

IMPACTS OF WEIGHT TRAINING ON PHYSICAL FITNESS IN TABLE TENNIS



ORIGINAL ARTICLE
ARTIGO ORIGINAL
ARTÍCULO ORIGINAL

IMPACTOS DO TREINAMENTO COM PESOS SOBRE A APTIDÃO FÍSICA NO TÊNIS DE MESA

IMPACTOS DEL ENTRENAMIENTO CON PESAS EN LA APTITUD FÍSICA EN EL TENIS DE MESA

Chongjiang Zhan¹ 
(Physical Education Professional)

Pengtao Cui² 
(Physical Education Professional)

1. Jiyang College of Zhejiang A&F University, Zhuji, Zhejiang, China.

2. Shaoxing University Yuanpei College, Shaoxing, Zhejiang, China.

Correspondence:

Pengtao Cui
Shaoxing, Zhejiang, China. 312000.
cuipt@usx.edu.cn

ABSTRACT

Introduction: Sportive physical fitness is the capacity to accomplish of physical or muscular activity in a satisfactory way and its variables for excellence include corporal composition, flexibility, force, and muscular resistance. Weight training generates benefits in the musculoskeletal system and is believed that with its practice there is some impact on the athletes' physical fitness. **Objective:** Study the impacts of weight training on the physical fitness of table tennis athletes. **Methods:** Sixteen professional table tennis players were selected for this study and randomly divided into a control and an experimental group. The control group maintained the existing table tennis training program, and the experimental group received additional weightlifting training using 30% maximal strength based on the existing training. Relevant fitness data were collected before and after the intervention, analyzed, and discussed statistically. **Results:** The time of the Illinois sensitivity test in the experimental group was reduced to 17.20±0.23 s, a reduction of approximately 0.43 s, while in the control group, it was approximately 0.08 s. As for the hexagonal ball sensitivity test, in the experimental group it was reduced to 0.52 s, while in the control group, the reduction was 0.175 s. **Conclusion:** In table tennis training, weight gain can improve training efficiency and optimize the competitive level of table tennis players.

Level of evidence II; Therapeutic studies - investigation of treatment outcomes.

Keywords: Training, Strength; Racquet Sports; Physical Fitness.

RESUMO

Introdução: A aptidão física esportiva é a capacidade de realização de atividade física ou muscular de maneira satisfatória e suas variáveis para a excelência incluem composição corporal, flexibilidade, força e resistência muscular. O treino com pesos gera benefícios no sistema musculoesquelético e acredita-se que com a sua prática haja algum impacto sobre a aptidão física dos atletas. **Objetivo:** Estudar os impactos do treinamento com pesos sobre a aptidão física dos atletas de tênis de mesa. **Métodos:** Foram selecionados 16 jogadores profissionais de tênis de mesa para este estudo, divididos aleatoriamente em grupo controle e experimental. O grupo de controle manteve o programa de treinamento de tênis de mesa existente, e o grupo experimental recebeu um treinamento adicional de levantamento de pesos utilizando a força máxima em 30%, com base no treinamento existente. Dados relevantes de aptidão física foram coletados antes e após a intervenção, analisados e discutidos estatisticamente. **Resultados:** O tempo do teste de sensibilidade de Illinois no grupo experimental foi reduzido para 17,20±0,23 s, uma redução de aproximadamente 0,43 s, enquanto que no grupo controle foi de aproximadamente 0,08 s. Quanto ao teste de sensibilidade com bola hexagonal, no grupo experimental reduziu-se 0,52 s, enquanto no grupo controle a redução foi de 0,175 s. **Conclusão:** No treinamento de tênis de mesa, o aumento do peso pode melhorar a eficiência do treinamento e otimizar o nível competitivo dos jogadores de tênis de mesa. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Musculação; Esportes com Raquete; Aptidão Física.

RESUMEN

Introducción: La aptitud física deportiva es la capacidad de realización de actividad física o muscular de forma satisfactoria y sus variables para la excelencia incluyen composición corporal, flexibilidad, fuerza y resistencia muscular. El entrenamiento con pesas genera beneficios en el sistema músculo-esquelético y se cree que con su práctica hay algún impacto en la aptitud física de los atletas. **Objetivo:** Estudiar los impactos del entrenamiento con pesas en la aptitud física de atletas de tenis de mesa. **Métodos:** Dieciséis jugadores profesionales de tenis de mesa fueron seleccionados para este estudio, divididos aleatoriamente en grupos control y experimental. El grupo de control mantuvo el programa de entrenamiento de tenis de mesa existente, y el grupo experimental recibió un entrenamiento adicional con pesas utilizando la fuerza máxima en un 30% basado en el entrenamiento existente. Se recogieron datos relevantes sobre la forma física antes y después de la intervención, y se analizaron y discutieron estadísticamente. **Resultados:** El tiempo de la prueba de sensibilidad de Illinois en el grupo experimental se redujo a 17,20±0,23 s, una reducción de aproximadamente 0,43 s, mientras que en el grupo de control fue de aproximadamente 0,08 s. En cuanto a la prueba de sensibilidad con pelota hexagonal, en el grupo experimental se redujo a 0,52 s, mientras que en el grupo de control la reducción fue de 0,175 s. **Conclusión:** En el entrenamiento de tenis de mesa, el aumento de peso puede mejorar



Descriptores: *Musculación; Deportes de Raqueta; Aptitud Física.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012023_0036

Article received on 01/31/2023 accepted on 02/16/2023

INTRODUCTION

Table tennis is well known in China. It is a well-deserved “national ball” in China. It is in a very high position in China. It is also a popular ball sport in the world. China’s outstanding athletes have made outstanding achievements in the major international table tennis competitions and created brilliant historical achievements.¹ Table tennis can be seen in every community in Chinese cities, so it can be seen that table tennis is very popular in China. As we all know, the five competitive elements of table tennis are speed, strength, rotation, landing point and arc, and the most important physical quality index for athletes to practice these five elements is agility.² Sensitive quality refers to the ability of people to coordinate, flexibly, quickly and accurately complete actions under various sudden changes in the outside world. It is the comprehensive performance of people’s physical quality and various sports skills.³ The important physiological basis of the sensitive quality is the comprehensive analysis ability of the human cerebral cortex when conducting neural activities. Therefore, the sensitive quality is affected by genetic factors, such as gender, age, height, fat and thin, these inherent factors of the body will affect the directional movement, and the proficiency of the movement technology, the strength and extensibility of the body muscles are also the main factors that affect its ability.⁴ The evaluation of the sensitive quality should be based on the judgment, reaction ability and the ability to maintain balance when completing the action, and combine various sports qualities and sports skills under different external conditions, so that the existing physical quality can be effectively applied to practice.⁵ In view of the above description, this paper takes 16 players of a professional table tennis club as the research object to explore the impact of weight training on the sensitivity of table tennis’s directional movement.⁶ I hope that through the experimental results, we can optimize the existing table tennis sensitivity training methods, make the table tennis turn to a higher level of movement, improve the competitive level of table tennis players, so that the players of table tennis clubs can achieve better results.⁷

METHOD

Sixteen table tennis players from a professional table tennis club were selected as the research object, and were divided into experimental group and control group according to the form of random sampling. The study and all the participants were reviewed and approved by Ethics Committee of Zhejiang A&F University (NO.ZJAFU21F05). Their height and weight data are shown in Table 1, $p > 0.05$, indicating that there is no significant difference. It is proved that the selection of experimental objects in this paper will not interfere with the experimental results.

The experiment adopts the method of control experiment. The goal is to influence the sensitivity of table tennis’s directional movement. The variable design is whether to carry out weight-bearing training. Therefore, during the whole experiment, the control group kept the existing

table tennis training program unchanged, and the experimental group increased the weight of the maximum strength by 30% on the basis of the existing, and adjusted the overall weight in the form of sandbags and resistance bands, so that the weight of each athlete was 30% of its maximum strength. During the whole process of sports training, the experimental group and the control group were carried out according to the existing training program of the club, and their training time and training content. As well as the daily work and rest, diet, etc., are uniformly arranged by the club. Through closed training, the interference of unrelated human factors on the experimental results is minimized.

Before and after the experiment, the data of table tennis players were measured. The duration of 30m running, the distance of standing long jump and the distance of triple jump were selected as the indicators for judging the physical test of table tennis players; The duration of the cross-quadrant jump, the number of repeated leaps and the time of “8” word stepping were selected as the judgment indicators of table tennis players’ directional movement; The Illinois sensitivity test time, the hexagonal sensitivity test time and the T-type running sensitivity test time were selected as the judgment indicators of the sensitivity movement of table tennis players. Through the summary and collation of the data before and after the experiment, Excel and SPSS software are used to summarize the data and sort out the tables for the convenience of subsequent research.

RESULTS

Impact of weight-bearing training on the basic situation of table tennis players

Before the experiment, there was no significant difference between the experimental group and the control group in three aspects: the duration of the 30m run, the distance of the standing long jump and the distance of the triple jump. According to the data in Table 2, $P > 0.05$ indicates that there is no significant difference, and the physical fitness of athletes will not affect the experimental results.

Table 3 shows the data summary after the experiment. After the experiment, the 30 m running time of the experimental group was shortened to (4.15 ± 0.1367) s, and the shortened time was about 0.402 s, while that of the control group was shortened to (4.36 ± 0.2315) s, and the shortened time was about 0.222 s. The distance of standing long jump in the experimental group was increased to (2.72 ± 0.0365) m, and the distance was increased by about 0.067 m, while the distance in the control group was increased to (2.59 ± 0.0764) m, and the distance was decreased by about 0.059 m. The distance of the standing long jump in the experimental group was raised to (7.79 ± 0.1295) m, and the distance was about 0.193 m, while the distance in the control group was raised to (7.55 ± 0.1914) m, and the distance was about 0.067 m. From the intra-group comparison, it can be seen that after the experiment, the indexes of the 30-meter run, the standing long jump and the triple jump in the experimental group and the control group have improved, indicating that any training method can play a certain role in promoting the improvement of the athletes’ quality level. Through the comparison between groups, it can be seen that the proportion of athletes in the experimental group is higher than that in the control group, indicating that the efficiency of weight training in improving the basic indicators of athletes is better than the existing training methods.

Table 1. Basic information of the research object.

Basic indicators	Height	Weight
Experience group	167.80 \pm 5.9950	65.52 \pm 5.3876
Control group	167.76 \pm 5.4145	66.84 \pm 4.5365
P	0.05662	0.07357

Table 2. Basic information of the two groups of athletes before the experiment.

Physical indexes	30m run (s)	Standing long jump (m)	Triple jump (m)
Experience group	4.55 ±0.2410	2.66 ±0.0503	7.60 ±0.1795
Control group	4.58 ±0.2264	2.65 ±0.0606	7.49 ±0.1954
P	0.06376	0.05059	0.05351

Table 3. Training of the two groups of athletes after the experiment.

Physical indexes	30m run (s)	Standing long jump (m)	Triple jump (m)
Experience group	4.15 ±0.1367	2.72 ±0.0365	7.79 ±0.1295
Control group	4.36 ±0.2315	2.59 ±0.0764	7.55 ±0.1914
P	0.05636	0.07206	0.06620

Effect of weight-bearing training on the sensitivity of table tennis's directional movement

The characteristics of sensitive quality are speed, accuracy, coordination and resilience. Among them, the speed and explosive force of athletes' movement, reaction and discrimination are the main factors affecting speed; Athletes' own body feeling, space geometry feeling and their own control of body muscles are the main factors that affect the accuracy rate; Athletes' reserve of motor skills and the degree of hard work in their own training are the main factors that affect their own coordination; Under the sudden influence of the outside world, athletes can quickly adjust themselves and have a high response ability, which is the standard to measure the far mobilization of strain.

Before the experiment, the experimental group and the control group had little difference in the three sensitivity indicators of cross-quadrant jump time, the number of repeated crosses and the "8" word step time, and the three sensitivity indicators of Illinois sensitivity test time, hexagonal sensitivity test time and T-type running sensitivity test time. From the data in Table 4, it can be seen that $P > 0.05$, indicating that there is no significant difference, and the athletes' own basis of directional movement and sensitivity will not affect the experimental results.

Table 5 shows the data summary after the experiment. In the aspect of direction change movement, after the experiment, the time of cross quadrant jump in the experimental group was shortened to (6.44 ± 0.1084) s, and the shortened time was about 0.324 s, while the time of the control group was shortened to (5.73 ± 0.0663) s, and the shortened time was about 1.058 s. The optimization effect of the experimental group was not as good as that of the control group, indicating that the experimental design in this paper had certain defects in the cross quadrant jump index. The number of repeated crosses in the experimental group increased to (48.41 ± 3.2158), the number of increases was about 4.253, and the number of increases in the control group increased to (12.86 ± 0.0678) s, the number of increases was about 0.055. The optimization effect of the experimental group was much better than that of the control group. The time of "8" stamp in the experimental group was shortened to (12.80 ± 0.1132) s, and the shortened time was about 0.174 s, while that in the control group was shortened to (12.86 ± 0.0678) s, and the shortened time was about 0.055 s. The optimization effect of the experimental group was better than that of the control group.

Through the summary and comparison of the data, it can be seen that after training, the athletes' directional movement indicators and sensitivity indicators have improved in the experimental group and the control group. From the perspective of the extent of improvement, the improvement effect of the experimental group is better than that of the control group, which shows that adding a certain amount of weight-bearing training to the existing table tennis training mode can better stimulate the physical quality level of athletes and improve the training efficiency of sports training.

Table 4. Basic information of the two groups of athletes before the experiment.

Diverse motion index	Cross quadrant jump (s)	Cross over (repeatedly)	"8" word stamp (s)
Experience group	6.77 ±0.0749	44.15 ±2.0386	12.97 ±0.0806
Control group	6.79 ±0.0785	44.97 ±2.8639	12.92 ±0.0638
P	0.05059	0.06812	0.07864
Sensitivity index	Illinois sensitivity test (s)	Hexagonal ball sensitivity test (s)	T-type running sensitivity test (s)
Experience group	17.63 ±0.2299	3.58 ±0.1579	11.38 ±0.6475
Control group	17.79 ±0.1285	3.68 ±0.2194	10.45 ±0.4324
P	0.05535	0.05587	0.05172

Table 5. Training of the two groups of athletes after the experiment.

Diverse motion index	Cross quadrant jump (s)	Cross over (repeatedly)	"8" word stamp (s)
Experience group	6.44 ±0.1084	48.41 ±3.2158	12.80 ±0.1132
Control group	5.73 ±0.0663	45.68 ±2.5968	12.86 ±0.0678
P	0.06838	0.04817	0.07205
Sensitivity index	Illinois sensitivity test (s)	Hexagonal ball sensitivity test (s)	T-type running sensitivity test (s)
Experience group	17.20 ±0.2349	3.06 ±0.2131	11.18 ±0.6230
Control group	17.70 ±0.1264	3.50 ±0.2154	10.92 ±0.4942
P	0.04714	0.05671	0.05978

DISCUSSION

Table tennis, as a major antagonistic event, is smaller than football and basketball, so its movement speed is faster, its skill is stronger, and its playing method is also changeable. The technical actions of playing table tennis mainly include forehand, backhand, pull and push, and other skills, combined with the athlete's pace skills, to give play to the strength of the ball. In table tennis, we mainly pay attention to the quality of agility and speed. In the match, we mainly pay attention to the use of fast, accurate and firm strokes and feet. There are scientific data that show that athletes have developed a very effective training method to improve the strength, sensitivity and speed of the body: weight-bearing resistance training. This kind of training can enhance the physical movement of athletes, and then improve the performance of athletes, and enhance the sensitivity of athletes to a certain extent can reduce the probability of injury in sports competition. With the change and improvement of table tennis rules, the pace of table tennis competition is relatively much faster and the competition is also much more intense. Under such external conditions, athletes must have excellent physical fitness, so that they can stand out in this fierce competition.

When athletes show their agility, most of them change their movements or positions through the performance of their own strength. Therefore, their muscles perform better than the strength assembly. Some of the senses in the human body are related to sports. Therefore, in the process of sports, athletes must have good sensory state, so that athletes can make quick and accurate judgments in a very short time under the sudden influence of the outside world, so as to solve the impact of the outside world. Therefore, athletes with good sensors will also have a good impact on their sensitive quality. Only athletes have a good sense of body muscle and body control, so that they can feel the changes in space when exercising, and can cope with a variety of external influences through the adjustment of their own muscles. Through unremitting training, the more skilled the athletes master the technical movements, the more stable and coherent the movements will be in our movement process.

CONCLUSION

Although China's table tennis has achieved good results at present, we must guard against arrogance and rashness and pay attention to the cultivation of reserve talents. Only by continuously improving the competitive level of table tennis players can table tennis be in an invincible position in the changing environment. Therefore, this paper optimizes and adjusts the existing table tennis sensitivity training program and adds the content of load resistance. The research results show that in the existing table tennis training, adding weight training can improve the efficiency of training, optimize the competitive level of table tennis players, and make table tennis players have more initiative in the field,

so it is worth promoting. Although this paper does carry out weight training, there are still some problems. For example, this paper selects 30% of the maximum weight as the weight index. Whether this data is scientific and reasonable has not been further verified. Therefore, in the follow-up, we should increase the weight index of different weights, carry out more control training, and further explore the interference of the weight on the training results, so as to make the experimental results more rigorous.

All authors declare no potential conflict of interest related to this article

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. Chongjiang Zhan and Pengtao Cui: writing and execution.

REFERENCES

1. Mülling K, Kober J, Kroemer O, Peters J. Learning to select and generalize striking movements in robot table tennis. *Int J Rob Res.* 2013;32(3):263-79.
2. Schumacher DJ, Holmboe ES, Van Der Vleuten C, Busari JO, Carraccio C. Developing resident-sensitive quality measures: A model from pediatric emergency medicine. *Developing resident-sensitive quality measures: A model from pediatric emergency medicine. Acad Med.* 2018;93(7):1071-8.
3. Rahn DJ. Transformational teamwork: exploring the impact of nursing teamwork on nurse-sensitive quality indicators. *J Nurs Care Qual.* 2016;31(3):262-8.
4. Lindberg M, Ludvigsen MS. Ultrafiltration rate as a nursing-sensitive quality indicator in haemodialysis. *Int J Nurs Stud.* 2012;49(10):1320-4.
5. Shen Z, Qin W, Zhu L, Lin Y, Ling H, Zhang Y. Construction of nursing-sensitive quality indicators for cardiac catheterisation: A Delphi study and an analytic hierarchy process. *J Clin Nurs.* 2022;31(19-20):2821-38.
6. Sheng H. Application of Hierarchical Teaching in Table Tennis Teaching in Colleges. *J Front Sport Res.* 2021;1(2):22-5.
7. Biswas SK, Paul M, Sandhu JS. Role of sports vision and eye hand coordination training in performance of table tennis players. *Braz J Biomotricity.* 2011;5(2):106-16.