

INFLUENCE OF INSTABILITY TRAINING ON BALANCE AND COORDINATION IN TENNIS PLAYERS

INFLUÊNCIA DO TREINAMENTO COM INSTABILIDADE SOBRE O EQUILÍBRIO E A COORDENAÇÃO NOS JOGADORES DE TÊNIS

INFLUENCIA DEL ENTRENAMIENTO DE INESTABILIDAD SOBRE EL EQUILIBRIO Y LA COORDINACIÓN EN JUGADORES DE TENIS



ORIGINAL ARTICLE
ARTIGO ORIGINAL
ARTÍCULO ORIGINAL

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ABSTRACT

Introduction: Corporal balance and psychomotor coordination are factors of extreme importance in the physical fitness of tennis players. It is believed that implementing training with instability in training can have repercussions in a better capacity of action influencing positively in the sports practice. **Objective:** Explore whether the addition of instability training to daily training can influence the physical fitness of tennis players. **Methods:** For this experiment, 100 national secondary professional tennis players were selected as volunteers, and divided equally into experimental and control groups. The experimental group received 12 weeks of additional intervention with instability training, while the control group remained with standard training. Pertinent data were collected before and after the intervention, statistically analyzed, and compared to the literature. **Results:** Anterior motion range of motion in the experimental group increased from 28.965 ± 0.418 to 39.357 ± 0.25 ; anterior motion accuracy increased from 26.258 ± 2.239 to 34.608 ± 0.342 . Posterior stroke range of motion increased from 25.026 ± 2.136 to 34.528 ± 0.10 , and posterior motion accuracy increased from 18.230 ± 1.096 to 28.225 ± 0.261 . The data in the control group did not show significant changes. **Conclusion:** Instability training added to tennis players' daily training may influence tennis players' balance ability and movement coordination, positively impacting tennis players' fitness. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Training, Exercise; Tennis; Physical Fitness.

RESUMO

Introdução: O equilíbrio corporal e a coordenação psicomotora são fatores de extrema importância na aptidão física dos tenistas. Acredita-se que a implementação de treinamentos com instabilidade no treinamento possa repercutir em uma melhor capacidade de ação influenciando positivamente na prática esportiva. **Objetivo:** Explorar se o acréscimo do treinamento com instabilidade ao treino diário pode influenciar a aptidão física dos jogadores de tênis. **Métodos:** Para este experimento, 100 tenistas profissionais secundários nacionais foram selecionados como voluntários, divididos igualmente em grupo experimental e controle. O grupo experimental recebeu 12 semanas de intervenção adicional com o treinamento com instabilidade, enquanto o grupo de controle permaneceu com o treinamento padrão. Os dados pertinentes foram coletados antes e após a intervenção, analisados estatisticamente e comparados à literatura. **Resultados:** A abrangência do movimento anterior no grupo experimental aumentou de $28,965 \pm 0,418$ para $39,357 \pm 0,25$; a precisão do movimento anterior elevou-se de $26,258 \pm 2,239$ para $34,608 \pm 0,342$, a abrangência do curso posterior aumentou de $25,026 \pm 2,136$ para $34,528 \pm 0,10$, e a precisão do movimento posterior aumentou de $18,230 \pm 1,096$ para $28,225 \pm 0,261$. Os dados no grupo controle não apresentaram alterações significativas. **Conclusão:** O treinamento com instabilidade adicionado ao treinamento diário dos tenistas pode influenciar a capacidade de equilíbrio e a coordenação de movimentos dos tenistas, impactando positivamente a aptidão física dos jogadores de tênis. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento Físico; Tênis; Aptidão Física.

RESUMEN

Introducción: El equilibrio corporal y la coordinación psicomotriz son factores de suma importancia en la aptitud física de los tenistas. Se cree que la implementación de entrenamiento con inestabilidad en el entrenamiento puede repercutir en una mejor capacidad de acción influyendo positivamente en la práctica deportiva. **Objetivo:** Explorar si la adición del entrenamiento con inestabilidad al entrenamiento diario puede influir en la aptitud física de los tenistas. **Métodos:** Para este experimento, se seleccionaron como voluntarios 100 tenistas profesionales de nivel secundario nacional, divididos equitativamente en grupo experimental y grupo de control. El grupo experimental recibió 12 semanas de intervención adicional con entrenamiento de inestabilidad, mientras que el grupo de control permaneció con el entrenamiento estándar. Se recogieron datos pertinentes antes y después de la intervención, se analizaron estadísticamente y se compararon con la bibliografía. **Resultados:** La amplitud del movimiento anterior en el grupo experimental aumentó de $28,965 \pm 0,418$ a $39,357 \pm 0,25$; la precisión del movimiento anterior se elevó



de $26,258 \pm 2,239$ a $34,608 \pm 0,342$, la amplitud del movimiento posterior aumentó de $25,026 \pm 2,136$ a $34,528 \pm 0,10$, y la precisión del movimiento posterior se elevó de $18,230 \pm 1,096$ a $28,225 \pm 0,261$. Los datos del grupo de control no mostraron cambios significativos. **Conclusión:** El entrenamiento de inestabilidad añadido al entrenamiento diario de los tenistas puede influir en la capacidad de equilibrio y la coordinación de movimientos de los tenistas, lo que repercute positivamente en la forma física de los tenistas. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Entrenamiento Físico; Tenis; Aptitud Física.

DOI: http://dx.doi.org/10.1590/1517-8692202329012023_0037

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

INTRODUCTION

As one of the events against the net, tennis requires players not only to have good physical control ability, but also to have the ability to hit the ball with the front and back hands to control stability.¹ The specific embodiment of tennis players' sports skills is whether they can hit the ball with the front and back hands stably, and have a good sense of the ball to make the hitting route clear, and it is easier to play a perfect return stroke in normal training and competitive competitions.² In the game, players need to frequently switch between attack and defense, specifically, they need to move forward, backward, left and right quickly to hit the ball to obtain effective scores. Due to frequent fast movement, players will lose their body balance, which will lead to hitting mistakes. The above problems come down to the fact that the athletes did not carry out special training on balance ability in their usual training.³

How to improve the stability of backhand and forehand return stroke of tennis players in daily training has become an urgent problem. In recent years, tennis has developed rapidly, and this sport also tends to be specialized and commercialized. Whether professionals or amateurs, their tennis skills can reach a high level.⁴ All kinds of competitions have full attractions. Players in the game are hitting the ball faster and faster, and the placement of tennis is increasingly unpredictable. It is easy for athletes to lose stability when they move quickly in the game.⁵ Because the stability of hitting is affected by the balance of the athletes, if they lose stability, they will easily lose the score and lose the whole game. If the athletes can return the tennis smoothly even in an unstable state through training, they can occupy a dominant position in the game, so as to win points and win the game.⁶

Therefore, the key to winning the game is to improve the stability of the player's hitting on the premise of physical instability. Tennis players have certain competitive power, but in the competition, they will still have wrong forehand and backhand strokes, because fast and frequent sports will damage the balance of the body.⁷ Through research, we can intuitively see the effect of special training methods. This has carried out a coordinated analysis on the evaluation of the comprehensive performance of human physical fitness. The research has confirmed that coordination is affected by genetic factors, but the degree of acquired development is related to the lack of exercise in the critical period, because lack of exercise will hinder the development of physical stability, and coordinated physical exercise can be effectively improved after days of exercise.⁸ In this study, we tried to use experimental methods to study the effects of unstable training on the balance and coordination of tennis players.

METHOD

Research object

In order to further explore the impact of unstable training on tennis players, this paper selects 100 professional male tennis players, all of whom have been trained for more than 4 years and are national level II players, and have not had any similar training before. The study and all the participants were reviewed and approved by Ethics Committee of Zhejiang Wanli University (NO.ZJWU20PT05). The basic physical conditions of the

subjects studied in this paper are shown in Table 1. 100 professional male tennis players were randomly divided into two groups: experimental group and control group. The experimental group added unstable training on the basis of daily tennis training to explore the impact of unstable training on tennis players' balance ability and movement coordination.

Research methods

1. Literature method: Before the experiment, this paper searched more than 40 articles related to instability training, balance ability, and coordination of movement through the well-known literature data websites in China, such as CNKI and Wanfang, and provided a theoretical basis for the experiment of this paper through a large number of documents. On the basis of reading a large number of documents, this paper basically understood how to measure the various indicators of tennis players' balance ability and movement coordination, and how to add unstable training with appropriate intensity to tennis players' daily tennis training to achieve the training effect, and at the same time, not to cause sports injuries to tennis players due to excessive training.

2. Experimental method: Before the experiment, 100 professional male tennis players were measured for basic body information, and all passed the independence test. There was no significant difference between the P values of more than 0.05100 professional male tennis players. Next, 100 professional male tennis players were randomly divided into two groups, the experimental group and the control group, for a 12 week experiment. In the 12 week experiment, the control group only carried out daily tennis training without additional training. The experimental group was divided into two groups according to the different quality levels of the athletes. The group with good physical quality received unstable training of intermediate intensity, and the group with general physical quality received unstable training of primary intensity. During the experiment, the physical information of tennis players was recorded by professional equipment, and the information was summarized after the experiment for subsequent analysis. After the experiment, compare the experimental information of tennis players with the basic information before the experiment, and also compare the experimental information of tennis players in the experimental group and the control group, so as to analyze the impact of unstable training on the balance ability and movement coordination of tennis players.

Experimental equipment

The experiment was conducted in the tennis training hall. The experimental equipment includes BOSU balls, tape measures, hula hoop, Swiss balls, tennis equipment, etc.

Table 1. Basic information of the research object.

Group	Experience group	Control group
Height (cm)	174.145 \pm 6.101	176.874 \pm 4.400
Weight (kg)	70.520 \pm 4.558	72.040 \pm 5.206
Sports grade	Second level	Second level
Training years (years)	5.294 \pm 0.779	4.765 \pm 0.705

RESULTS

Influence of Unstable Training on Balance Ability of Tennis Players

Table 2 shows the changes of various indicators of tennis players' balance ability before and after the experiment.

By comparing the changes of various data of tennis players' balance ability in the Y balance test before and after the experiment, it can be found that tennis players in the experimental group have significantly improved in front extension, back outside and back inside. The improvement of the control group was not obvious. The balance ability of tennis players in the experimental group is obviously better than that in the control group after the experiment. Among them, the tennis players in the experimental group had the most significant backward outward improvement.

Influence of Unstable Training on the Action Coordination of Tennis Players

Table 3 shows the changes of various indicators of tennis players' action coordination before and after the experiment.

By comparing the movement coordination data of 50 tennis players in the experimental group before and after the experiment, it can be found that after 12 weeks of unstable training intervention, the movement coordination of tennis players has been significantly improved. The time of treading in situ with eyes closed, standing on one foot with eyes closed, and 30 meter rhythm running has been significantly improved. At the same time, the number of square jumps has also been significantly increased. Compared with the data of 50 tennis players' movement coordination before and after the experiment in the control group, there was no significant difference in the movement coordination of tennis players in the control group before and after the experiment, and even decreased in some aspects, such as when standing with one foot closed. By comparing the data of tennis players in the experimental group and the control group after the experiment, it can be found that the 50 tennis players in the experimental group who have undergone unstable training are significantly better than the control group in all aspects of action coordination after the experiment, and there are significant differences.

Effect of Unstable Training on Sports Performance of Tennis Players

Table 4 shows the changes of various indicators of tennis players' coordination of tennis movements before and after the experiment.

By comparing the data of stroke coordination of 50 tennis players in the experimental group before and after the experiment, it can be found that the depth and accuracy of forehand stroke and backhand stroke of tennis players have significantly improved after 12 weeks of unstable training intervention. By comparing the data of forehand and backhand strokes of 50 tennis players in the control group before and after the experiment, there was no significant difference in the coordination of tennis players' strokes in the control group before and after the experiment, and there was no significant improvement in the depth and

Table 2. Changes of Balance Ability of Tennis Players Based on Y-balance Test.

Option		Experience group	Control group
Protrusive	Before experiment	70.474 ±7.021	69.761 ±6.796
	After experiment	88.269 ±8.217	74.772 ±6.852
Posterolateral	Before experiment	93.592 ±12.893	91.353 ±11.617
	After experiment	113.792 ±15.022	102.873 ±12.817
Posterior interior	Before experiment	85.894 ±9.470	83.211 ±9.905
	After experiment	102.327 ±13.830	94.152 ±12.538

Table 3. Changes of tennis players' movement coordination.

Option		Experience group	Control group
Step in situ with eyes closed (s)	Before experiment	8.460 ±0.579	8.389 ±0.318
	After experiment	11.607 ±0.790	8.979 ±1.318
Stand with eyes closed (s)	Before experiment	175.786 ±17.479	176.225 ±19.142
	After experiment	185.892 ±16.612	173.038 ±17.600
30 meter rhythm run (s)	Before experiment	7.778 ±0.486	7.728 ±0.506
	After experiment	7.091 ±0.549	7.664 ±0.645
Square jump (times)	Before experiment	26.920 ±5.155	27.679 ±5.449
	After experiment	29.992 ±4.527	27.241 ±4.835

Table 4. Changes of tennis players' movement coordination.

Option		Experience group	Control group
Forehand stroke depth	Before experiment	28.965 ±0.418	28.930 ±0.172
	After experiment	39.357 ±0.256	34.818 ±2.058
Forehand accuracy	Before experiment	26.258 ±2.239	26.768 ±1.543
	After experiment	34.608 ±0.342	26.984 ±1.604
Backhand stroke depth	Before experiment	25.026 ±2.136	26.474 ±2.357
	After experiment	34.528 ±0.101	26.944 ±2.028
Backhand accuracy	Before experiment	18.230 ±1.096	18.230 ±2.456
	After experiment	28.225 ±0.261	18.925 ±2.125

accuracy of forehand and backhand strokes. By comparing the data of tennis players in the experimental group and the control group after the experiment, it can be found that 50 tennis players in the experimental group who have undergone unstable training are significantly better than the control group in all aspects of the coordination of the stroke after the experiment, especially in the depth of forehand stroke, which is significantly better than the control group.

DISCUSSION

The forehand and backhand stroke is the most basic and important technology in tennis. The stability of forehand and backhand stroke will affect the final result of the game: if the player's forehand and backhand stroke stability is high in the game, then you can hit back or volley the tennis according to the player's own ideas. The combined route strategy is directly determined by the stability. The higher the stability, the higher the degree of freedom and completion of the combined route. This leads to the opponent being unable to predict and finally winning the game. In recent years, basketball, table tennis, football and other projects often use instability training, but tennis has not used instability training. Therefore, through the collection of information about unstable training, the aim is to apply unstable training to tennis, and analyze the impact of unstable training on tennis players' balance and coordination ability. This experiment conducted a series of unstable training for tennis players, which is to improve the stability of tennis players' body posture. Tennis players measured data before and after the experiment to verify the influence of the stability of body posture on the stability of tennis forehand and backhand strokes.

Asymmetrical body movements and body instability caused by external forces will lead to unstable states, which can be trained through the following professional equipment: elastic band, BOSU ball, balance board, foam shaft, etc. In addition, you can also use the natural environment to establish unstable training conditions, such as snow, ice, etc. Under different conditions, the unstable support surface is composed of external forces or overcome self gravity to enable the deep muscles of the body to exercise, enhance the basic muscle strength, and improve the training method or the stability of the body.

The basis of human movement is body balance. The process of children learning to stand is actually a process of learning balance. When children grow up and learn various activities, most of them will

use balance. Balance will accompany human growth. Therefore, the simplest human skill is balance ability. There are many factors that affect the balance ability of the human body. The important organ of the human body to maintain balance is the brain. When the position of the brain changes, it will lead to muscle tension and affect the balance. The height of the center of gravity, the size and stability of the supporting surface also affect the balance. Through research, it is found that the higher the physical stability of tennis players, the better their sports skills will be. The most important quality in sports training is the training of balance ability, which has become the main key to select athletes. All sports need to be expressed through body movements, which can show the basis for mastering coordination ability and various sports skills. Therefore, if you want to make your movements elegant, natural and relaxed, excellent body coordination is indispensable.

CONCLUSION

Through this study, we can draw a conclusion that in the daily tennis training, adding instability training can effectively improve the balance ability and movement coordination of tennis players. It can

improve the depth and accuracy of forehand and backhand strokes of tennis players, and effectively improve the tennis technical level of tennis players. In the process of unstable training, professional coaches are required to provide guidance to prevent tennis players from being injured due to improper exercise. At the same time, for tennis players who have not been exposed to unstable training before, they should carry out unstable training of primary difficulty when conducting unstable training for the first time. And, gradually transition to the intermediate difficulty of instability training. Through this gradual overtraining method, tennis players can have a good transition period. Provide a buffering phase for the tennis player's body. The control ability of tennis players in the experimental group who have undergone unstable training to hit tennis has been significantly improved, and they can control the impact point of tennis more stably. It shows that instability training can effectively improve the coordination of tennis players' stable movements.

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. Xianfeng Tang and Shuwei Zhao: writing and execution.

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