

# FUNCTIONAL TRAINING EFFECTS ON POSTURAL CONTROL CAPACITY IN SPORTS DANCERS



ORIGINAL ARTICLE  
ARTIGO ORIGINAL  
ARTÍCULO ORIGINAL

EFEITOS DO TREINAMENTO FUNCIONAL SOBRE A CAPACIDADE DE CONTROLE POSTURAL NOS DANÇARINOS ESPORTIVOS

EFFECTOS DEL ENTRENAMIENTO FUNCIONAL SOBRE LA CAPACIDAD DE CONTROL POSTURAL EN LOS BAILARINES DEPORTIVOS

Xi Zheng<sup>1</sup>   
(Physical Education Professional)

1. Shanghai Maritime University,  
Shanghai, China.

## Correspondence:

Xi Zheng  
Shanghai, China, 201306.  
smuaerobic@163.com

## ABSTRACT

**Introduction:** Functional training can improve athletes' coordination and physical control. Some studies prove the improvement of the strength of the core muscles after functional training. However, the research that questions athletes' dynamic balance submitted to functional training is inconclusive. **Objective:** To analyze the methods of postural control and the impact of functional training on sports dancers. **Methods:** Young sports dancers were randomly divided into control and experimental groups. Both groups performed traditional fitness training, and a functional training protocol was added to the experimental group. Mathematical statistics were employed in the comparative analysis of the fitness of the two groups of athletes before and after training. **Results:** The athletes in the functional training group rapidly achieved postural control ability, with high statistical relevance ( $P < 0.05$ ). **Conclusion:** Athletes need to adopt a scientific and systematic training plan when performing sports dance training. The establishment of the test indexes for postural control ability in athletes can be diversified. **Evidence Level II; Therapeutic Studies – Investigating the results.**

**Keywords:** Strength training; Dancing; Athlete; Physical fitness testing.

## RESUMO

**Introdução:** O treinamento funcional pode melhorar a coordenação e o controle físico dos atletas. Também há estudos que comprovam a melhora da força dos músculos do core após o treinamento funcional. Porém ainda são inconclusivas as pesquisas que questionam o equilíbrio dinâmico dos atletas submetidos ao treino funcional. **Objetivo:** Analisar os métodos de controle postural e o impacto do treinamento funcional em dançarinos esportivos. **Métodos:** Jovens dançarinos esportivos foram divididos aleatoriamente em grupos controle e experimental. Os dois grupos executaram o treino de aptidão física tradicional e foi adicionado um protocolo de treino funcional ao grupo experimental. Estatísticas matemáticas foram empregadas na análise comparativa da aptidão física dos dois grupos de atletas, antes e depois do treinamento. **Resultados:** Os atletas do grupo de treinamento funcional atingiram rapidamente a capacidade de controle postural, com alta relevância estatística ( $P < 0,05$ ). **Conclusão:** Os atletas precisam adotar um plano de treinamento científico e sistemático ao realizarem treinos de dança esportiva. O estabelecimento dos índices de teste para a capacidade de controle postural nos atletas pode ser diversificado. **Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.**

**Descritores:** Treinamento de Força; Dança; Atleta; Testes de Aptidão Física.

## RESUMEN

**Introducción:** El entrenamiento funcional puede mejorar la coordinación y el control físico de los atletas. También hay estudios que demuestran la mejora de la fuerza de los músculos del core tras el entrenamiento funcional. Sin embargo, las investigaciones que cuestionan el equilibrio dinámico de los atletas sometidos a un entrenamiento funcional aún no son concluyentes. **Objetivo:** Analizar los métodos de control postural y el impacto del entrenamiento funcional en los bailarines deportivos. **Métodos:** Los jóvenes bailarines deportivos fueron divididos aleatoriamente en grupos de control y experimentales. Ambos grupos realizaron un entrenamiento físico tradicional y se añadió un protocolo de entrenamiento funcional al grupo experimental. Se emplearon estadísticas matemáticas en el análisis comparativo de la forma física de los dos grupos de atletas antes y después del entrenamiento. **Resultados:** Los atletas del grupo de entrenamiento funcional alcanzaron rápidamente la capacidad de control postural, con gran relevancia estadística ( $P < 0,05$ ). **Conclusión:** Los atletas necesitan adoptar un plan de entrenamiento científico y sistemático cuando realizan un entrenamiento de danza deportiva. El establecimiento de los índices de prueba de la capacidad de control postural en los deportistas puede diversificarse. **Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.**

**Descriptorios:** Entrenamiento de Fuerza; Baile; Atleta; Pruebas de Aptitud Física.



## INTRODUCTION

Functional core strength is a strong ability whose main purpose is to stabilize the core part of the human body, control the movement of the center of gravity, and transmit the strength of the upper and lower limbs. This training can improve the strength of the core muscles so that our whole body can achieve dynamic stability and balance.<sup>1</sup> It is the main ability to form the core stability of the human body. The difficult movements of sports dance mainly include flexibility and balance, jumping, and turning. Difficulty moves play an important role in the fluency and beauty of the whole set of sports dance movements. Teenagers can effectively control the body's center of gravity and the stability of technical movements by training the body's core muscle groups. This article uses experimental, camera analysis, questionnaire survey, interview, and other methods to conduct functional core strength training experiments on two groups of adolescents. We explore the impact of functional core training on the technical training, performance, and injury prevention of youth sports dance.

## METHOD

### Research object

We took 60 students specializing in sports dance as experimental subjects and divided them into experimental and subject groups. Volunteers undergo practical training for ten weeks.<sup>2</sup> The article analyzes the impact of functional core strength training on youth sports dance technical training.

### Research methods

Camera preparation, location selection, and trial adjustments are carried out every Sunday at 1 p.m. The test officially started at two points. We filmed the entire assessment process.<sup>3</sup> After the evaluation, save the video of the examination process of the 60 experimenters. We edit videos of 60 people. We use slow playback and observe everyone's performance. We discussed with the coaches and judges' teachers and calculated each individual's impressive and comprehensive results. The experimental survey data after 10 weeks was sorted and analyzed using Excel 2010 software.

### Action similarity calculation method based on pose estimation

Because the dance movements mainly depend on the changes of the dancer's limbs, this article only considers the offset of 8 joint points. The contents are left and right shoulder joints, left and right elbow joints, left and right hip joints, and left and right knee joints.<sup>4</sup> We number from 1 to 8 respectively. When the limbs are shifted back and forth in space, the length of the two-dimensional projection of the limbs on the picture will change. Therefore, the length information of the limbs can be used to derive the forward and backward offset angle  $d_1$  of the limbs in space:

$$d_{1k} = \frac{180}{\pi} \arccos \frac{d(p_k^{i+1}, f(p_k^{i+1}))}{d(p_k^i, f(p_k^i))} \quad (1)$$

$k$  is the joint number.  $p_k$  is the center point corresponding to the joint. We use the position information of the joint to infer the angle information of the joint point to obtain the counterclockwise rotation angle  $d_2$  of the two-dimensional plane of the joint point:

$$\begin{aligned} \vec{a}_k^i &= f_1(p_k^i) - p_k^i \\ \vec{b}_k^i &= f_2(p_k^i) - p_k^i \\ d_{2k} &= \frac{180}{\pi} [\pi + \arctan(\tan \langle \vec{a}_k^i, \vec{b}_k^i \rangle)] \end{aligned} \quad (2)$$

We infer the offset angle of the joint in the three-dimensional space based on the two-angle information calculated by formulas (1) and (2):

$$d_k = \frac{180}{\pi} \arccos \left( 1 - \frac{\sin^2 d_{1k} + \sin^2 d_{2k}}{2} \right) \quad (3)$$

Where  $d_k \in (0^\circ, 180^\circ)$ .

## RESULTS

### Grouping of experimental subjects

We divided the 60 students into groups based on the length of time studying sports, dance, physical fitness, special practice results, height, and weight. (Table 1)

### Experiment content

We conducted experiments on the experimental group for two and a half months from November 2019 to January 2020. The control and experimental groups received normal daily training every week.<sup>5</sup> The experimental group had a 45-minute functional core strength training course three times weekly. (Table 2)

### Comparative analysis of test scores of difficulty movements

The specific difficulty action selected the time required to rotate 360 degrees horizontally and 360 degrees with whip judges'. (Table 3) After functional core training, the experimental group's performance improved significantly, while the performance of the control group was relatively average. There is not much difference between the experimental and control groups in the difficulty of balance and flexibility.<sup>6</sup> This shows that functional core training has little effect on balance and flexibility. In the total difficulty score, the experimental group's results that have undergone functional core training are more optimistic.

**Table 1.** Comparison of differences in height, weight, physical fitness, and special performance between the control and experimental groups.

Group	N	Height	Weight
test group	30	165±0.05	53±0.8
Control group	30	164±0.85	51±1.3

**Table 2.** Functional core strength training content of the experimental group.

Practice movement	Practice time	Practice frequency	Training load	Practice equipment
Plank high-five	Lasts 10 weeks	4-6 groups in total, 15 in each group	Overcome self-bearing exercises in the first 5 weeks, and perform 2 kg weight-bearing exercises in the next 5 weeks	Freehand exercise sandbag pulley
Pulley support				
Russian swivel				
Fast sit-ups turn				
Backbend				
Back up				

**Table 3.** Comparison of the difficulty scores of specific actions between the experimental and control groups in the first and tenth weeks.

	Before the experiment		After the experiment	
	Test group	Control group	Test group	Control group
Time to pan 360°(s)	2.52±0.022	2.51±0.052	2.12±0.056	2.29±0.76
Turn 360° with whip time(s)	2.52±0.056	2.52±0.008	2.15±0.025	2.22±0.055
Balance and flexibility difficulty score	76.2±0.22	76.1±0.66	76.7±0.66	76.66±0.72
Total difficulty score	72.6±0.82	76.2±0.12	87.22±0.62	82.26±0.22

### Comparative analysis of physical fitness test results

The physical fitness test content mainly includes plank support high-five, pulley support, Russian turn, quick sit-up turns, backbend, back up. The assessment method is the quantity and quality of completion per unit time of 1 minute.

After ten weeks of functional core training, the quantity and quality of the six physical exercises of the 30 students in the experimental group have improved significantly.<sup>7</sup> In particular, the physical fitness of the Russian students in the rotation, plank high-five, and backup was significantly improved compared to the students in the test group. (Table 4) There is little change in pulley support quantity and quality, sit-ups and turns, and backbends. The quality and quantity of the six exercises in the control group also improved, but the changes were small.

There are several reasons why Russia's rotation, plank high-five, and backup movements have changed significantly. 1. The difficulty of the three movements is less difficult than the other movements.<sup>8</sup> It can be improved through regular long-term training. 2. The strength training of the waist and abdomen affects each other. The improvement of back muscle strength is conducive to promoting the training of abdominal muscles. The two promote and influence each other.

### Comparative analysis of special test sets

The final score of the test set consists of two parts. One part is scored by the judges on-site, and the video scores the other part. In this analysis, the test scores of the experimental group and the subject group were analyzed and compared in the fifth week.

The scores of all students before and after the experiment improved significantly. (Table 5) There are some differences between on-site scoring and video scoring. In particular, there is a relatively large gap between the on-site scores of the experimental group and the video scores.<sup>9</sup> This may be because the completion of the action is different in two respects. The experimental group whose total score has undergone functional core training showed positive results.

### Comparative analysis of total test scores

The test content is divided into specific movement difficulties, physical fitness tests, and a special set of tests.<sup>10</sup> Therefore, the total score of this test is converted using the formula of the total test score. Total

**Table 4.** Comparison of physical fitness between the experimental and control groups before and after the experiment.

Finish		Test group		Control group	
		Before the experiment	After the experiment	Before the experiment	After the experiment
Plank high-five	quantity	30	41	32	37
	quality	0.4	0.6	0.4	0.5
Pulley support	quantity	8	14	8	11
	quality	0.3	0.5	0.3	0.45
Russian swivel	quantity	32	60	33	46
	quality	0.5	0.6	0.5	0.6
Fast sit-ups turn	quantity	30	32	26	29
	quality	0.5	0.7	0.5	0.6
Backbend	quantity	15	21	15	18
	quality	0.5	0.6	0.5	0.6
Back up	quantity	30	36	26	33
	quality	0.4	0.6	0.4	0.5

test score = (special movement difficulty and physical fitness test score + special set of tests) ÷ 2.

From Table 6, it can be seen that the total scores of the experimental group students after functional core strength training are continuously improving. The control group's performance in daily training also continued to improve. But overall, the experimental group has the largest change. It can be seen that functional core training still positively impacts the technical training of youth sports dance. After passing all aspects of the test, the test results of the adolescents in the experimental group after the experiment were better.

**Table 5.** Comparison of the experimental and control groups' test results in the first week and the fifth week.

		Live scoring results	Video scoring results	Total Score
Before the experiment	Test group	77.42±1.33	77.42±1.46	77.42±1.4
	Control group	78.41±1.42	78.43±1.18	78.42±1.31
After the experiment	Test group	86.33±1.56	87.31±1.24	86.79±1.41
	Control group	81.39±1.76	81.33±1.54	81.36±1.65

**Table 6.** Comparison of total test scores between the experimental and subject groups in the first, fourth, seventh, and tenth weeks.

	The first week	The fourth week	The seventh week	The tenth week
Test group	75.2±0.30	82.2±0.3	84.5±0.23	87.8±0.22
Control group	75.4±0.23	79.7±0.22	82.6±0.2	82.3±0.56

## DISCUSSION

The functional core strength training of sports dance should be based on young people's mental and physical characteristics. Training is diverse and interesting.<sup>11</sup> This carried out functional core strength training and made the youngsters not feel bored and exhausted in training.

In the load training of competitive aerobics, the coach should tell the students the importance of core training. At the same time, it is necessary to popularize theoretical knowledge.<sup>12</sup> This allows students to have a deeper understanding of core strength training. It is necessary to control the amount of load and the intensity of the load. Training needs to be rhythmic. In training, you must control the quantitative and qualitative changes of movements and control the time and number of exercises.

## CONCLUSION

The completion of sports dance moves requires athletes to have excellent strength qualities and have strong core stability. Functional core strength training specifically emphasizes coordinating core parts and small muscle groups. This training emphasizes balance, stability, dynamics, and proprioception. An athlete completes technical movements at a fast, accurate, and stable angle. Athletes can more accurately understand their physical abilities and understand the core technical training of sports dance. Through this training, sports injuries such as muscle strains of athletes can be reduced. It can improve the core foundation of sports dance athletes. The athlete's body forms muscle memory and automatically completes the action. This training can ensure that the athletes are accurate, stable, and error-free during the competition and performance.

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

## REFERENCES

1. Grygus I, Nesterchuk N, Hrytseniuk R, Rabcheniuk S, Zukow W. Correction of posture disorders with sport and ballroom dancing. *Медичні перспективи*. 2020;25(1):174-84.
2. Norouzi E, Hosseini F, Vaezmosavi M, Gerber M, Pühse U, Brand S. Zumba dancing and aerobic exercise can improve working memory, motor function, and depressive symptoms in female patients with fibromyalgia. *European Journal of Sport Science*. 2020;20(7):981-91.
3. Korobeynikov GV, Mishko VV, Korobeinikova LG. Factor structure of manifestation of success in the formation of choreographic skills in young dancers. *Health, sport, rehabilitation*. 2020;6(1):26-31.
4. Thieser S, Dörfler J, Rudolph I, Wozniak T, Schmidt T, Hübner J. Influence of ballroom dancing on fatigue, body image, self-efficacy, and endurance of cancer patients and their partners. *Medical Oncology*. 2021;38(2):1-10.
5. Bhide R, Choi SM. A Dance-Based Exercise Training Will Be Better Remedy for Individuals with Alzheimer's Disease. *Research in Dance and Physical Education*. 2019;3(2):63-9.
6. Ljubojevic A, Popovic B, Bijelic S, Jovanovic S. Proprioceptive training in dance sport: effects of agility skills. *Turkish Journal of Kinesiology*. 2020;6(3):109-17.
7. Ganciu OM. Strategies for Improving the Functional Parameters of the Students of the University of Bucharest. *Bulletin of the Transilvania University of Brasov. Series IX, Sciences of Human Kinetics*. 2020;13(1):153-8.
8. Steinberg N, Tenenbaum S, Waddington G, Adams R, Zakin G, Zeev A et al. Isometric exercises and somatosensory training as intervention programmes for patellofemoral pain in young dancers. *European journal of sport science*. 2020;20(6):845-57.
9. Letton ME, Thom JM, Ward RE. The Effectiveness of Classical Ballet Training on Health-Related Outcomes: A Systematic Review. *Journal of Physical Activity and Health*. 2020;17(5):566-74.
10. Declerck L, Kaux JF, Vanderthommen M, Lejeune T, Stoquart G. The effect of adaptive sports on individuals with acquired neurological disabilities and its role in rehabilitation: A Systematic Review. *Current sports medicine reports*. 2019;18(12):458-73.
11. Yang Y, Van Schooten KS, McKay HA, Sims-Gould J, Hoang RA, Robinovitch SN. Recreational Therapy to Promote Mobility in Long-Term Care: A Scoping Review. *Journal of Aging and Physical Activity*. 2020;29(1):142-61.
12. Yin AX, Geminiani E, Quinn B, Owen M, Kinney S, McCrystal T et al. The evaluation of strength, flexibility, and functional performance in the adolescent ballet dancer during intensive dance training. *Pm&r*. 2019;11(7):722-30.