

APPLICATION OF STATE-OF-THE-ART COMPUTER TECHNOLOGY TO STRENGTH TRAINING IN TENNIS INSTRUCTION



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APLICAÇÃO DA TECNOLOGIA DE COMPUTAÇÃO DE PONTA NO TREINAMENTO DE FORÇA NO ENSINO DE TREINAMENTO DE TÊNIS

APLICACIÓN DE TECNOLOGÍA INFORMÁTICA MÁS AVANZADA EN EL ENTRENAMIENTO DE FUERZA EN LA ENSEÑANZA DEL ENTRENAMIENTO DE TENIS

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ABSTRACT

Introduction: Strength training plays a unique role in improving muscle strength and stability in athletes. Initially used in rehabilitation, it is now widely used in competitive sports. **Objective:** To combat the problem of physical exercise capacity and body posture maintenance when tennis players complete several complex movements in training, this article reviews the research on strength training in various countries from the core concept. **Methods:** Based on the main bones, joints, and muscle groups in the core area, the kinematic characteristics, and the physiological mechanism of these muscle groups, the research model of applying strength training in teaching tennis was established. The application of state-of-the-art computer technology in strength training can be based on data feedback from athletes and their training in tennis training. It can be used for real-time or faster data processing and analysis: data processing is closer to the data source than in an external data center or done in the cloud to reduce lag time. **Results:** Based on the data, we can carry out the corresponding training plans to help the athletes win the championship. With the methods of literature review, experiment, and comparative analysis, this paper studies the influence of strength training on body shape characteristics, the impact of strength training on technical accuracy characteristics, and the effect of strength training on physical health indicators. **Conclusion:** The results show that the accuracy of the experimental data is improved by 20%, and the authenticity of the data is more robust, thus of practical value. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Resistance Training; Training, Exercise; Biomechanical Phenomena; Performance Computing, High.

RESUMO

Introdução: O treinamento de força tem um papel único na melhoria da força e estabilidade dos músculos dos atletas. Inicialmente utilizado em reabilitação, atualmente está sendo bastante utilizado em esportes competitivos. **Objetivo:** No intuito de combater o problema relacionado ao exercício da capacidade física e à manutenção da postura corporal no momento em que os tenistas completam vários movimentos complexos no treinamento, este artigo analisa a pesquisa sobre o treinamento de força em vários países a partir do conceito do core. **Métodos:** Baseado nos principais ossos, articulações e grupos musculares na área do core, nas características cinemáticas e mecanismo fisiológico desses grupos musculares, foi estabelecido o modelo de pesquisa de aplicação do treinamento de força no ensino do treinamento de tênis. A aplicação da tecnologia de computação de ponta no treinamento de força pode ser baseada no feedback de dados dos atletas e seu treinamento na prática de tênis. Pode ser usado para processamento e análise de dados em tempo real ou mais rápido: o processamento de dados está mais próximo da fonte de dados do que em um centro de dados externo ou feito na nuvem para reduzir o tempo de atraso. **Resultados:** Com base nos resultados dos dados, podemos realizar os planos de treinamento correspondentes para ajudar os atletas a vencer o campeonato. Com os métodos de revisão de literatura, experiência e análise comparativa, este artigo estuda a influência do treinamento de força nas características de forma do corpo, o impacto do treinamento de força nas características de precisão técnica e o efeito do treinamento de força nos indicadores de saúde física. **Conclusão:** Os resultados mostram que a precisão dos dados experimentais é aperfeiçoada em 20%, e a autenticidade dos dados é mais robusta, portanto, apresenta valor prático. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento de Força; Treinamento Físico; Fenômenos Biomecânicos; Computação de Alta Performance

RESUMEN

Introducción: El entrenamiento de fuerza tiene un papel único en la mejora de la fuerza y la estabilidad de los músculos de los deportistas. Inicialmente se utilizaba en la rehabilitación, pero en la actualidad se está extendiendo su uso en los deportes de competición. **Objetivo:** Para combatir el problema relacionado con el ejercicio de la capacidad física y el mantenimiento de la postura corporal cuando los tenistas completan varios movimientos complejos en el entrenamiento, este artículo analiza la investigación sobre el entrenamiento de la fuerza en varios países a



partir del concepto básico. Métodos: Sobre la base de los principales huesos, articulaciones y grupos musculares de la zona central, las características cinemáticas y el mecanismo fisiológico de estos grupos musculares, se estableció el modelo de investigación de la aplicación del entrenamiento de fuerza en la enseñanza del tenis. La aplicación de la tecnología informática más avanzada en el entrenamiento de la fuerza puede basarse en la retroalimentación de los datos de los deportistas y su entrenamiento en la formación del tenis. Puede utilizarse para el procesamiento y el análisis de datos en tiempo real o más rápido: el procesamiento de datos está más cerca de la fuente de datos que en un centro de datos externo o se realiza en la nube para reducir el tiempo de retraso. Resultados: A partir de los resultados de los datos, podemos llevar a cabo los correspondientes planes de entrenamiento para ayudar a los atletas a ganar el campeonato. Con los métodos de revisión de la literatura, experimento y análisis comparativo, este trabajo estudia la influencia del entrenamiento de fuerza en las características de la forma corporal, el impacto del entrenamiento de fuerza en las características de precisión técnica y el efecto del entrenamiento de fuerza en los indicadores de salud física. Conclusión: Los resultados muestran que la precisión de los datos experimentales mejora en un 20%, y la autenticidad de los datos es más robusta, por lo que tiene valor práctico. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Entrenamiento de Fuerza; Entrenamiento Físico; Fenómenos Biomecánicos; Computación de alto Rendimiento.

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INTRODUCTION

Application Background of Strength Training in Tennis Training Teaching.

As a new training concept, strength training is attracting the attention of sports circles. Strength is an important part of generating athletes' motivation, which directly affects the competitive level of athletes. Many foreign coaches have added the content of strength training to athletes' training. Core strength training is of great significance to improve athletes' performance and prevent injuries. However, most of our athletes and coaches are not aware of the real role of strength training and master reasonable and effective training methods.

Research Related Work

Motion control and joint stability are very important in daily and exercise. In order to verify whether the same or different intensity training intensity has different effect on shoulder dynamic stability muscle. Salles measured the sharpness of shoulder joint JPS by calculating the absolute error.¹ Spector SA studied the effect of 12 week progressive muscle strength training program on myasthenia in 5 patients with sporadic inclusion body myositis (IBM).² The purpose of this exploratory study by Jeraj D is to determine how coaches consider six feedback factors that may affect the error correction process.³ Mitija SP explored whether the moderator could partially explain the weight.⁴ Taylor J strengthens the deep trunk muscles of patients with chronic low back pain through core strength training.⁵ However, these experiments are complicated, the amount of calculation is large, and the practicability is not strong.

The main innovations are as follows:

This paper adopts three scientific research methods: literature, experiment and comparative analysis. According to the purpose of the study and the needs of the research content, combined with the strength level of the discipline, the weekly planned group training was carried out. By improving the traditional statistical methods, the data is analyzed and studied again, which improves the accuracy and authenticity of the data.

Research methods of strength training in tennis

Study type

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Strength Training Method

By consulting the relevant literature, this paper found three kinds of related training: static training, dynamic training and proprioception

training.^{6,7} The aim is to increase the strength of the core muscles, improve their balance ability, and maintain the stability of the body. As we all know, muscles are quiet before all kinds of physical exercises.⁸ If you want to wake up your muscles to work, you should be well prepared.⁹ Lie under the bar with your hands a little wider than your shoulders. Tighten the waist and abdomen, pull the body upward to a 90 ° angle with the elbow joint, keep the body straight all the time, press on the shoulder and slowly retract, and pay attention not to lift the chest when touching the barbell bar.^{10,11} Finally, the fall control of the body is controllable. Through these equipment exercises, we mainly use various unstable factors to stimulate muscles and nerves, so as to improve the stability of trunk core.^{12,13}

Tennis Training

The physical fitness training of tennis players refers to the physical exercise in which athletes develop various physical qualities and basic abilities required by each special item of tennis players according to the needs of special techniques, training and competition.¹⁴ When the athletes have strong adaptability to the original strength training methods and means, only by improving the training methods, trying different training methods and strengthening the strength training of the weak links of the athletes, can the strength continue to develop healthily.^{15,16}

The main training methods are as follows:

Strength training requires more and more strength. But speed training mainly combines the exercise of sports speed, speed training and strength training, and develops speed through the strength training of corresponding parts.¹⁷ Competitive gymnastics is a way to improve the speed of sports through continuous exercise, while mass fitness mainly improves the public's reaction ability and flexibility by increasing the displacement speed.^{18,19}

Literature Method

According to the needs of the research content of this paper, through consulting CNKI, China Daily, Internet and other channels, we collected a large number of methods and means of strength training and physical exercise. It mainly includes strength training, professional theory of competitive gymnastics, physical exercise, sports training, sports medicine, sports rehabilitation, sports psychology. After watching the related lecture video, I have a preliminary understanding of the research status of strength training theory.²⁰ Collect and organize books and video materials. At the same time, it analyzes and sorts out the literature to provide a theoretical basis for the writing of this paper.

Comparative Analysis

In data processing, each is described by multiple indicators²¹. At this time, the single data we get is different in dimension, or even in the same dimension, the specific observation values of different indicators may be completely different in the order of magnitude. Therefore, it is necessary to process the data dimensionless and convert the index value and order of magnitude of different measurement units into the same quantitative value, so as to make the characteristics of different indicators comparable in value.²²

Data standardization processing:

$$Z = \frac{X_z - \bar{X}}{\sigma} \quad (1)$$

Interval processing:

$$Z = \frac{X_z - \min X_z}{\max X_z - \min X_z} \quad (2)$$

The average treatment was as follows:

$$Z = \frac{X_z}{X} \quad (3)$$

In fact, each method has its advantages and disadvantages when dealing with dimensionless data. The above three processing methods can eliminate the size effect of data and classify the data into the same order of magnitude.^{23,24} In the analysis, it is necessary to select a reasonable processing method according to the different characteristics of panel data, research purposes, and other available information such as indicators for non dimensional processing. Microsoft and Excel software were used to sort out the relevant data and charts of the paper, and SPSS17.0 statistical software was used to analyze the data before and after the experiment, so as to verify whether the experiment has significant effect.²⁵

Experimental simulation of strength training in tennis training teaching

Training Objects

30 tennis players were randomly selected and randomly divided into two groups, 15 in each group. The experimental group and the control group received routine training at the same time, the control group received routine training, and the experimental group received conventional strength training. Before the experiment, the experimental group and the control group were tested as the starting data, and recorded in the experimental process. This experiment is divided into three cycles, each cycle is used to test two groups of members with test indicators. Finally, combined with the three test data and the characteristics of tennis, the changes of two groups of body function indexes were detected.

Experimental Steps

The strength training steps of competitive gymnastics mainly include four aspects

1. Pre test: before the start of the comparative experiment, the strength evaluation, difficulty movement completion evaluation and the complete set of movement quality evaluation were conducted for the two groups of students, and the data obtained from the evaluation were used for independent t-test by SPSS17.0.

2. Single person without equipment exercise (push up on the stable ground): lie on the ground, bend your knees, put your arms on the side of the body, and push up the hip to make the lower limbs, hips and trunk form a straight line. Four supine top hip movements were divided into 1 group and 2 groups.

3. Single with equipment exercise: various support exercises with unstable equipment (such as Swiss ball); static exercise of Swiss ball can effectively enhance the strength of the core part. The supine and push up exercises of Swiss ball have obvious effect on strengthening the strength of internal, external oblique and rectus muscles. Do two groups of ten.

4. Exercise with integrated equipment (e.g. higher difficulty): with one hand and the other foot with the same fulcrum, place the side foot on the foot, lift the side hand perpendicular to the side hand, and support the body to the side so that the lower limbs, hip joints, trunk and head are in line. Six lateral support motions were divided into group 1 and group 2.

Experimental Control

Independent variable control: through experimental training, determine the specific action method of strength training in the experimental group, using the combination of strength action method and traditional strength action method. The strength training action method is: before the traditional strength training method; the experimental process of the control group adopts the traditional strength training method, we will not intervene in other aspects. The control of experimental objects: 30 gymnasts were selected as the specific experimental objects. First, the basic information (age, height, weight) was collected, and then the dependent variable index was measured. Then the data were obtained and t-test was carried out to make the basic situation and dependent variable indexes of the experimental group and the control group not significantly different.

Analysis of experimental results of strength training in tennis training teaching

Comparison And Analysis Of Strength Test Results Of Two Groups Of Athletes Before And After Training

As shown in Table 1 and table 2, compared with the previous results, the test results of the strength evaluation indexes of the experimental group are basically at the same level, and the basic level of the competitive athletes in the control group is the same. In addition, there are back muscle test data, Zhong sit up test data, side lying leg raising test data and Swiss Ball sit up test data of the experimental group and the control group athletes using SPSS17.0.

This shows that before the contrast experiment, the core strength level of the experimental group and the control group is basically the same, which ensures that the strength test results of the two groups are comparable. And the scientificity of the comparison experiment results.

Table 1. Results of athletes' indexes before the experiment.

Training program	Experience group	Control group	T value	P value
Training without equipment	31.24±3.236	23.36±0.365	-0.036	0.365
Training with equipment	35.15±2.036	28.36±2.662	-0.325	0.247
Comprehensive training	42.36±3.654	39.21±1.032	-0.231	0.956

Table 2. Results of athletes' indexes after the experiment.

Training program	Experience group	Control group	T value	P value
Training without equipment	45.32±2.365	38.45±0.274	-1.331	0.445
Training with equipment	42.36±3.251	33.12±1.509	-0.674	0.287
Comprehensive training	44.25±2.375	45.36±4.367	-1.397	0.369

After 3 weeks of comparative experiment, This shows that, after the contrast experiment, although the results of sit up test and side leg raising test of Aerobics Athletes in the experimental group and the control group have improved, the improvement rate of the two groups is basically the same, and they are still at the same level after the end of the comparative experiment.

Comparative Analysis Of Physical Fitness Test Results Between Experimental Group And Control Group

As shown in Figure 1, It is assumed that after three small training cycles, there are significant differences in physical fitness between the experimental group and the control group. After statistical analysis, the probability of the above four physical fitness indexes between the experimental group and the control group was $p < 0.05$, the difference was statistically significant, which confirmed the original hypothesis. The results showed that after three cycles of training, the four physical qualities of the experimental group were better than those of the control group.

As shown in Figure 2, the group had only two improvements in health. After three cycles of training, the above four physical qualities of the experimental group were significantly different from those before the experiment. Compared with the results after two small cycles, the average value is increased and the standard deviation is reduced, which indicates that not only the physical health has been greatly improved, but also the stability of performance has been improved. In the control group, compared with before the experiment only, two physical fitness improved significantly.

Compared with the two short-term results, the average values of the four kinds of physical fitness are improved, but the standard deviation of the two kinds of physical fitness in prone position is increased, which indicates that the performance of these two kinds of bodies is stable, and the two kinds of physical fitness decrease after the experiment.

Comparison And Analysis Of Complete Movement Quality Between The Two Groups Before And After The Experiment

As shown in Figure 3, before the contrast experiment, this shows that before the start of the comparative experiment, the quality of the complete movement of the experimental group and the control group is the same, basically at the same level, so as to ensure the comparability of the scores between the two groups. The movement analysis and experimental results of the two groups of athletes are scientific.

As shown in Figure 4, after three weeks of comparative experiment, although the results of the two groups of athletes have improved to varying degrees, the performance quality scores of the two sets of Aerobics athletes with the same quality are tested again by the independent t test in SPSS17.0. This shows that the conventional waist and abdomen strength training and strength training have a certain role in improving the overall effect of competitive gymnasts, but the targeted strength training has more advantages than the traditional waist and abdomen strength in improving artistic score and difficulty.

CONCLUSION

In order to fight with the problem of exerting physical strength and keeping body posture when tennis players complete various difficult movements, this paper reviews the research status of strength training in various countries from the core concept. Starting from the main bones, joints and muscle groups that constitute the core area, the kinematic characteristics and physiological mechanism of these muscle groups, the application research model of strength training in competitive gymnastics training teaching was established, and its main functions and training ideas, strength training, and the basic theoretical framework of core strength were elaborated. The training was discussed preliminarily. Through the methods of literature review, experiment and comparative analysis, the influence of strength training on body shape characteristics,

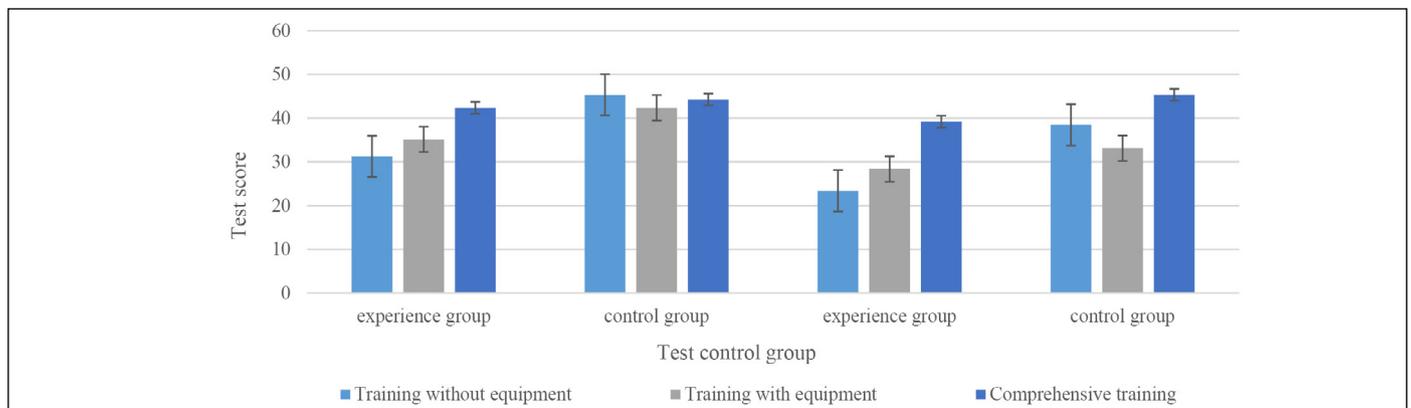


Figure 1. The average of each index in the experimental group and the control group.

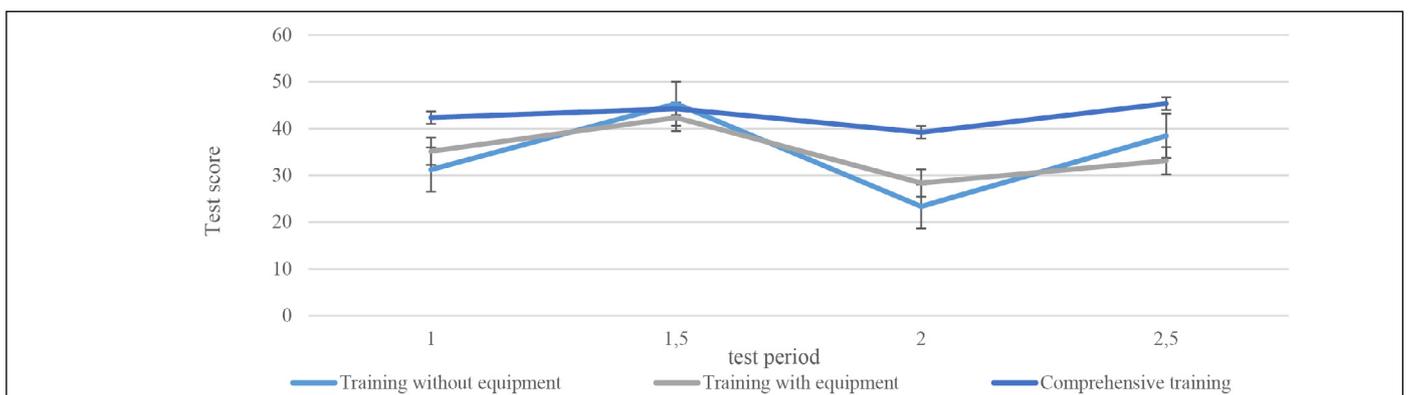


Figure 2. Changes in the scores of the experimental group and the control strength test.

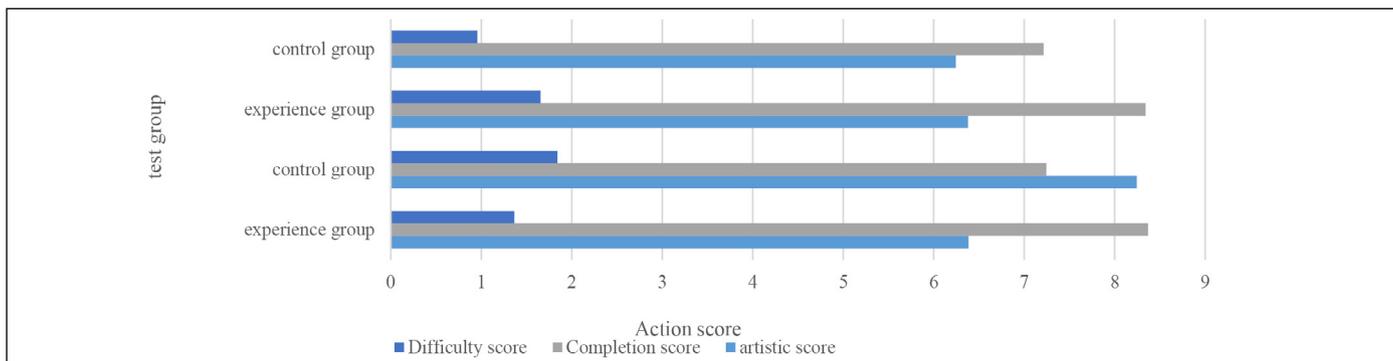


Figure 3. The scores of the two groups of athletes before and after the experiment.

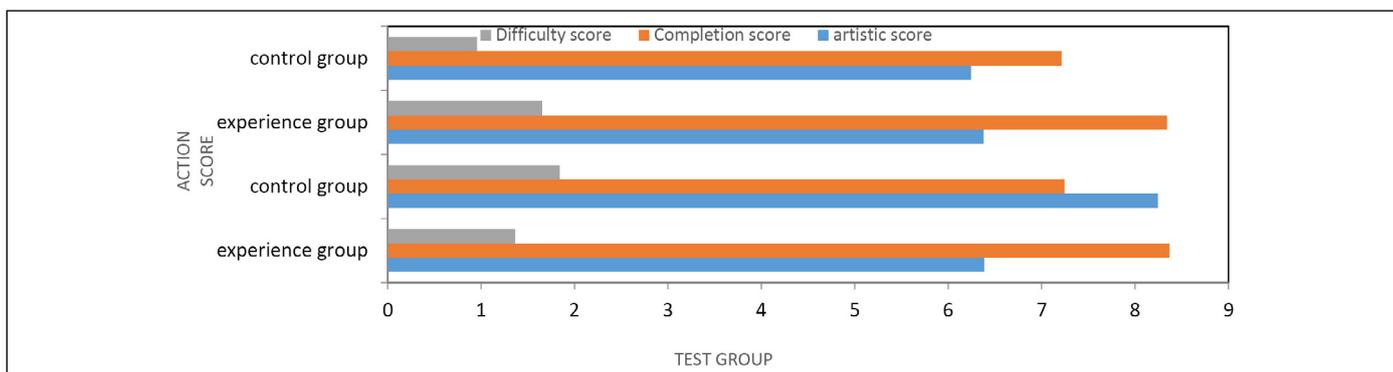


Figure 4. Score distribution of experimental control group 3.

the influence of strength training on technical accuracy characteristics and the influence of strength training on physical health indicators were studied.

Due to the limited experience of the author, coupled with the limitations of the conditions, the study is not comprehensive enough, which

is deeply regretted. In the future, the author will continue to conduct in-depth research.

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

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