the characteristics of the table tennis competition, the long-term cognition and exploration of table tennis are carried out. The winning factor of Chinese table tennis is "ruthlessness, accuracy, speed, change and turn". From this point of view, the development of table tennis is a process of improving personal level, and the winning factors will change with the combination of technical and tactical level and athletes' physical quality. For a long time, in the period of rapid development of technology and tactics, physical fitness has always been in the position of service skills.³ With the development of the Universiade, competitive sports in Colleges and universities continue to rise. Colleges and universities attach great importance to the Universiade and championships.⁴ Due to the continuous improvement of the level of competition, the stadium has put forward higher requirements for the physical quality, technical level and physical fitness of college sports teams and athletes. The physical condition and special quality of the athletes also determine the performance and application level of the athletes' skills and tactics.⁵ Therefore, it is very necessary to do physical exercise. Good physical condition can be an important factor for athletes to win the competition, and also an important development point for athletes to overcome technical obstacles and break their own limits.⁶

METHOD

In this paper, we selected the table tennis students of a freshman college of physical education as the research object. In the same score range, we selected 30 students and divided them into experimental group and control group by drawing lots. The study and all the participants were reviewed and approved by Ethics Committee of Northeast Agricultural University (NO.19NEAU64-FS). The basic information, including height, age and training years, is shown in Table 1. After statistics, $P > 0.05$ indicates that there is no significant difference.

The whole experiment adopts the method of control test. The daily exercise time of the experimental group and the control group is consistent, and the living environment, work and rest time and eating habits are consistent. In terms of strength training design, as shown in Table 2, the control group adopts the traditional training project types, including sit ups and rotations, pushups, fast runs, table touching exercises and continuous frog jumps, with a duration of 9 weeks. The experimental group adopts the form of periodic strength training. According to the existing training basis and the achievement of training objectives, the coaches designed periodic training programs including the back bridge, sit ups and rotations, and back extension. The duration of exercise in the experimental group and the control group remained the same, with a frequency of 3 times per week for a total of 9 weeks.

Table 1. Basic information of experimental group and control group.

	Height	Age	Training period
Test group	172.833±7.133	19.298±0.708	10.359±0.837
Control group	173.005±8.274	19.896±1.035	10.568±1.093
P value	0.720	0.946	0.814

In the aspect of athletes' physical fitness test, the data before and after the experiment are also compared. The physical indexes of table tennis players are divided into five aspects: speed, strength, flexibility, sensitive coordination and endurance. The physical test items that best represent this type are selected as the indexes for each event, as shown in Table 3.

RESULTS

Effect of strength training on the improvement of table tennis hitting skills

Table 4 shows the analysis of the improvement of table tennis hitting skills by strength training. It can be seen from Table 4 that with the progress of the experiment, the success rate of serving in the control group increased from (12.892 ± 2.565)% to (16.173 ± 2.149)%; The service speed increased from (103.307 ± 30.992) m / s to (107.059 ± 32.910) m / S; The rotation speed of the serve increased from (49.536 ± 7.911) R / s to (52.146 ± 8.033) R / s. The above data show that the traditional strength training has a certain effect on improving the hitting skills of table tennis, but the effect is limited. For the experimental group, the success rate of serving increased from (12.630 ± 2.492)% to (18.789 ± 2.156)%; The service speed increased from (103.557 ± 40.195) m / s to (123.101 ± 29.786) m / S; The rotation speed of the serve increased from (49.030 ± 7.910) R / s to (56.366 ± 7.205) R / s, $P < 0.05$, indicating a significant difference. The above data show that the strength training combination optimization

Table 2. Strength training design of experimental group and control group.

Cycle	Test group		Control group	
	Training project	Time	Training project	Time
1-3 weeks	Stretch bridge	10min	Start up and sit up and connect	10min
	Start up and sit up and connect	10min	push ups	10min
	Back stretch	10min	Run quickly	10min
	Prone	10min	Practice	10min
	Squat on the wall	10min	Continuous frog jet	10min
3-6 weeks	Bridge on the ball	10min	Start up and sit up and connect	10min
	Sepaled ball flexion, turning the body	10min	push ups	10min
	Planting up on a prone ball	10min	Run quickly	10min
	High -piercing lying arms supporting the ball	10min	Practice	10min
	Squat on the ball	10min	Continuous frog jet	10min
6-9 weeks	Half -bedball holds the heart ball turnover	10min	Start up and sit up and connect	10min
	Sipid back to support the ball	10min	push ups	10min
	Hand -supported ball push -up	10min	Run quickly	10min
	Straight arms and legs to support the piercing bridge	10min	Practice	10min
	Squatting on the back of the two people	10min	Continuous frog jet	10min

Table 3. Physical fitness classification and test indicators.

Category	Specific indicator
Speed	50M
Force class	Standing long jump
Flexible	Siter
Endurance	800M
Sensitive coordination	X shape forward and back away

scheme proposed in this paper has a better effect on improving the hitting skills of table tennis, and the improvement range is greater than the traditional strength training scheme of the control group.

Effect of strength training on table tennis physical ability

Table 5 shows the influence of strength training on the improvement of table tennis physical ability. It can be seen from the table that, with the progress of the experiment, the performance of the experimental group in 50m running increased from (9.347 ± 0.850) s to (8.671 ± 0.870) s, the performance of standing long jump increased from (174.107 ± 9.680) cm to (191.923 ± 9.001) cm, the performance of sitting forward flexion increased from (24.089 ± 2.216) cm to (30.071 ± 3.442) cm, and the performance of 800 running increased from (3.777 ± 0.259) min to (3.196 ± 0.178) min, The results of X-shaped forward and backward running increased from (10.233 ± 0.176) s to (8.989 ± 0.062) s, and the above data were all $P < 0.05$, indicating a significant difference. The analysis shows that the strength training combination optimization scheme proposed in this paper has a better promotion effect on the comprehensive development of table tennis physical ability. It can effectively improve the speed and sensitivity of table tennis players, improve their core strength and lower limb explosive force, enhance the coordination of limbs and muscle flexibility, and improve the endurance limit of athletes. Compared with the traditional training program of the control group, the advantages of the experimental group are more obvious.

Table tennis is a sport with high comprehensive quality for athletes. For example, table tennis players need to have good lower limb strength, overcome the resistance caused by the racket ball and their own gravity, improve the maximum acceleration of the service, greatly increase the threat of the service, and thus obtain the initiative. Therefore, the standing long jump is the criterion for judging the strength of the lower limbs. The longer the distance, the higher the strength of the lower limbs. The 50 meter and X-shaped forward and backward running, which represent speed and sensitive coordination, can effectively evaluate the explosive force and reaction force of the lower limbs of the athletes. The table tennis players with better scores in this respect can improve the movement speed of the lower limbs and the sensitivity and flexibility of the front, back, left and right changes during the table tennis competition, so as to be more flexible in the field and master the initiative in the field as soon as possible. Similarly, table tennis is also a sport that

needs endurance. In the whole game, athletes need to move and swing constantly. Therefore, good physical endurance effect plays a key role in winning table tennis matches, especially the table tennis matches that are close to each other. In this paper, the 800 meter race was selected as the physical fitness judgment standard in endurance.

DISCUSSION

According to the analysis of sports training theory, the development of special skills and tactics can be realized through good physical fitness. Generally speaking, physical ability is a broad concept, which refers to the physical ability of competitive sports. It can also represent the ability of athletes to overcome fatigue and complete technical actions with high quality under the maximum load during training and competition. Physical training refers to the training of human body's sports ability under high load environment, and its purpose is to carry out production function and psychological adaptation. Special physical quality training is a part of physical training and a narrow interpretation of physical training. In general, the special physical training focuses more on the main sports ability required by the characteristics of the project, and improves the special skills through the implementation of targeted training, while the conventional physical training is relatively more extensive and comprehensive. Table tennis requires each ball to have a certain speed, accuracy, strength, rotation and change. Where "rotation" refers to rotating the ball. Nowadays, rotation and speed have become two basic problems in table tennis. If rotation and speed are reasonably used, athletes can gain advantages in the competition. How to make the rotation of table tennis more stable in the movement is a problem worthy of consideration by all table tennis fans. The rotation speed shall be based on the force of hitting the ball. Once the player exerts force on the ball, the ball will spin. In addition, the increase in the volume of table tennis puts forward higher requirements for athletes to generate rotation by improving the hitting force. The drop point is usually reflected in the accuracy of table tennis. In table tennis, the range of movement of an athlete's body depends on the position of the opponent's ball on the table. Of course, players can also change the ball's landing point to contain opponents. Especially in the game, if an athlete wants to win the game, he must effectively control the landing point of the return ball, find the weakness of the other side, change the landing point of the return ball, and win the initiative. In order to ensure the stability and accuracy of the landing point when the players hit the ball with fast motion, the players must maintain their physical strength, which needs the support of core strength.

CONCLUSION

For college table tennis professional athletes, how to improve the effectiveness of training and improve the competitive ability of table tennis training in the shortest time is very important for their own development. Therefore, we should choose a more effective training program. The results show that the strength training combination optimization scheme proposed in this paper can scientifically adjust the training scheme according to the training situation of the athletes and improve the training efficiency of the athletes. It also avoids the disconnection and dullness caused by the long-term single training mode, and improves the training enthusiasm of athletes. Therefore, it is worth promoting. In the actual training process, the coach should also adjust the training plan scientifically according to the actual situation of the strength development of the athletes, so as to promote the development of sports training with sports theory.

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Table 4. Improvement of table tennis hitting skills by strength training.

Option	Group	Before	After	P
Rate success rate (%)	test group	12.630±2.492	18.789±2.156	0.0277
	Control group	12.892±2.565	16.173±2.149	0.2686
Sending speed (m/s)	test group	103.557±40.195	123.101±29.786	0.0219
	Control group	103.307±30.992	107.059±32.910	0.8162
Rotating speed (r/s)	test group	49.030±7.910	56.366±7.205	0.0283
	Control group	49.536±7.911	52.146±8.033	0.4608

Table 5. Improvement of table tennis physical ability by strength training.

Option	Group	Before	After	P
50m (s)	test group	9.347±0.850	8.671±0.870	0.0110
	Control group	10.034±0.948	9.137±0.753	0.0138
Standing long jump (cm)	test group	174.107±9.680	191.923±9.001	0.0026
	Control group	174.544±5.650	185.509±2.616	0.0303
Siter forward flexion (cm)	test group	24.089±2.216	30.071±3.442	0.0166
	Control group	21.756±3.774	23.472±3.745	0.0354
800 (min)	test group	3.777±0.259	3.196±0.178	0.0178
	Control group	3.969±0.346	3.707±0.347	0.0318
X shape forward and back (s)	test group	10.233±0.176	8.989±0.062	0.0467
	Control group	10.239±0.183	9.446±0.336	0.0568

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