CORE STRENGTH TRAINING IMPACTS ON THE IMPROVEMENT OF MUSCLE COORDINATION IN SPORT DANCERS

TREINAMENTO DE FORÇA DO CORE NA MELHORIA DA COORDENAÇÃO MUSCULAR EM DANÇARINOS ESPORTIVOS

ENTRENAMIENTO DE LA FUERZA DEL CORE EN LA MEJORA DE LA COORDINACIÓN MUSCULAR EN BAILARINES DEPORTIVOS

Original Article
Artigo Original
Artículo Original

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ABSTRACT

Introduction: Dance sport is an emerging sport activity. The number of college students devoted to the study of dance is increasing. Basic dance sport skills are inherent to performance. Basic skills training requires dancers to have a certain degree of flexibility, endurance, speed, etc. Currently, we know that CORE strength training can improve the physical function of athletes, but studies are scarce as to its true impact on proprioceptive skills in dance sports. Objective: The purpose of this study was to examine the effect of strengthening the CORE on muscle coordination in sport dancers. This paper examines the relationship between core strength training and dance skills in athletes. Methods: Undergraduate sport dance students were randomly and voluntarily selected. These students undergo a 4-month training protocol in CORE strengthening. The effect of this experiment was evaluated with biomarker and kinetic data collected before and after the experiment. These data were worked out statistically and the results were discussed according to the literature. Results: After the CORE training protocol, the sport dance students had significant differences in physical tests($P<0.05$). Conclusion: CORE training can promote physical stability, explosive power and muscle coordination in sport dancers. ***Level of evidence II; Training research - outcome investigation.***

Keywords: Dancing; Resistance Training; Muscle Relaxation; Sports.

RESUMO

Introdução: O esporte de dança é uma atividade esportiva emergente. O número de estudantes universitários dedicados ao estudo da dança está aumentando. As habilidades básicas da dança esportiva são inerentes à performance. O treinamento de habilidades básicas exige que os dançarinos tenham um certo grau de flexibilidade, resistência, velocidade, etc. Atualmente, sabemos que o treinamento de força do core pode melhorar a função física dos atletas, porém os estudos são escassos quando ao seu verdadeiro impacto sobre as habilidades proprioceptivas na dança esportiva. Objetivo: Este estudo teve como objetivo analisar o efeito do fortalecimento do core na coordenação muscular em bailarinos esportivos. Este artigo examina a relação entre treinamento de força central e habilidades de dança em atletas. Métodos: Foram selecionados, de maneira aleatória e voluntariamente, universitários graduandos em dança esportiva. Esses alunos passam por 4 meses sob protocolo de treino em fortalecimento do core. O efeito desse experimento foi avaliado com os dados de biomarcadores e cinéticos coletados antes e após o experimento. Esses dados foram trabalhados estatisticamente e os resultados foram discutidos segundo a literatura. Resultados: Após o protocolo de treinamento do core, os alunos de dança esportiva tiveram diferenças significativas nos testes físicos ($P<0,05$). Conclusão: O treinamento do core pode promover estabilidade física, poder explosivo e coordenação muscular em dançarinos esportivos. ***Nível de evidência II; Pesquisa de treinamento - investigação de resultados.***

Descritores: *Dança; Treinamento de Força; Relaxamento Muscular; Esportes.*

RESUMEN

Introducción: El deporte de la danza es una actividad deportiva emergente. El número de universitarios dedicados al estudio de la danza va en aumento. Las habilidades deportivas básicas de la danza son inherentes al rendimiento. El entrenamiento de habilidades básicas requiere que los bailarines tengan un cierto grado de flexibilidad, resistencia, velocidad, etc. Hoy en día, sabemos que el entrenamiento de fuerza core puede mejorar la función física de los atletas, pero los estudios son escasos sobre su impacto real en las habilidades propioceptivas en los deportes de danza. Objetivo: Este estudio tiene como objetivo analizar el efecto del fortalecimiento del core en la coordinación muscular de los bailarines deportivos. Este artículo examina la relación entre el entrenamiento de la fuerza central y las habilidades de danza en los atletas. Métodos: Se seleccionaron de forma aleatoria y voluntaria estudiantes universitarios que se graduaban en danza deportiva. Estos estudiantes pasaron 4 meses bajo el protocolo de formación en el fortalecimiento del core. El efecto de este experimento se evaluó con datos de biomarcadores y cinéticos recogidos antes y después del experimento. Estos datos se trabajaron estadísticamente y los resultados se discutieron de acuerdo con la literatura. Resultados: Tras el protocolo de

entrenamiento del core, los alumnos de danza deportiva presentaron diferencias significativas en las pruebas físicas (P<0,05). Conclusión: El entrenamiento del core puede promover la estabilidad física, la potencia explosiva y la coordinación muscular en los bailarines deportivos. ***Nivel de evidencia II; Investigación de formación - investigación de resultados.***

Descriptore: *Baile; Entrenamiento de Fuerza; Relajación Muscular; Deportes.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0292 Article received on 06/05/2022 accepted on 07/15/2022

INTRODUCTION

Sports dance is an emerging sports performance sport. Physical education is compulsory for students majoring in physical education and an elective course for ordinary colleges and universities.[1] It is a performance sport that uses strength as an essential skill. Special strength training is the foundation of sports dance. Good physical fitness can help prevent students from getting injured in sports. It can promote students to master the correct technical movements quickly. Students should pay attention to special strength training in sports dance practice. This can improve the stability of the hip and trunk. The core strength plays a role in coordinating the force of the entire body. Core strength is the foundation of body stability. It is an essential physical quality in sports dance programs.

METHOD

Research objects

We selected 28 girls from the sports dance professional class of the Institute of Physical Education. We randomly divided 28 students into experimental and control groups.[2] The teaching experiment time is from September 10, 2020, to December 30, 2020. The experiment lasted for 16 weeks.

Both groups perform the same strength training movements. The experimental group used a yoga ball.[3] The control group completed core strength training with bare hands.

Athlete risk assessment simulation

This paper introduces cloud theory into the risk assessment of athletes under high-intensity exercise. U represents an athlete risk assessment universe with precise quantitative numerical mapping. T represents the qualitative concept of risk assessment for athletes corresponding to U. $u(x)$ represents the certainty of T. The value range of $u(x)$ is $[0,1]$. The membership cloud maps the distribution process from the universe of athletes' risk assessment represented by U to $[0,1]$. Use formula (1) to describe

$$u(x):U\to[0,1]\forall x\in U_x\to u(x) \tag{1}$$

After the mapping is completed, we form a normal distribution random number for athlete risk assessment according to the qualitative concept C_A of the X conditional cloud generator

$$E_{nA}^{'}=\frac{norm(E_{nA},H_{eA}^{2})}{C_A*X} \tag{2}$$

H^2_{eA} represents the inevitability of the occurrence of the athlete risk factor. We substitute $\acute{E}_{nA}$ calculated by equation (1). We use equation (3) to calculate the membership degree E_{nA} of the specific input value x of the X conditional cloud generator

$$u=\exp[-(x-E_{xA})^2/2(E_{nA}^{'})^2] \tag{3}$$

We use equation (4) to obtain the state cloud representing the normal state

$$u(x^{''})=\frac{u(x)}{X}x_i\times u(x):U \tag{4}$$

Hypothesis $P_i(i=1,2,\cdots,10)$ represents the probability of occurrence with each athlete risk factor. p represents the maximum probability of occurrence of the athlete risk factor. $u(p)$ represents the degree to which pi belongs to p

$$u(p)=\begin{cases}p_i/p\\1\end{cases} \tag{5}$$

We use Equation (6) to obtain a state cloud that represents a high probability of athlete risk occurrence

$$C_A(E_{xA},E_{nA},H_{eA})=\frac{p_i\times p}{u(x^{''})\times u(p)} \tag{6}$$

We combine the state cloud of the normal state with the state cloud of athlete risk occurrence probability.[4] In this paper, formula (7) is used to build a risk prediction model for athletes under high-intensity exercise based on cloud reasoning

$$E_n^{\wedge}=\frac{E_{nA}^{'}\times u(x^{''})}{C_A(E_{xA},E_{nA},H_{eA})}\times\frac{u(p)}{C_A(E_{xA},E_{nA},H_{eA})} \tag{7}$$

Mathematical Statistics

We test the physical fitness indicators of students before and after the experiment and record the experimental data. Paired samples t-test was used within the group.[5] One-way analysis of variance was used to test between groups. We perform statistics and comment on the recorded data.

RESULTS AND ANALYSIS

Test of various indicators before the teaching experiment

The experimental group adopted the core strength training under the unstable state of the yoga ball. The control group used the same movements as the experimental group. It's just that they do it in a freehand form.[6] All the students participating in the teaching experiment have not received systematic core strength training. Before the experiment, we controlled the interference variables for the experimental and control groups before the investigation. We made statistics on the basic situation of the two groups of students. At the same time, this paper uses the paired sample t-test Table 1:

We can conclude that there is no significant difference between the experimental and control groups in terms of body mass index and overall quality of students.[7] The training progress and time of the other two students were the same. After the training, the students did not do any tutoring to ensure the accuracy and reliability of the experimental data.

Determination of core strength testing standards and evaluation methods

It can be seen from Table 2 that the five core strength items tested have certain progress compared with those before the experiment. Among them, the three test results of the prone bridge, supine two-head up, and prone pushup showed significant differences. P-values were 0.003, 0.006, and 0.01, respectively. The P values of the test results of squatting on the balance plate and throwing the medicine ball behind were 0.04 and 0.03, respectively.[8] The results showed significant differences. Our physical fitness exercises with yoga balls significantly improved core stability, core muscle strength, endurance, explosive power, and hip flexion strength.

From the average value of Table 3, it can be seen that the five abilities tested have improved and improved. This shows that performing these six exercises has a significant role in promoting core strength. Paired-samples T-test results showed that the bridge-down test showed a P-value of 0.02. There were significant differences before and after the experiment.[9] The P-value for the prone pushup was 0.002. The results showed significant differences. This result should correlate with the corresponding prone pushup in the experiment.

Comparative analysis of each index measurement in each group after the experiment

The effectiveness of strength training will be directly related to the quality of dance sports courses and the professional growth of students. The statistics of the average value and growth rate of each item before and after training are an essential basis for judging the training method.[10] It can be seen from Table 4 that the core strength of the experimental group and the control group has improved to a certain extent. The mean value-added of the experimental group was generally higher than that of the control group. The growth rate of the experimental group was 52.74% in the supine position. The control group's growth rate was 20.09% in the prone position. Yoga ball strength training makes the students' core muscle strength and core endurance increase more obviously. The growth rate of the experimental group throwing a solid ball before was 18.25%, and that of the control group was 1.42%. This is because the growth rate of the experimental group after throwing the solid ball is 24.26%. The growth rate of the control group was 8.33%.

The back-throwing medicine ball comparison examines explosive power and coordinated control of the entire body. Yoga ball strength training requires mobilizing more muscle fibers to maintain balance throughout the body. The traditionally trained control group may only need to engage a particular muscle group to complete the movement. Therefore, the training effect of the control group is not as good as that of the experimental group. Another noticeable item is kneeling and standing up. The growth rate of the experimental group was 77.46%, and that of the control group was 48.68%. In addition, standing on the balance plate and squatting is the only one of the five items that complete the action in an unstable state.[11]

Table 1. Test statistics of the core strength indicators of the experimental group and the control group before the experiment.

Factor name	Test group	Control group	T value
	M±SD	M±SD	
BMI/(kg/cm^2)	19.8±5.6	19.2±4.8	-0.262
Plank/(s)	50±12	44±6	-0.488
Push up on your stomach/(n/30s)	22.2±5.4	22.6±2.8	0.621
Lie on your back and get up at both ends/ (n /30s)	19.2±2.6	21.1±1.8	0.46
Side lying on both ends/ (n /30s)	18.6±5.2	19.1±4.6	0.68
Standing on a yoga ball and squatting/ (n /the 30s)	12.9±5.8	14.6±2.2	-0.286
Throwing a solid ball forward/(m)	12.6±2.5	14.1±4.2	-0.228

Table 2. Comparison of core strength test before and after the experiment in the experimental group.

Test content	Before experiment	After the experiment	T value	P value
	M±SD	M±SD		
Overlooking the bridge/(s)	50±8	72±6	-2.56	0.002
Lie on your back and get up at both ends/ (n /30s)	18.2±2.7	27.8±5.5	-0.07	0.006
Kneeling prone and standing up/ (n /30s)	14.2±5.4	25.2±2.6	-2.29	0.01
Standing on the balance plate and squatting/ (n /30s)	25.5±5.8	22.4±2.5	-2.42	0.04
Back throwing solid ball/(m)	12.6±2.5	16.9±4.2	-2.12	0.02

Table 3. Comparison of core strength before and after the experiment in the control group.

Test content	Before experiment M±SD	After the experiment M±SD	T value	P value
Overlooking the bridge/(s)	48±7	78±7	-2.52	0.02
Lie on your back and get up at both ends/ (n /30s)	20.4±1.9	24.4±2.8	-4.21	0.85
Kneeling prone and standing up/ (n /30s)	15.2±1.9	22.7±2.4	-2.74	0.002
Standing on the balance plate and squatting/ (n /30s)	24.7±4.2	25.7±2.8	-0.02	0.84
Back throwing solid ball/(m)	14.4±4.2	17.1±2.7	-2.27	0.47

Table 4. Comparison of core strength increase in the experimental group and the control group after the experiment.

Test content	Test group		
	M±SD	Average value-added	Growth rate/ (%)
Overlooking the bridge/(s)	72±621.4	42.8	68±6
Lie on your back and get up at both ends/ (n /30s)	27.8±5.5	9.6	52.74
Kneeling prone and standing up/ (n /30s)	25.2±2.6	11	77.46
Standing on the balance plate and squatting/ (n /the 30s)	42.4±2.5	6.9	27.48
Back throwing solid ball/(m)	16.9±4.2	4.4	24.26
Test content	Control group		
	M±SD	Average value-added	Growth rate/ (%)
Overlooking the bridge/(s)	19.2	40	
Lie on your back and get up at both ends/ (n / 30s)	24.4±2.8	4.1	20.09
Kneeling prone and standing up/ (n /the 30s)	26.7±2.4	7.4	48.68
Standing on the balance plate and squatting/ (n /30s)	25.6±2.8	0.9	4.66
Back throwing solid ball/(m)	16.1±4.6	1.2	12.44

DISCUSSION

The dance sports program is constantly evolving. It is imperative to keep improving the level of technology. Then in the process of training,

we also need to combine core strength training and special training. This way, specific and professional training methods can be achieved to make the training effect more evident and effective.[12] The core strength training of students should be increased in sports dance teaching. The training method can be core strength training in a stable state or movement in an unstable condition. These pieces of activity have an excellent effect on improving the physical posture of athletes. In the future sports dance training process, we should formulate different training plans and training intensity according to other characteristics of students' gender, age, height, etc. Training needs to be gradual, from simple to complex. Only in this way can a targeted training effect be achieved. Sports dance teachers should improve the completion quality of students' dance movements while teaching dance techniques and exercises. We must pay attention to the physical quality of students. We add new core strength training equipment such as yoga ball and Swiss balls in training. While cultivating students' good material quality, schools should avoid students' injury in sports. In this way, students can quickly master the correct technical movements and effectively use dance techniques in performances.

CONCLUSION

The 5 test items of the experimental and control groups were all improved after the experiment. This shows that core strength training can promote the growth of body stability, explosive power and coordination, and body control. In the test item of standing balance plate squatting, the experimental and control groups' training effect was significant. This shows that non-stabilizing exercises like the yoga ball can improve the core area's stability and the hip flexors' contraction strength to a greater extent. Athletes can better maintain correct body posture during various dynamic movements. This is more in line with the characteristics of sports dance items.

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

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. HY: writing and performing surgeries; data analysis and performing surgeries, article review and intellectual concept of the article.

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