

ABDOMINAL CENTER STRENGTH TRAINING IN TABLE TENNIS PLAYERS

TREINAMENTO DE FORÇA DO CENTRO ABDOMINAL EM JOGADORES DE TÊNIS DE MESA

ENTRENAMIENTO DE FUERZA DEL CENTRO ABDOMINAL EN JUGADORES DE TENIS DE MESA



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ABSTRACT

Introduction: A series of reforms in table tennis involving the development trend of table tennis technology and the needs of athletes to improve competitive ability and prevent injuries have presented new requirements for the abdominal center strength of athletes. **Objective:** Study the impacts of implementing abdominal center strength training on the training of table tennis players. **Methods:** A broad literature search and experimental comparison were performed. Twenty professional athletes aged 14 to 20 from the men's table tennis team were selected as volunteers for the research, divided into two groups according to the mean, standard deviation, and results of special technical tests. An independent sample t-test was performed on both groups. **Results:** Significant differences were found for abdominal control, for legs and arms crossed on both ends, for supine posture, and for leg raising ($P < 0.05$). **Conclusion:** Abdominal center strength training can effectively improve the special ability level of young table tennis players, improve the body control ability in players, and the stability of the shot action. **Level of evidence II; Therapeutic studies - investigating the results of treatment.**

Keywords: Abdominal Core; Physical Education and Training; Resistance Training.

RESUMO

Introdução: Uma série de reformas no tênis de mesa que envolvem a tendência de desenvolvimento da tecnologia do tênis de mesa e as necessidades dos atletas para melhorar a capacidade competitiva e prevenir lesões tem apresentado novos requisitos para a força do centro abdominal dos esportistas. **Objetivo:** Estudar os impactos da implementação do treinamento de força no centro abdominal no treinamento dos jogadores de tênis de mesa. **Métodos:** Efetuou-se vasta pesquisa bibliográfica e comparação experimental. Foram selecionados 20 atletas profissionais com idade entre 14 e 20 anos da equipe masculina de tênis de mesa como voluntários para pesquisa, divididos em dois grupos de acordo com a média, desvio padrão e resultados de testes técnicos especiais. Realizou-se um teste T de amostra independente nos dois grupos. **Resultados:** Foram encontradas diferenças significativas para controle abdominal, para pernas e braços cruzados de ambas as extremidades, para postura supina e para levantamento de pernas ($P < 0.05$). **Conclusão:** O treinamento da força do centro abdominal pode efetivamente melhorar o nível de habilidade especial dos jovens jogadores de tênis de mesa, melhorar a capacidade de controle corporal nos jogadores e a estabilidade da ação dos tiros. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Centro Abdominal; Educação Física e Treinamento; Treinamento de Força.

RESUMEN

Introducción: Una serie de reformas en el tenis de mesa relacionadas con la tendencia de desarrollo de la tecnología del tenis de mesa y las necesidades de los atletas para mejorar la capacidad competitiva y prevenir las lesiones han presentado nuevos requisitos para la fuerza del núcleo abdominal de los atletas. **Objetivo:** Estudiar los impactos de la implementación del entrenamiento de la fuerza del núcleo abdominal en el entrenamiento de los jugadores de tenis de mesa. **Métodos:** Se realizó una amplia investigación bibliográfica y una comparación experimental. Se seleccionaron como voluntarios para la investigación 20 atletas profesionales con edades comprendidas entre los 14 y los 20 años del equipo masculino de tenis de mesa, divididos en dos grupos según la media, la desviación estándar y los resultados de las pruebas técnicas especiales. Se realizó una prueba T de muestras independientes en los dos grupos. **Resultados:** Se encontraron diferencias significativas para el control abdominal, para las piernas y los brazos cruzados de ambas extremidades, para la postura supina y para la elevación de las piernas ($P < 0,05$). **Conclusión:** El entrenamiento de la fuerza del núcleo abdominal puede mejorar eficazmente el nivel de habilidad especial de los jóvenes jugadores de tenis de mesa, mejorar la capacidad de control del cuerpo en los jugadores y la estabilidad de la acción de tiro. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptorios: Núcleo Abdominal; Educación y Entrenamiento Físico; Entrenamiento de Fuerza.



INTRODUCTION

In recent years, a series of reforms in table tennis, the development trend of table tennis technology, and the needs of athletes to enhance their competitive ability and prevent injuries, all of them put forward new requirements for the core strength of table tennis players. However, in specific training, many coaches do not have a deep enough understanding of the core strength training theory of athletes, the training effect is also lacking, which affects the further improvement of the competitive level of table tennis players.¹ Yang L believes that with regard to power transmission in table tennis, any problem in the performance of power in any link will have an impact on the entire movement process.² Sun X pointed out that under the new rules of table tennis, coaches began to pay attention to the strength training of athletes, and introduced in detail the positive role of core strength training in table tennis, and combined with the characteristics of table tennis, the different roles of deep and superficial muscle groups in the core part of the body are expounded from the anatomy and physiology aspects.³ Xia R believes in the article that if athletes want to play their sports level in competition, they must use core strength as a guarantee to achieve balance in fast movement.⁴ According to Popescu R I, core strength training for table tennis players has the following four advantages: ① It can improve the speed of the athlete's footwork; ② It can improve the stability of the athlete's hitting; ③ It can enhance the athlete's control of the swing force; ④ It can effectively prevent sports injuries.⁵

METHOD

Research object

The author takes the research effect of core strength training application of outstanding young men's table tennis players in a province as the research object.

Documentation method

The main ways of retrieving documents include CNKI, Ph.D. and Master's thesis database, the library of the College of Physical Education and other resources, including books on sports training, exercise physiology, item group theory, sports biochemistry, core training and other related books and literature on strength training, core strength training and table tennis training, and related materials are studied and sorted out to provide sufficient theoretical basis for the writing of the thesis.⁶

Mathematical Statistics

Statistical methods were used to perform statistical analysis on the test indicators of the team members participating in the test, and SPSS23.0 software and EXCELL software were used for data classification and statistics.⁷

Experimental method

The author adopts the research method of two groups to compare, the results of the two groups of athletes before and after the experiment were compared and analyzed, during the 8-week experimental period, the two groups of athletes adopted different training methods, at the same time, the data of the relevant test indicators before and after the experiment of the two groups of athletes were effectively recorded. In addition, relevant information such as performance, ball age, weight and body mass index of the tested athletes were collected.

Determination of core area

Combined with the relevant literature,⁸ the author believes that the location of the core region should be defined as the muscle groups around the hip, lumbar spine and pelvis. Through research on the muscles around the pelvis, lumbar spine and hip joints, it is found that the

muscle distribution of the starting and ending points of this part has a total of 25 pairs of starting points in the core, 1 pair of insertion points in the core, and 7 pairs of starting and ending points in the core + one piece, a total of 33 (pairs) + 1 (block), as shown in Table 1.

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Tianjin Vocational University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Analysis of the basic physical conditions of the two groups of athletes before the experiment

As shown in Table 2, the ages of the athletes in the experimental group and the control group were 15.6 ± 1.8 and 15.5 ± 2.0 years old, respectively, the heights are 176.7 ± 1.5 cm and 175 ± 2.9 cm, and the weights are 66.5 ± 4.6 kg and 64.8 ± 4.3 kg, respectively, body mass index (BMI) were 21.3 ± 1.5 kg/m² and 21.2 ± 1.2 kg/m², respectively. Before the experiment, an independent sample T test was performed on the four physical indicators (body mass index, age, height, and weight) of the two groups of test athletes, so the following conclusions can be drawn: Therefore, the influence of individual differences of athletes participating in the experiment on the validity of this experiment can be excluded during the experiment.

Analysis of the basic physical conditions of the two groups of athletes after the experiment

As can be seen from Table 3, after 8 weeks of experiment, there was little change in body weight between the two experimental groups. After the test, an independent t-test was conducted on the data of the experimental and control groups, and it was found that the athletes of

Table 1. Distribution of core muscle groups.

| Muscle group | Start at the core | Stop at the core | Start and end at the core |
|--------------------------|--|-------------------------|--|
| Thigh muscles (11 pairs) | rectus femoris, biceps femoris, tensor latissimus, semitendinosus, semimembranosus, pectineus, adductor magnus, adductor longus, brevis, sartorius, gracilis | | |
| Back muscles (9 pairs) | latissimus dorsi, spine, iliocostalis, serratus posterior, longissimus | | Rotator, interspinous, intertransverse, multifidus |
| Abs (5 pairs) | rectus abdominis | External oblique muscle | Internal oblique, transverse abdominis, quadratus lumborum |
| Diaphragm (1 pair) | | | Diaphragm |
| Pelvic girdle (8 pairs) | gluteus medius, iliacus, psoas, piriformis | | |

Table 2. Analysis of the basic physical conditions of the athletes in the experimental group and the control group before the experiment.

| | Age | Height/cm | Weight/kg | Body Mass Index (BMI) |
|------------------------------------|---------------|----------------|---------------|-----------------------|
| Athletes in the experimental group | 15.6 ± 1.8 | 176.7 ± 1.5 | 66.5 ± 4.6 | 21.2 ± 1.4 |
| Athletes in the control group | 15.5 ± 2.0 | 175 ± 2.9 | 64.5 ± 4.3 | 21.2 ± 1.2 |
| P value | 0.9 | 0.1 | 0.4 | 0.7 |
| Relationship to 0.05 | >0.05 | >0.05 | >0.05 | >0.05 |

the two groups were tested for four age groups age ($P=0.91>0.05$), height ($P=0.11>0.05$), weight ($P=0.37>0.05$), and body mass index ($P=0.72>0.05$), there were no significant differences after weeks of testing, in this way, the influence of large-scale changes in various indicators in the experiment on the validity of the experiment can be excluded, thereby ensuring the validity of the experiment.

Statistics and analysis of test scores of core strength indicators

Four indicators that can more objectively reflect the level of core strength (single-arm push-up to control the abdomen, legs and arms crossed to get up at both ends, supine hip lift, prone leg lift) were selected to test the two groups of athletes, the results are shown in Table 4.

As shown in Table 4, before the experiment, the athletes in the experimental group were 43.6 ± 2.0 times per minute in a prone position with one arm to control the abdomen, the number of athletes in the control group was 42.8 ± 1.1 , P value was 0.29, $P>0.05$, there was no significant difference. After the test, the number of times per minute for the athletes in the experimental group to lie prone with one arm and the abdomen was 46.5 ± 2.1 , and the number of times for the athletes in the control group was 44.6 ± 1.4 , with a P value of 0.03, $P<0.05$, and there was a significant difference. Before the experiment, the number of times per minute for the athletes in the experimental group to cross their legs and arms was 45.9 ± 2.7 , and the number of times for the athletes in the control group was 45.7 ± 2.0 , P value was 0.86, $P>0.05$, there was no significant difference. After the test, the number of times per minute that the athletes in the experimental group crossed their arms and legs was 49 ± 2.5 , while that of the athletes in the control group was 46.7 ± 2.1 , with a P value of 0.04, $P<0.05$, and

Table 3. Analysis of the basic physical conditions of the two groups of athletes after the experiment.

| | Age | Height/Cm | Weight/kg | Body Mass Index (BMI) |
|------------------------------------|---------------|----------------|---------------|-----------------------|
| Athletes in the experimental group | 15.6 ± 1.8 | 176.7 ± 1.5 | 66.5 ± 4.6 | 21.3 ± 1.5 |
| Athletes in the control group | 15.5 ± 2.0 | 175 ± 2.9 | 64.8 ± 4.3 | 21.2 ± 1.2 |
| P value | 0.9 | 0.1 | 0.4 | 0.8 |
| Relationship to 0.05 | >0.05 | >0.05 | >0.05 | >0.05 |

there was a significant difference. Before the experiment, the number of times per minute of the athletes in the experimental group lying on their backs and raising the hips was 42.6 ± 1.3 , and the number of athletes in the control group was 42.3 ± 1.2 , P value was 0.59, $P>0.05$, there was no significant difference.

DISCUSSION

When formulating a training plan for core strength training, it is necessary to adhere to the principle of gradual progress, combine the actual situation of athletes, pay attention to the individual differences of athletes, and also pay attention to the psychological training and recovery training of athletes.⁹ Core strength training should be combined with special training, and it is necessary to recognize that core strength training and traditional strength training are both different and related, in order to combine the advantages of the two to jointly serve the special training of table tennis, it is not possible to one-sidedly pursue a single strength training.¹⁰

CONCLUSION

After 8 weeks of testing, the results of athletes in the experimental group improved significantly, indicating that core strength training can improve mobility, coordination hands on the body, and thinking in athletes, while at the same time improving physical performance. The effect of the spread of energy on athletes. Both groups of athletes improved their test scores, but the results of core strength training in the experimental group were greater than in the control group, indicating the impact of training the core strength and traditional strength training. Although core strength training is beneficial to players' swing consistency, it can improve players' swing speed.

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Table 4. Statistical table of the results of the athletes in the experimental group and the athletes in the control group before and after the experiment Unit: individual.

| Test items | Group | Before experiment | After the experiment | Comparison between the experimental group and the control group before the experiment (P value) | After the experiment, the comparison between the experimental group and the control group (P value) |
|---|---------------|-------------------|----------------------|---|---|
| One-arm push-ups for abdominal control (times/min) | Test group | 43.6 ± 2.0 | 46.5 ± 2.1 | 0.3 | 0.03 |
| | Control group | 42.8 ± 1.1 | 44.6 ± 1.4 | | |
| Cross the legs and arms from both ends (times/minute) | Test group | 45.9 ± 2.7 | 49.0 ± 2.5 | 0.9 | 0.04 |
| | Control group | 45.7 ± 2.0 | 46.7 ± 2.1 | | |
| Supine hip lift (times/min) | Test group | 42.6 ± 1.3 | 45.4 ± 1.7 | 0.6 | 0.02 |
| | Control group | 42.3 ± 1.2 | 43.8 ± 1.2 | | |
| Prone leg raise (times/min) | Test group | 44.2 ± 1.6 | 46.8 ± 2.2 | 0.5 | 0.04 |
| | Control group | 43.8 ± 1.2 | 45.0 ± 1.5 | | |

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