

# APPLICATION OF THE OVERHEAD TRAINING METHOD IN SPORTSMEN

APLICAÇÃO DO MÉTODO DE TREINAMENTO SUSPENSO NOS ESPORTISTAS

APLICACIÓN DEL MÉTODO DE ENTRENAMIENTO EN SUSPENSIÓN EN DEPORTISTAS



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Jianping Li<sup>1</sup>   
(Physical Education Professional)  
Shuo Kong<sup>1</sup>   
(Physical Education Professional)

1. Heze University, School of Physical Education and Health, Heze, Shandong, China.

## Correspondence:

Shuo Kong  
Heze, Shandong, China. 274015.  
hzyks@163.com

## ABSTRACT

**Introduction:** Suspension training is a new activity in which exercises are performed exploring the body weight as resistance, using a suspension tape. The body remains in constant motion due to the support reaction force formed by the open kinetic chain, requiring rapid muscle contractions for continuous balance adjustment. It is believed that this training can improve proprioceptive neuromuscular function, although there is little scientific evidence of its benefits on body posture in athletes. **Objective:** Explore the function and application of the overhead training method in athletes. **Methods:** Sixteen male athletes from a provincial badminton team volunteered for the research. Divided into two groups, the experimental group added suspension training. In contrast, the control group kept only traditional training, the other training contents were the same between the two groups, and the experiment lasted 12 weeks. The relevant data were collected before and after the intervention period by the GoodBalance balance tester, and the balance ability of all athletes with eyes closed on one foot was evaluated. **Results:** The balance ability of the athletes in the experimental group was significantly improved, while the balance ability of the athletes in the control group changed little. **Conclusion:** Suspension training can significantly improve the balance ability of athletes and can be used as an effective auxiliary training method for balance improvement.

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

**Keywords:** Physical Education and Training; Sports; Postural Balance.

## RESUMO

**Introdução:** O treinamento suspenso é uma nova forma de atividade na qual se realiza exercícios explorando o peso corporal como resistência, utilizando uma fita de suspensão. O corpo permanece em constante movimento, devido à força de reação de apoio formada pela cadeia cinética aberta, exigindo contrações musculares rápidas para ajuste contínuo do equilíbrio. Acredita-se que esse treinamento possa melhorar a função proprioceptiva neuromuscular, embora haja poucas evidências científicas de seus benefícios sobre a postura corporal em esportistas. **Objetivo:** Explorar a função e a aplicação do método de treinamento suspenso nos esportistas. **Métodos:** 16 atletas masculinos da equipe de badminton de uma província foram voluntários para a pesquisa. Divididos em dois grupos, ao grupo experimental adicionou-se o treinamento em suspensão enquanto o grupo controle manteve apenas o treinamento tradicional, os outros conteúdos de treinamento foram exatamente os mesmos entre os dois grupos, o experimento durou 12 semanas. Os dados relevantes foram coletados antes e após o período de intervenção pelo testador de equilíbrio GoodBalance, a habilidade de equilíbrio de todos os atletas com os olhos fechados em um pé foi avaliada. **Resultados:** A habilidade de equilíbrio dos esportistas no grupo experimental foi significativamente aprimorada, enquanto a habilidade de equilíbrio dos atletas no grupo de controle sofreu poucas alterações. **Conclusão:** O treinamento de suspensão pode melhorar significativamente a capacidade de equilíbrio dos esportistas, podendo ser usado como um método de treinamento auxiliar eficaz para o aprimoramento de equilíbrio. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Educação Física e Treinamento; Esportes; Equilíbrio Postural.

## RESUMEN

**Introducción:** El entrenamiento en suspensión es una nueva forma de actividad en la que se realizan ejercicios explorando el peso del cuerpo como resistencia, utilizando una cinta de suspensión. El cuerpo se mantiene en constante movimiento, debido a la fuerza de reacción de apoyo formada por la cadena cinética abierta, exigiendo rápidas contracciones musculares para el ajuste continuo del equilibrio. Se cree que este entrenamiento puede mejorar la función neuromuscular propioceptiva, aunque hay pocas pruebas científicas de sus beneficios sobre la postura corporal en los deportistas. **Objetivo:** Explorar la función y la aplicación del método de entrenamiento por encima de la cabeza en los deportistas. **Métodos:** 16 atletas masculinos de un equipo provincial de bádminton se ofrecieron como voluntarios para la investigación. Divididos en dos grupos, al grupo experimental se le añadió el entrenamiento en suspensión mientras que el grupo de control mantuvo sólo el entrenamiento tradicional, los demás contenidos del entrenamiento fueron exactamente los mismos entre los dos grupos, el experimento duró 12 semanas. Los datos relevantes se recogieron antes y después del periodo de intervención mediante el probador de equilibrio GoodBalance, y se evaluó la capacidad de equilibrio de todos los atletas con los ojos cerrados sobre un pie. **Resultados:** La capacidad



de equilibrio de los atletas del grupo experimental mejoró significativamente, mientras que la capacidad de equilibrio de los atletas del grupo de control sufrió pocos cambios. Conclusión: El entrenamiento en suspensión puede mejorar significativamente la capacidad de equilibrio de los atletas, y puede utilizarse como un método de entrenamiento auxiliar eficaz para mejorar el equilibrio. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptores:** Educación y Entrenamiento Físico; Deportes; Equilibrio Postural.

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## INTRODUCTION

Among the training methods of competitive sports, suspension training belongs to a new type of training method, but the appearance of suspension training is not too late, and it was applied to the rehabilitation of orthopedic diseases during World War II. In recent years, suspension training has been applied to the rehabilitation training of sports injuries, and has been applied and developed in the field of sports training. In an unstable state, suspension training conducts a comprehensive training of the athlete's organs, strengthens the deep muscles of the athlete's vital trunk and pelvis. In suspension training, the athlete's muscle groups and nerves can be in a state of balance.<sup>1</sup> Suspension equipment is the main equipment used in suspension training, and is generally equipped with sponge rubber pads for training. Suspension training plays an important role in badminton physical training, so it is necessary to apply suspension training reasonably, so as to achieve the effect and purpose of training.<sup>2</sup>

## METHOD

### Research object

A total of 16 male athletes in the shooting team of A province were selected as the research objects, all of them were right-handed, they were randomly divided into the experimental group and the control group, with 8 athletes in each group, the basic information of the research objects is shown in Table 1.

### Expert interview method

Consult and discuss with famous shooting coaches and physical training experts on suspension training, balance ability, etc., and provide help for the author.

### Experimental method

Training arrangement: The experimental group is arranged to perform 30-min suspension training at the end of the morning training session on Tuesday and Friday every week, the experimental period is 12 weeks in total, the main training contents include prone knee bends, supine hip lifts, suspension double-leg sit-ups, suspension push-ups, suspension bilateral support, kneeling straight arm push-pull, single (double) foot standing balance pad, legs and arms support prone position Eight movements of the legs, do each movement 10 to 12 times, and do 4 sets of circuit training, with an interval of 1 min between each set. During the training process, the support force and instability of the arm are mainly increased by adjusting the height of the suspension rope, and the load intensity is increased by increasing the number of training groups.<sup>3,4</sup> The control group did not perform suspension training, and other daily training contents were exactly the same as the experimental group.

**Table 1.** Basic information of the research objects.

group	age	height	weight	training years
test group	19.34±1.15	181.64±6.46	75.51±6.20	7.09±2.39
control group	19.71±1.23	180.35±5.88	74.68±7.17	6.79±2.49

## Test indicators

When standing on one foot with eyes closed, the average speed of the subject's center of gravity swaying on the X and Y axes ( $V_x/V_y$ ), the average distance of the subject's center of gravity moving on the X and Y axes ( $M_x/M_y$ ), the total distance ( $D_x/D_y$ ) of the subject's center of gravity moving in the X and Y axes, the horizontal distance and the vertical distance are the displacement of the X and Y coordinates of the center curve ( $L_x/L_y$ ).<sup>5</sup>

## Mathematical Statistics

SPSS 22.0 statistical software was used for statistical processing of the data obtained from the test, and the results were expressed as mean + standard deviation ( $\bar{X} \pm S$ ). The data before and after training within the same group were tested by independent sample T test, and the variance of one-way ANOVA was used to test the difference between groups,  $P < 0.05$  indicated that the difference was significant.<sup>6</sup>

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

## Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Heze University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

## RESULTS AND ANALYSIS

### The effect of suspension training on the balance ability of the left foot of shooters

$V_x$  and  $V_y$  represent the mean speed of the subject's center of gravity shaking in the X-axis and Y-axis directions, respectively,  $L_x$  and  $L_y$  represent the movement displacement of the subject's center of gravity in the X-axis and Y-axis directions, respectively,  $D_x$  and  $D_y$  represent the total distance that the subject's center of gravity moves in the X-axis and Y-axis directions, respectively,  $M_x$  and  $M_y$  represent the average distance that the subject's center of gravity moves in the X-axis and Y-axis directions, respectively, the better the subject's balance ability.<sup>7</sup>

As can be seen from Table 2, before training, the shooters in the experimental group and the control group closed their eyes with their left feet, there was no significant difference in each index of balance ability ( $P > 0.05$ ). After 12 weeks of training in different ways, the left foot balance ability of the two groups of athletes changed to varying degrees, the values of  $V_x$ ,  $V_y$ ,  $L_x$ ,  $D_x$ ,  $M_x$  and  $M_y$  of the left foot of the athletes in the control group decreased slightly after the experiment, but the decrease was very small, and there was a significant difference in the rings ( $P > 0.05$ ), however,  $L_y$  and  $D_y$  increased slightly after the experiment, but there was no difference ( $P > 0.05$ ), after the experiment, the balance ability of the left foot of the athletes in the control group with their eyes closed did not

improve significantly. After 12 weeks of suspension training, the values of Vx, Vy, Lx, Dx, Dy, Mx, and My in the shooting athletes of the experimental group decreased significantly compared with those before training, and there was a significant difference ( $P < 0.05$ ), and compared with the control group after the experiment, there was a significant difference ( $P < 0.05$ ), the Ly value of the experimental group athletes decreased slightly after the experiment compared with before the experiment, but there was no significant difference ( $P > 0.05$ ), and there was no significant difference compared with the control group after the experiment ( $P > 0.05$ ). It can be seen that after 12 weeks of suspension training, the balance ability of the left foot of the shooters in the experimental group with eyes closed has been significantly improved, and the balance ability after the experiment is significantly better than that of the control group.<sup>8</sup>

### The effect of suspension training on the balance ability of the shooter's right foot

As can be seen from Table 3 and Figure 1, before training, the shooters in the experimental group and the control group closed their eyes with their right feet, there was no significant difference in each index of balance ability ( $P > 0.05$ ). After 12 weeks of training in different ways, the indicators of the balance ability of the right foot of the two groups of athletes changed to varying degrees, the values of Vx, Vy, Lx, Dx, and Mx of the right foot of the athletes in the control group decreased slightly after the experiment, but the decrease was very small, and there was no significant difference ( $P > 0.05$ ), however, the values of Ly, Dy and My increased slightly after the experiment, but the increase was very small, and there was no significant difference ( $P > 0.05$ ), it can be seen that after the experiment, when the athletes in the control group closed their eyes, the balance ability of the right foot is not improved as much as the left foot.<sup>9,10</sup> After 12 weeks of suspension training, the values of Vx, Vy, Lx, Dx, Dy and My in the experimental group decreased significantly compared with those before training, and there

was a significant difference ( $P < 0.05$ ), and compared with the control group after the experiment, there was a significant difference ( $P < 0.05$ ), but the Ly and Mx values of the athletes in the experimental group decreased slightly after the experiment compared with before the experiment, and there was no significant difference ( $P > 0.05$ ), and compared with the control group after the experiment, there was no significant difference ( $P > 0.05$ ). It can be seen that after 12 weeks of suspension training, the balance ability of the right foot of the shooters in the experimental group with eyes closed has been significantly improved, and the balance ability after the experiment is significantly better than that of the control group.

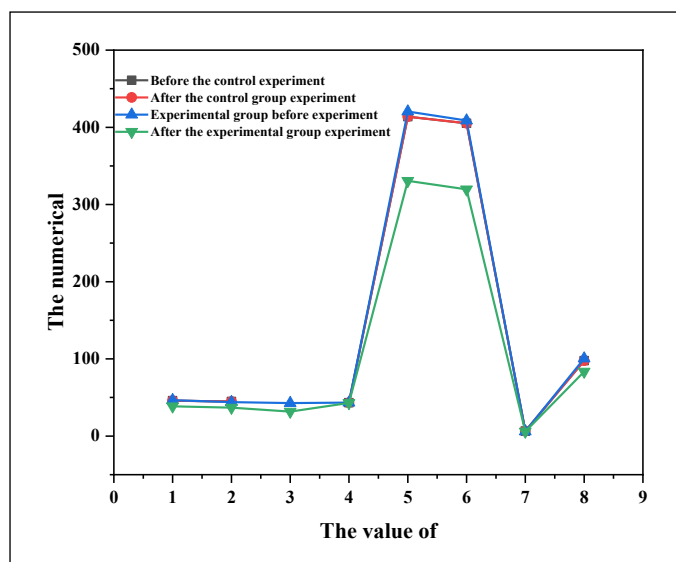


Figure 1. Comparison of the subjects' right foot balance ability before and after suspension training.

Table 2. Changes of left foot balance ability of subjects before and after suspension training.

	control group		test group	
	Before experiment	After the experiment	Before experiment	After the experiment
Vx	52.86±10.30	50.28±11.41	51.83± 10.57	40.13±7.05
Vy	49.52±9.47	47.24±8.90	49.18±9.93	38.48±6.37
Lx	45.35±9.52	43.97±9.48	46.17±19.06	33.24±6.73
Ly	43.53±10.48	45.27±10.08	44.18±9.77	43.05±7.20
Dx	462.34±121.05	449.92±102.56	471.46±123.55	345.48±108.35
Dy	448.04±135.37	463.93±123.81	436.51±114.02	327.31±110.78
MX	8.86±5.11	8.01±4.92	9.11±5.45	5.83±3.54
My	126.52±20.47	138.48±22.05	124.04±23.05	84.60±17.47

Table 3. Changes in the balance ability of the subjects' right foot before and after suspension training.

	control group		test group	
	Before experiment	After the experiment	Before experiment	After the experiment
Vx	45.85±9.37	43.62±10.04	46.43±10.72	38.62±7.61
Vy	44.71±10.52	44.37±19.02	43.94±8.31	36.81±6.92
Lx	43.37±8.61	42.48±8.61	42.82±9.84	31.67±6.37
Ly	43.28±19.46	43.81±10.82	43.454±8.72	42.87±7.36
Dx	413.73±110.83	401.35±105.51	420.52±110.5	330.71±106.20
Dy	405.21±106.74	411.61±116.72	408.81±107.80	319.61±106.28
MX	6.47±4.78	6.27±5.00	6.02±4.71	5.81±4.37
My	97.62±17.82	108.94±19.62	100.56±18.41	83.58±16.81

## CONCLUSION

By standing on one foot with eyes closed, the authors can detect the ability of athletes to maintain balance and stability. The results of this study found that after 12 weeks of experimentation, because the athletes in the control group did not perform suspension training, the balance ability index values of the left and right feet increased or decreased slightly, the amplitudes are all small, and there is no significant difference compared with before the experiment. After 12 weeks of suspension training, except for the movement displacement  $L_y$  of the left and right feet in the Y-axis direction, and the average distance  $M_x$  of the right foot in the X-axis direction, the values of the athletes in the experimental group did not decrease significantly compared with those before the experiment, the balance

ability index values of other left and right feet decreased significantly, indicating that the balance ability of the athletes in the experimental group was significantly improved; It can be seen that suspension training can improve the difference in the balance ability of the left and right sides of the athlete, and make the balance ability of the left and right sides of the athlete closer, which is helpful for the improvement of the athlete's athletic ability and reduces the occurrence of sports injuries.

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The author declares no potential conflict of interest related to this article.

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