

INFLUENCE OF PILATES TRAINING ON PHYSICAL COORDINATION AND STABILITY OF VOLLEYBALL PLAYERS



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INFLUÊNCIA DO TREINAMENTO DE PILATES NA COORDENAÇÃO FÍSICA E ESTABILIDADE DOS JOGADORES DE VOLEIBOL

INFLUENCIA DEL ENTRENAMIENTO DE PILATES EN LA COORDINACIÓN FÍSICA Y EN LA ESTABILIDAD DE LOS JUGADORES DE VOLEIBOL

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ABSTRACT

Introduction: Pilates prioritizes the control of central muscle groups, which have a strong predilection value for volleyball training. **Objective:** To investigate the repercussions of Pilates training on motor coordination and stability in volleyball players. **Methods:** 20 athletes from a female volleyball team were randomly divided between the experimental and the control groups. Pilates intervention was performed in the experimental group. The control group followed the traditional training format, finally comparing the training results after eight weeks. **Results:** In the flexibility index of the experimental group, the weights increased from $23,11 \pm 5,08$ times to $28,02 \pm 6,42$ times; the left and right axes increased from $7,74 \pm 10,13$ seconds to $8,83 \pm 8,13$ seconds. In terms of the stability index, the number of intervals repeated in 20 seconds increased from $35,44 \pm 0,75$ to $46,45 \pm 0,91$; the lateral throw of the medicine ball was increased from $59,61 \pm 16,16$ meters to $78,38 \pm 16,22$ meters. The range of variation of each index is more evident than that of the control group. **Conclusion:** Pilates training becomes superior to usual training for the improvement of coordination and stability of volleyball players. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Pilates Training; Perceptual Motor Performance; Volleyball.

RESUMO

Introdução: O Pilates prioriza o controle de grupos musculares centrais, que possuem um forte valor predileto para o treinamento do vôlei. **Objetivo:** Investigar as repercussões do treino Pilates na coordenação motora e na estabilidade das jogadoras de voleibol. **Métodos:** 20 atletas de uma equipe feminina de voleibol foram divididas aleatoriamente entre o grupo experimental e o grupo controle. A intervenção do Pilates foi realizada no grupo experimental. O grupo de controle obedeceu ao formato tradicional de treinamento, comparando-se finalmente os resultados do treinamento após 8 semanas. **Resultados:** No índice de flexibilidade do grupo experimental, os pesos elevaram-se de $23,112 \pm 5,088$ vezes para $28,020 \pm 6,427$ vezes; os eixos esquerdo e direito cresceram de $7,745 \pm 10,138$ segundos para $8,831 \pm 8,133$ segundos. Em termos de índice de estabilidade, o número de intervalos repetidos em 20 segundos aumentou de $35,444 \pm 0,753$ para $46,453 \pm 0,919$; o arremesso lateral da bola medicinal foi elevado de $59,617 \pm 16,160$ metros para $78,386 \pm 16,221$ metros. O intervalo de variação de cada índice é mais evidente do que o do grupo de controle. **Conclusão:** O treinamento de Pilates se torna superior ao treinamento habitual para a melhora da coordenação e estabilidade das jogadoras de vôlei. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Método Pilates; Desempenho Perceptual-Motor; Voleibol.

RESUMEN

Introducción: Pilates prioriza el control de los grupos musculares centrales, que tienen un fuerte valor de predilección para el entrenamiento del voleibol. **Objetivo:** Investigar la repercusión del entrenamiento de Pilates sobre la coordinación motora y la estabilidad de jugadoras de voleibol. **Métodos:** 20 atletas de un equipo femenino de voleibol se dividieron aleatoriamente entre el grupo experimental y el grupo de control. La intervención de Pilates se realizó en el grupo experimental. El grupo de control siguió el formato de entrenamiento tradicional, comparando finalmente los resultados del entrenamiento después de 8 semanas. **Resultados:** En el índice de flexibilidad del grupo experimental, los pesos aumentaron de $23,11 \pm 5,08$ veces a $28,02 \pm 6,42$ veces; los ejes izquierdo y derecho aumentaron de $7,74 \pm 10,13$ segundos a $8,83 \pm 8,13$ segundos. En cuanto al índice de estabilidad, el número de intervalos repetidos en 20 segundos aumentó de $35,44 \pm 0,75$ a $46,45 \pm 0,91$; el lanzamiento lateral del balón medicinal aumentó de $59,61 \pm 16,16$ metros a $78,38 \pm 16,22$ metros. El rango de variación de cada índice es más evidente que el del grupo de control. **Conclusión:** El entrenamiento con Pilates llega a ser superior al entrenamiento habitual para la mejora de la coordinación y estabilidad de los jugadores de voleibol. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptorios: Método Pilates; Desempenho Motor Perceptual; Voleibol.



INTRODUCTION

During the volleyball match, many technical actions are carried out in the air, and unexpected situations such as instant stop, loss of center of gravity and body twisting will occur.¹ Or if you lose your balance or lose your center of gravity after taking off, you will cause knee and ankle injuries. Therefore, for all volleyball players, every technical action in training and competition needs strong body control ability.² In competition and training, the balance and stability of landing after taking off is very important, and has an important relationship with body coordination and stability. For volleyball players, strong physical coordination and stability are essential qualities, which can improve the skill level and touch control ability during sports.³ Pilates training originated from combined motor system therapy, mainly through training small muscle groups deep in the body, maintaining and improving normal posture, achieving body balance, and improving the range of motion and mobility of the trunk and limbs.⁴ Pilates emphasizes the control of central muscle tissue during the training process, which can strengthen the nerve sense and brain control of limbs and skeletal muscle tissue. The whole process achieves whole-body coordination through correct breathing techniques.⁵ Based on the effect of Pilates training, combined with the characteristics of volleyball training, this paper designed relevant experiments to study the impact of Pilates training on the physical fitness of volleyball players, such as coordination and stability, so as to better improve the volleyball training plan.⁶

METHOD

Research object

This paper takes the effect of Pilates training on the physical coordination and stability of volleyball players as the research purpose. Before the experiment, 20 players were selected from the women's volleyball team of a college of physical education as the experimental objects. The study and all the participants were reviewed and approved by Ethics Committee of Chuzhou University (NO.CZUN21ZD076). The subjects were randomly divided into two groups, the experimental group and the control group, with 10 persons each. Before the formal training, the basic information and sports indicators of the two groups were measured. The statistical results of basic information are shown in Table 1.

The statistical results show that there is no significant difference between the experimental group and the control group in all indicators including Table 1, which conforms to the basic requirements of the control experiment in this paper. In addition, before the formal start of the experiment, a simple pre-experiment of Pilates training was carried out on the athletes in the experimental group, and it was confirmed that the subjects in this article had no injury or other basic diseases, and their physical condition was more suitable for Pilates training.

Experimental arrangement

The experiment designed in this paper lasted for 8 weeks. In the process of experimental training, according to the previous volleyball team training plan, the basic training contents such as physical training and preparation and stretching training remain unchanged. Train three times a week, and the duration of each training is controlled at about 1 hour. In the strength training module, Pilates intervention was carried out on the experimental group, and the control group followed the traditional

strength training mode. Finally, the effects of the two groups of training methods on the coordination and stability of women volleyball players were compared through the data before and after the test.

Experimental test method

After the experiment, this paper mainly tests the physical coordination and stability of the tested athletes.

The body coordination index mainly includes five items: weight bearing sit-ups, left and right side bridges, inside throwing solid ball, hexagonal snatch and T-shape sensitivity test, which mainly evaluate the body coordination ability and strength of the tested athletes. Weight-bearing sit-ups are counted in units. The subjects are required to fully fold their upper and lower body. The weight of the chest weight dumbbell is 2.5 kg, and the test time is 1 minute. The left and right side bridges are counted in seconds. It is necessary to ensure that the subject's hips are upright and the body is in a straight line. The inside throw ball is counted in meters, and the weight of the ball is 2kg. The subject holds the ball in both hands and throws the ball up behind his head. The highest score is obtained after three tests. The hexagonal snatch is counted in seconds. The size of the hexagonal snatch is 4.8x5.8cm. The highest score is obtained after three tests. The T-shaped sensitivity test is counted in seconds, with a total of 4 cones placed in a T-shaped shape. The subjects start the test at cone 1, start the timing when issuing the command, and stop the timing after returning to the starting line. The highest score is obtained for the three tests.

The body stability indicators mainly include plate support, single-foot standing with eyes closed, 15s standing and holding, repeated crossing and medicine ball side throwing. Tablet support is counted in seconds. The subjects are required to keep their shoulders and elbows perpendicular to the ground, tighten their abdomen, and form a straight line from head to foot. Single-foot standing with closed eyes is counted in seconds. It is necessary to ensure that the subject stands with both feet in front of and behind. The time will be counted after the eyes are closed, and the time will be stopped after the instability. The highest score will be obtained for the three tests. The index of standing, holding and supporting for 15s is counted in units. After the test starts, the subjects need to bend their knees and squat fully, stretch their hands and legs back, and then push the floor and tuck in, and then return to the upright position. The effective number is counted after 15s. Repeated crossing for 20 seconds is counted in times, and the center line is kept at a distance of 1.2 meters. Before the test starts, both feet start to cross the center line, and cycle across in the order of left, middle, right and middle. The side throw of the medicine ball is counted in meters, and the weight of the medicine ball is 2kg.

RESULTS

The influence of Pilates training on the physical coordination of women volleyball players

After 8 weeks of training, the physical coordination indexes of women volleyball players in the experimental group and the control group were tested and counted. The test results of the athletes in the control group undergoing routine training are shown in Table 2.

The data in Table 2 shows that after 8 weeks of routine training, the five indexes of body coordination in the control group have significant changes compared with those before training ($P < 0.05$). Among them, the test result of weight bearing sit-ups index increased from 22.722 ± 4.204 times before training to 24.305 ± 5.393 times; The test results of left and right bridge indicators increased from 7.989 ± 1.019 seconds before training to 8.815 ± 1.139 seconds; The test result of the inner throw solid ball index increased from 26.707 ± 1.906 meters before training

Table 1. Summary of basic information of the two groups of subjects.

Group	Experience group	Control group
Age (years)	20.131±1.088	19.734±0.690
Height (cm)	178.523±3.557	177.142±6.768
Body weight (cm)	62.339±3.535	66.039±7.492

Table 2. The Influence of Routine Training on the Body Coordination of Women Volleyball Players.

Option	Before experiment	After experiment	P
Weight-bearing sit-ups (times)	22.722±4.204	24.305±5.393	0.02856
Left and right side axles (seconds)	7.989±1.019	8.815±1.139	0.02351
Throw solid ball inside (m)	26.707±1.906	27.587±2.037	0.01895
Hexagonal snatch (seconds)	3.802±0.285	3.329±0.509	0.04779
T-shaped sensitivity test (seconds)	11.398±0.884	11.037±0.438	0.01111

to 27.587 ± 2.037 meters; The test result of the hexagonal snatch index increased from 3.802 ± 0.285 seconds before training to 3.329 ± 0.509 seconds; The test result of T-shaped sensitivity test index increased from 11.398 ± 0.884 seconds before training to 11.037 ± 0.438 seconds. The data results in Table 2 show that the systematic and professional routine training is effective in improving the physical coordination quality of volleyball players.

Test the physical coordination index of the experimental group, and the data results are shown in Table 3.

The data in Table 3 shows that after 8 weeks of Pilates training, the five indexes of body coordination in the experimental group have significant changes compared with those before training ($P < 0.05$). Among them, the test result of weight bearing sit-ups index increased from 23.112 ± 5.088 times before training to 28.020 ± 6.427 times; The test results of left and right bridge indicators increased from 7.745 ± 10.138 seconds before training to 8.831 ± 8.133 seconds; The test result of the inner throw solid ball index increased from 27.144 ± 31.884 meters before training to 29.208 ± 28.442 meters; The test result of the hexagonal snatch index increased from 3.934 ± 0.326 seconds before training to 2.604 ± 0.350 seconds; The test result of T-shaped sensitivity test index increased from 11.761 ± 0.596 seconds before training to 10.357 ± 0.499 seconds. The data results in Table 3 show that after a certain period of Pilates training, the physical coordination quality of the volleyball players will be significantly improved.

Effect of Pilates Training on the Physical Stability of Women Volleyball Players

The physical stability indexes of women volleyball players in the experimental group and the control group were tested and counted. The test results of the test athletes in the control group undergoing routine training are shown in Table 4.

The data in Table 4 shows that after 8 weeks of routine training, the five indexes of body stability in the control group have significant changes compared with those before training ($P < 0.05$). Among them, the test result of plate support index increased from 33.420 ± 3.548 seconds before training to 35.836 ± 4.714 seconds; The test result of standing index with closed eyes on one foot increased from 13.646 ± 1.318 seconds before training to 14.857 ± 1.522 seconds; The score of the 15s standing grip index test was increased from 5.343 ± 1.044 before training to 6.612 ± 0.735; The score of the 20s repeated cross-index test increased from 35.576 ± 0.763 times before training to 45.963 ± 0.739 times; The test result of medicine ball side throw index increased from 61.227 ± 16.870 meters before training to 66.655 ± 17.336 meters. The data results in Table 4 show that systematic and professional routine training plays a certain role in improving the physical stability of volleyball players.

The statistical analysis results of various indexes of body stability of women volleyball players in the experimental group undergoing Pilates training are shown in Table 5.

The data in Table 5 shows that after 8 weeks of Pilates training, the five indexes of body stability in the experimental group have relatively significant changes compared with those before training (P . The score of the 20-second repeated cross-index test increased from 35.444 ± 0.753 times before training to 46.453 ± 0.919 times; The test result of side throwing index of medicine ball was raised from 59.617 ± 16.160 meters before training to 78.386 ± 16.221 meters. In addition, the test result of the plate support index increased from 32.790 ± 36.562 seconds before training to 34.055 ± 34.682 seconds; The test result of standing index with closed eyes on one foot increased from 13.767 ± 16.190 seconds before training to 15.376 ± 14.059 seconds; The score of the 15s standing grip and support index test increased from 5.598 ± 0.760 before training to 7.491 ± 0.755. The data results in Table 5 show that after a certain period of Pilates training, the physical coordination quality of the volleyball players will be significantly improved.

DISCUSSION

In general, Pilates training is a training method for coordinated movement of the whole body, which helps to improve the stability of the body, strengthen the shallow and deep muscle groups of the trunk, and has a positive effect on the body shape and physical quality. Pilates can strengthen physique, improve posture, promote balance, improve coordination and relieve muscle tension by adjusting muscle tension of various parts of the body. Integrating Pilates into the auxiliary training of

Table 3. The Effect of Pilates Training on the Body Coordination of Women Volleyball Players.

Option	Before experiment	After experiment	P
Weight-bearing sit-ups (times)	23.112±5.088	28.020±6.427	0.01307
Left and right side axles (seconds)	7.745±10.138	8.831±8.133	0.03472
Throw solid ball inside (m)	27.144±31.884	29.208±28.442	0.03870
Hexagonal snatch (seconds)	3.934±0.326	2.604±0.350	0.03479
T-shaped sensitivity test (seconds)	11.761±0.596	10.357±0.499	0.01176

Table 4. The Influence of Routine Training on the Physical Stability of Women Volleyball Players.

Option	Before experiment	After experiment	P
Plate support (seconds)	33.420±3.548	35.836±4.714	0.02756
Standing with eyes closed on one foot (seconds)	13.646±1.318	14.857±1.522	0.03035
15s vertical grip support (pcs)	5.343±1.044	6.612±0.735	0.04710
Repeated crossing in 20s (times)	35.576±0.763	45.963±0.739	0.04946
Side throwing of medicine ball (m)	61.227±16.870	66.655±17.336	0.02093

Table 5. The Influence of Pilates Training on the Body Stability of Women Volleyball Players.

Option	Before experiment	After experiment	P
Plate support (seconds)	32.790±36.562	34.055±34.682	0.03141
Standing with eyes closed on one foot (seconds)	13.767±16.190	15.376±14.059	0.03766
15s vertical grip support (pcs)	5.598±0.760	7.491±0.755	0.02645
Repeated crossing in 20s (times)	35.444±0.753	46.453±0.919	0.00291
Side throwing of medicine ball (m)	59.617±16.160	78.386±16.221	0.00546

volleyball players has greatly improved the quality of volleyball training and the overall physical fitness. In addition, it also enriches the teaching content, breaks the traditional volleyball training mode, and provides new ideas for volleyball training.

CONCLUSION

During the 8-week experimental training, the coordination and stability indexes of the subjects in the experimental group and the control group were statistically evaluated before and after the experiment. The results show that after long-term, scientific and systematic training, Pilates training has a significant impact on the evaluation of coordination and stability indicators of volleyball players. Pilates training can not only strengthen core muscles, but also improve dynamic stability. It is suggested that daily training should focus on traditional strength training, while Pilates training should focus on activating the parts that need training. At the same time, we should emphasize the muscle training of each

muscle group in combination with the respiratory and nervous system, and pay more attention to the strength training of multiple joints and different muscle groups, so as to better implement technical actions and improve the performance of the competition. Improving the balance and stability of the body is very important for volleyball players, so this study provides some reference for the formulation of scientific body coordination and stability training plan.

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