

PHYSICAL TRAINING DEDICATED TO TABLE TENNIS ATHLETES



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TREINAMENTO FÍSICO DEDICADO AOS ATLETAS DE TÊNIS DE MESA

ENTRENAMIENTO FÍSICO DEDICADO A LOS DEPORTISTAS DE TENIS DE MESA

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ABSTRACT

Introduction: Table tennis is an explosive metabolic anaerobic sport of moderate intensity. Improving the level of its athletes depends on dedicated physical training methods. The Chinese state has invested more financial support for physical training believing in the effective possibility to improve the physical fitness and abilities of its table tennis athletes. **Objective:** This study aims to analyze the effect of special physical training on table tennis players' motor skills. **Methods:** This paper selects several table tennis players as research subjects. The volunteers were randomly divided into experimental and control groups. The experimental group adopted the exclusive physical training method. The control group underwent traditional training. Mathematical, statistical and experimental methods were used to analyze the impact of exclusive physical training on the motor skills of table tennis players. **Results:** The test scores of the experimental group were significantly improved after four weeks and six weeks of exclusive physical training ($P < 0.01$). There was no significant change in the three diagnostic test scores in the control group ($P > 0.05$). After six weeks of a physical training intervention in the experimental group, the 0-score group disappeared. The distribution of the scores of the athletes gradually converges to the highest group. **Conclusion:** Table tennis players showed good feedback on the functional intervention training protocol. Dedicated physical training positively affects the mastery, dexterity and skill in movement techniques of table tennis players. **This work can provide a theoretical basis for scientific training of table tennis players. Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Exercise; Tennis; Athletes.

RESUMO

Introdução: O tênis de mesa é um esporte anaeróbico metabólico explosivo de intensidade moderada. A melhoria do nível de seus atletas depende de métodos de treinamento físico dedicados. O estado chinês investiu mais apoio financeiro para o treinamento físico acreditando na efetiva possibilidade de aprimorar a aptidão física e as habilidades dos seus atletas de tênis de mesa. **Objetivo:** Este estudo visa analisar o efeito do treinamento físico especial sobre as habilidades motoras dos jogadores de tênis de mesa. **Métodos:** Este trabalho seleciona vários jogadores de tênis de mesa como objetos de pesquisa. Os voluntários foram divididos aleatoriamente em grupos experimental e controle. O grupo experimental adotou o método exclusivo de treinamento físico. O grupo de controle foi submetido a um treinamento tradicional. Utilizou-se métodos matemáticos, estatísticos e experimentais para analisar o impacto do treinamento físico exclusivo sobre as habilidades motoras dos jogadores de tênis de mesa. **Resultados:** Os resultados dos testes do grupo experimental foram significativamente aprimorados após quatro semanas e seis semanas de treinamento físico exclusivo ($P < 0,01$). Não houve mudança significativa nas três pontuações dos testes de diagnóstico no grupo de controle ($P > 0,05$). Após seis semanas de uma intervenção de treinamento físico no grupo experimental, o grupo de 0 pontos desapareceu. A distribuição das pontuações dos atletas converge gradualmente para o grupo mais elevado. **Conclusão:** Os jogadores de tênis de mesa apresentaram um bom retorno sobre o protocolo de treinamento de intervenção funcional. O treinamento físico dedicado afeta positivamente o domínio, destreza e habilidade nas técnicas de movimentação dos jogadores de tênis de mesa. Este trabalho pode fornecer uma base teórica para o treinamento científico dos jogadores de tênis de mesa. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Exercício Físico; Tênis; Atletas.

RESUMEN

Introducción: El tenis de mesa es un deporte anaeróbico metabólico explosivo de intensidad moderada. La mejora del nivel de sus atletas depende de los métodos de entrenamiento físico específicos. El Estado chino ha invertido más apoyo financiero en el entrenamiento físico creyendo en la posibilidad efectiva de mejorar la forma física y las habilidades de sus atletas de tenis de mesa. **Objetivo:** Este estudio tiene como objetivo analizar el efecto del entrenamiento físico especial en las habilidades motoras de los jugadores de tenis de mesa. **Métodos:** Este trabajo selecciona a varios jugadores de tenis de mesa como objetos de investigación. Los voluntarios se dividieron aleatoriamente en grupos experimentales y de control. El grupo experimental adoptó el método de entrenamiento físico exclusivo. El grupo de control fue sometido a un entrenamiento tradicional. Se utilizaron métodos matemáticos, estadísticos y experimentales para analizar el impacto del entrenamiento físico exclusivo en las habilidades motoras de los jugadores de tenis



de mesa. Resultados: Las puntuaciones de las pruebas del grupo experimental mejoraron significativamente tras cuatro y seis semanas de entrenamiento físico exclusivo ($P < 0,01$). No hubo cambios significativos en las puntuaciones de las tres pruebas de diagnóstico en el grupo de control ($P > 0,05$). Tras seis semanas de intervención de entrenamiento físico en el grupo experimental, el grupo de puntuación 0 desapareció. La distribución de las puntuaciones de los atletas converge gradualmente hacia el grupo más alto. Conclusión: Los jugadores de tenis de mesa mostraron una buena respuesta al protocolo de entrenamiento de intervención funcional. El entrenamiento físico dedicado afecta positivamente a la maestría, la destreza y la habilidad en las técnicas de movimiento de los jugadores de tenis de mesa. Este trabajo puede proporcionar una base teórica para el entrenamiento científico de los jugadores de tenis de mesa. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Ejercicio Físico; Tenis; Atletas.

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INTRODUCTION

Special physical training can improve the competitive ability of Chinese high-level table tennis players. This training can improve fitness levels and prevent sports injuries. It has a significant effect on maintaining a high level of competition. This study aims to examine the changes of special physical training on the movement technology of table tennis players from the perspective of movement technology diagnosis and evaluation.¹ This theory can enrich the movement technique evaluation system. The research theory of this paper provides a reference for the scientific training program of table tennis players.

METHOD

Research objects

This paper takes the effect of special physical training of table tennis players from the perspective of action technology diagnosis as the research object.

Research methods

This paper uses spss19.0 software to analyze the experimental data statistically. We compared the three diagnostic scores between groups and within groups at different time points.² At the same time, we used this to analyze the impact of specific physical training interventions on data changes.

Analysis of physical fitness characteristics of ECG signals

We use the ECG test sensor to sample the time domain waveform of the ECG signal. At this point, we get the psychological feature frame sequence sampling of the ECG signal as follows

$$Z_n = A_{up} \cdot \left[1 + \left(\frac{j\omega}{N} \right)^2 \right] \quad (1)$$

N is the frame number. A_{up} is the signal amplification factor. $\omega = \frac{1}{RC}$, RC stands for second-order low-pass filtering. j is a random constant. In this paper, a multi-layer recombination and fusion model of psychological characteristics of ECG signals is constructed based on the weight coefficient analysis method of velocity.³ We use the method of spectrum observation feature detection to obtain the short-term energy spectrum E_n of each frame of ECG signal:

$$E_n = 1 + 2(2 - A_{up}) \frac{j\omega}{N} + \left(\frac{J}{Z_n} \right)^2 \quad (2)$$

d_j is the length of the ECG signal. J is the fusion feature quantity of spectrum sensing. We use the Doppler frequency shift analysis method

to obtain the energy value data template function of psychological characteristics:

$$f = \frac{A_{up} * \left[1 + \left(\frac{j\omega}{N} \right) \right]}{1 + E_n * \frac{j\omega}{N} + \beta \left(\frac{J}{Z_n} \right)^2} \quad (3)$$

β is an unsupervised machine learning function of the ECG signal. It is between 0 and 1. We extract the psychological feature fusion parameter set of the ECG signal to obtain the psychological feature distribution entropy of the ECG signal:

$$T_j = \frac{\beta \sqrt{2 \ln(d_j(k))}}{f} \quad (4)$$

$d_j(k)$ represents the Euclidean distance. We perform multi-beam integration and information fusion processing on the collected ECG signals.⁴ We extract the sidelobe feature quantities of the ECG signal. This paper analyzes information collection and big data scheduling according to the feature extraction results.

There is no need for a code of ethics for this type of study.

RESULTS

Research results

The study results showed that the test scores of table tennis players had significant changes under the intervention of special physical training (Table 1). The diagnostic scores were derived from different time points of the same subject during the experiment.⁵ The main effect, time effect, and interaction effect work together on table tennis players. This paper found that $p = 0.635 > 0.05$ after the spherical test. The intervention of specific physical training satisfies the spherical assumption.

The test results showed $F(2, 18) = 16.06$, $p = 0.000$. The interaction effect was statistically significant. (Table 2) We compared differences in

Table 1. Three diagnostic scores of the control group and the experimental group.

	Initial score	Experiment 4 weeks	Experiment 6 weeks
Control group	8.1±1.79	8.6±2.01	7.9±1.63
Test group	8.1±1.66	10.3±1.86	10.8±1.93

Table 2. Multivariate Analysis Results.

Source		Type III sum of squares	df	Mean squared	F	Saliency
Intervention*time	Hypothetical sphere	22.43	2	11.21	16.06	0
Error (intervention * time)	Hypothetical sphere	12.56	18	0.698		

diagnostic scores between groups at different time points.⁶ The main effect of special physical training is pronounced.

The test scores of the experimental group were significantly improved after four weeks and six weeks of special physical training (Table 3). The P values were 0.025 and 0.002, respectively.⁷ The intervention effect of special physical training on test scores has a particular significance.

There was no significant change in the control group between the initial and 4-week post-test ($p=1.00$). There was no significant change between the initial score and the score after the 6-week test ($p=1.00$). There was no significant change in test scores after 4 and 6 weeks ($p=0.819$). (Table 4) The experimental group had significant changes in the test scores between the initial and four weeks later ($p=0.000$). There was a significant change in test scores between the initial and six weeks later ($p=0.000$). There was no significant change in test scores after 4 and 6 weeks ($p=0.580$). (Table 5)

DISCUSSION

Discussion of experimental data

The experimental group significantly differed between the initial diagnosis score and the 4-week and 6-week diagnosis scores.⁸ There was no significant change in diagnostic scores between 4 and 6 weeks in the experimental group. This study believes that two factors work together to cause this phenomenon:

1. The complex, multi-dimensional, variable, and individual characteristics initially stimulated the athlete's functional chain system development. It helps to improve the overall movement pattern of the athlete. This had initial results in improving the subjects' coordination ability and muscle work efficiency. Table tennis players have a low level of physiological

Table 3. Separate effect analysis of specific physical training.

Timepoint	Source	Type III sum of squares	df	Mean squared	F	Salience
Measured after four weeks	Intervene	11.05	1	11.05	7.13	0.015
	Error (intervention)	17.45	9	3.05		
Measured after 6 weeks	intervene	41.05	1	41.05	18.506	0.001
	Error (intervention)	11.45	9	2.272		

Table 4. Test results between the three-time points in the control group.

(I) Time	(J) time	Average Difference (I-J)	Standard error	Salience	95% confidence interval for the difference	
					lower limit	Upper limit
1	2	-0.2	0.296	1	-1.461	0.861
	3	0.2	0.289	1	-0.94	1.24
2	1	0.2	0.296	1	-0.861	1.461
	3	0.5	0.428	0.819	-0.756	1.756
3	1	-0.2	0.289	1	-1.24	0.94
	2	-0.5	0.428	0.819	-1.756	0.756

Table 5. Test results between the three-time points of the experimental group.

(I) Time	(J) time	Average Difference (I-J)	Standard error	Salience	95% confidence interval for the difference	
					lower limit	Upper limit
1	2	-2.400*	0.267	0	-2.182	-1.618
	2	-2.700*	0.26	0	-2.464	-1.926
2	1	2.400*	0.267	0	1.618	2.182
	2	-0.2	0.212	0.58	-0.926	0.226
2	1	2.700*	0.26	0	1.926	2.464
	2	0.2	0.212	0.58	-0.226	0.926

function, and their physical fitness is in a critical period of growth and development. Age factors and their conditions limit physical fitness levels. It cannot meet the needs of further development of action technology. 2. Athlete's desire and readily accept unique, novel, and diverse training content and methods. The concept of special physical training meets the self-development needs of athletes of this age group. At this time, the exercise produced a better training effect. Special physical training has become a standardized training mode. Athletes' expectations for training have declined. The state of mind fluctuated. It has a particular discount on the continuous training effect.

Although there was no significant difference before and after the experiment in the control group, there were also small fluctuations. The test scores after six weeks were lower than the initial test and the test scores after four weeks. The reason may be that the athlete's movement skills have initially entered the differentiation stage. Its dynamic styling is not yet stable.⁹ The performance of motor skills is greatly affected by physical function, emotional state level, and novel stimuli. It exacerbates the contingency of batting counts. These uncontrollable factors in the experimental process may have a particular impact on the experimental results.

Special physical training arrangements

Physical training theory puts forward physical exercise-specific physical training from a systematic and comprehensive perspective. This theory holds that among the multiple factors that constitute physical fitness, the composite quality of sensitivity, flexibility, coordination, and balance is the basis for its full functioning.¹⁰ This study flexibly designed a unique physical training program according to the growth and development characteristics and special quality needs of athletes. The content includes the training plan 15 minutes before regular exercises: 5 minutes of dynamic stretching exercises and 10 minutes of trunk stability exercises. The 15-minute training plan after the regular practice includes 10 minutes of motor skills practice and 5 minutes of speed, flexibility, and reaction training.

Experimental proposal

Although the experiments demonstrate that special physical training is helpful to the development of table tennis players' action techniques, the depth and breadth of its effects need long-term experimental data to reflect. According to the implementation of the practice process, we propose the following proposals:

1. The special physical training in this experiment should be selected and optimized according to the actual situation of the athletes. We need to take the flexible development of physical fitness and the overall improvement of special abilities as the core idea. We should start from the overall concept and emphasize cultivating core competence, dynamic balance, and movement patterns.¹¹ We need to develop physical abilities comprehensively. We need to target and stimulate the muscles that are not functioning correctly. This ensures that the athlete performs the movement technique correctly. We should respect the subjects' physical development stage characteristics and ensure that the athletes' flexibility, coordination, agility, and balance are fully exerted. Athletes need not destroy the objective laws of body development during training. Training can avoid the adverse effects of single, quantitative, high-intensity, and heavy-load exercises on athletes.
2. Coaches should pay attention to the impact of the location, teaching environment, and the subjects' physical, skill, and emotional state levels on the diagnostic test's performance when conducting experimental evaluations on the effects of special physical training for table tennis players. Help subjects adjust their functional state levels before the test. More accurate diagnostic results will be produced.
3. It is recommended that schools further improve and refine the diagnostic criteria, expand the test population, and prolong the duration of the experiment. Through horizontal comparison, we find the objective laws

and positive factors that affect the improvement of table tennis action skills. This provides a corresponding theoretical basis for transforming teaching and training concepts.

4. We should consider the bias of the subjects' psychological factors on the experimental results. On the one hand, we strengthen the ideological guidance of the subjects. In this way, he deeply realizes the help and change brought by special physical training to himself so that he pays enough attention to the training content. On the other hand, special physical training should also be carried out step by step. We need to inspire athletes to experience success in a variety of formats. This keeps athletes motivated and effective in training to achieve the expected requirements of the experiment.

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities

of Taizhou Vocational College of Science & Technology following all guidelines, regulations, legal, and ethical standards as required for humans or animals

CONCLUSION

The hitting stability of the experimental group showed a relatively apparent trend of change after the intervention of special physical training. There was no change before and after the control group. Table tennis players have good feedback on the effect of functional intervention training. To a certain extent, special physical training positively affects the mastery, improvement, and finalization of table tennis players' action techniques.

The author declare no potential conflict of interest related to this article

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