PHYSIOLOGICAL AND BIOCHEMICAL MONITORING IN DANCESPORT ATHLETES

MONITORAMENTO FISIOLÓGICO E BIOQUÍMICO DOS ATLETAS DE DANÇA ESPORTIVA

SEGUIMIENTO FISIOLÓGICO Y BIOQUÍMICO DE LOS ATLETAS DE DANZA DEPORTIVA

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ABSTRACT

Introduction: The dancesport is an emerging sports competition that integrates competitive sports and dance; college students have been using the training for aesthetic purposes in body delineation. However, the biochemical alterations are still underexplored. Objective: Explore the physiological and biochemical changes caused by dancesport. Methods: The volunteers were submitted to a two-week high-intensity dancesport protocol. Changes in physiological and biochemical indicators were monitored before and after the experiment. Results: The athletes exhibited individual changes in biochemical indicators (P<0.05), with emphasis on an increase in hemoglobin (from 152.3g/L to 169.2g/L). The physiological indices also changed significantly, with an average body fat reduction of over 5%. Conclusion: Dancesport proved to help improve its practitioners' physical and biochemical function. ***Evidence Level II; Therapeutic Studies – Investigating the results.***

Keywords: Dance; Physiological monitoring; Physical Conditioning, Human; Sports.

RESUMO

Introdução: A dança esportiva é uma competição esportiva emergente que integra esportes competitivos e dança; estudantes universitárias têm recorrido aos treinos para fins estéticos no delineamento corporal, porém as alterações bioquímicas ainda são pouco exploradas. Objetivo: Explorar as alterações fisiológicas e bioquímicas ocasionadas pela dança esportiva. Métodos: As voluntárias foram submetidas a um protocolo de dança esportiva de alta intensidade com duração de duas semanas. As alterações nos indicadores fisiológicos e bioquímicos foram monitoradas antes e depois do experimento. Resultados: Os atletas exibiram alterações individuais nos indicadores bioquímicos (P<0,05), com ênfase no aumento de hemoglobina (de 152,3g/L para 169,2g/L). Os índices fisiológicos também mudaram significativamente, com uma redução de gordura corporal média superior a 5%. Conclusão: A dança esportiva mostrou-se útil para melhorar a função física e bioquímica de seus praticantes. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Dança; Monitorização Fisiológica; Condicionamento Físico Humano; Esportes.*

RESUMEN

Introducción: El baile deportivo es una competición deportiva emergente que integra el deporte de competición y la danza; estudiantes universitarias han estado utilizando el entrenamiento con fines estéticos en la delineación del cuerpo, sin embargo, las alteraciones bioquímicas son todavía poco exploradas. Objetivo: Explorar las alteraciones fisiológicas y bioquímicas causadas por la danza deportiva. Métodos: Las voluntarias fueron sometidos a un protocolo de danza deportiva de alta intensidad de dos semanas. Los cambios en los indicadores fisiológicos y bioquímicos fueron monitoreados antes y después del experimento. Resultados: Los atletas mostraron cambios individuales en los indicadores bioquímicos (P<0,05), destacando el aumento de la hemoglobina (de 152,3g/L a 169,2g/L). Los índices fisiológicos también cambiaron significativamente, con una reducción media de la grasa corporal de más del 5%. Conclusión: La danza deportiva demostró ser útil para mejorar la función física y bioquímica de sus practicantes. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Baile; Monitoreo Fisiológico; Acondicionamiento Físico Humano; Deportes.*

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INTRODUCTION

Sports dance is a sport that can lead people to exercise in happiness and express their emotions. Fitness, performance, and competition are integrated. Sports dance is an emerging sports competition.[1] It integrates competitive sports and dance, and with its unique charm, it has become a new choice for college students to shape their fitness. The distinctive exercise style of sports dance makes the practitioner's body more symmetrical and the temperament more elegant. Various physiological indicators change with the increase of practice time.

The improvement of the physical function of the practitioner is the key to the evaluation of the exercise effect.[2] The human body has undergone good changes in structure, form, function, and biochemistry through many repetitive exercises. When the human body exercises, it consumes energy, changes the internal environment, and triggers changes in local tissues' functions, breathing, circulation, and regulation systems. Exercise training can make the human body appear a series of temporary changes in form and function. These changes will be embodied in some physiological and biochemical indicators of the human body. In turn, the

changes in these physiological and biochemical indicators can reflect the effects of exercise training, physical function, exercise load, fatigue, and injury. This experiment explains the influence of sports dance training on physical function and form from the changes of some physiological and biochemical indicators. In this way, the practitioner can accurately understand the changes in all aspects of the body after exercise.[3] This research is to guide and improve the process and methods of sports dance practice. In this way, its body functions are continuously optimized and provide reference suggestions for sports dance teaching.

METHOD

Research object

We surveyed 300 students majoring in sports dance and elective courses in the School of Physical Education.[4] At the same time, we used 30 students from the Sports Art Department, Physical Education Department, and Sports Training Department as the experimental subjects.

Research methods

Literature data method

We consulted the literature on sports dance, training, and physiology in the Chinese journal database in the past ten years.[5] At the same time, we compared and analyzed the research results related to this experimental study. This provides a relevant theoretical basis for this study.

Questionnaire survey method

We issued a questionnaire survey to some students who have studied sports dance in the whole college about the impact of state-based dance on some physiological and biochemical indicators of sports college students. Two hundred ninety-four copies were recovered, with a recovery rate of 98%. There were 226 valid questionnaires, with an effective rate of 76.9%. The questionnaire's return rate was analyzed and screened for reliability inspection.

Experimental research method

We randomly selected 30 students majoring in sports dance from the Department of Sports Arts, Department of Physical Education, and Sports Training as experimental subjects and conducted physiological and biochemical experiments.

Application of improved Infomax algorithm in biochemical process monitoring

In the extended *Info max* algorithm, the original data x is first de-averaged and spheroidized to obtain $Z = W_2X$. In this way, Europe removes the second-order cross-correlation between the elements in Z. In the formula, W_2 is the spheroidized array, and Z is the spheroidized data. In the preprocessing stage, in addition to spheroidization to remove the second-order cross-correlation, the second-order weighted covariance matrix $W_4 = \{E[\|Z\|^2 ZZ^T]\}^{\frac{1}{2}}$ of $FOBI$ is also used. In this way, $Z' = W_4Z$ is obtained to remove the fourth-order cross-correlation. In the process of iterative optimization W, it is better to keep the off-diagonal elements of the second-order weighted covariance matrix $R_4 = E[\| Y \|^2 YY^T]$ of output $Y = WZ'$ as small as possible.[6] In this way, the fourth-order cross--correlation between the outputs of each channel is ensured to be small. To this end, we can use the following criteria as a measurement criterion:

$$D = \log\left\{\frac{\prod[Diag(R_4R_4^T)]}{\det(R_4R_4^T)}\right\} \quad (1)$$

Whenever the value of D exceeds the set threshold, the input data X will update its W_2 and W_4, and then continue to iteratively optimize W through the following formula.

$$Y_k = W(k)Z_k \quad (2)$$

$$\Delta W = \eta[I - K\tanh(Y_k) \quad Y^T - Y_kY^T]W(k) \quad (3)$$

$$K = Diag[\operatorname{sgn} k_4^{(1)}(k), \operatorname{sgn} k_4^{(2)}(k), \cdots, \operatorname{sgn} k_4^{(N)}(k)] \quad (4)$$

Kurtosis k_4 can be obtained by the recursive algorithm:

$$k_4^{(i)}(k) = \frac{E(Y_i^4)}{E^2(Y_i^2)} - 3 = \frac{m_{4Y_i}(k)}{m_{2Y_i}^2(k)} - 3 \quad (5)$$

$$m_{4Y_i}(k) = aY_{ki}^4 + (1-a)\, m_{4Y_i}(k-1) \quad (6)$$

$$m_{2Y_i}(k) = aY_{ki}^2 + (1-a)\, m_{2Y_i}(k-1) \quad (7)$$

Finally $W_{all} = WW_4W_2$. The improvement of this method removes the partial correlation of each component. This reduces the complexity of the problem and speeds up the convergence speed.[7] Therefore, this algorithm is more conducive to real-time processing than the extended Info-max algorithm. The specific steps to improve the Infomax algorithm are as follows:

1. Given initial value $W_0 = W$ (random), observation vector X. (2) Perform whitening treatment on X. (3) Calculate $Y = WX$, η, $\varphi(Y)$. (4) Calculate $\Delta W = \eta(I - \varphi(Y)Y^T)W$. (5) Calculate $W = W + \Delta W$. (6) Repeat steps (3), (4), (5) until convergence. After obtaining W, obtain independence through $Y = WX$.

Mathematical Statistics

All experimental data are statistically processed by Excel software. At the same time, we conduct relevant comparative analysis on the corresponding indicators.

RESULTS

Results and analysis of the questionnaire

Frequent practice of sports dance helps shape the body shape

44.69% of the students who regularly practice physical dance have improved their body shape greatly under little change in their weight. 41.15% showed a significant decrease in body weight while improving their body shape.[8] Among them, 85.84% of the students did not increase their diet after practicing sports dance, and 93.36% felt their mental state improved. 97.79% of them are used to straight waists while standing, sitting, and lying, and their posture is more upright than before.

Sports dance can promote people's physical fitness

Most students who practice sports dance feel that their quality has improved significantly. In training, dancers generate sufficient muscle strength through a static contraction. In this way, control the neck, shoulders, arms, torso, waist, hips, and other body parts to maintain a correct body shape and a relatively stable holding posture. An overall center focus on the waist and hips as the center is formed during this process.[9] At this time, the body is in a natural state of being tight and not stiff. In fast-paced dances, dancers are required to drive the upper limbs to swing in a coordinated manner by the traction generated by the rhythm of the trunk muscles. The technique of swinging back and forth, left and right, up and down, and turning around the marrow and waist and abdomen in a

multi-dimensional space requires accurate and coordinated muscle force. This also has higher requirements for the coordination of the muscles of the skeleton and the waist.

Experimental test results and analysis

Sports dance helps practitioners lose weight and shape their bodies and maintain a good body shape

It can be seen from Table 1 that sports dance helps practitioners lose weight and maintain a good body shape. Sports dance requires the flexible use of body ups and downs, swings, turns, tilts, and waist, abdomen, and hip joint activities. Because of the pulling effect of muscles on bones, it will positively affect the shape of the practitioner. The exercise of sports dance can strengthen physical fitness and correct the bad postures of the shoulders, back, chest, legs, and feet during growth and development. This promotes the shape of the shoulders, spine, thorax, pelvis, lower limbs, and other body parts to be more perfect, and at the same time, can make the body lines more beautiful and symmetrical.

Sports dance has a positive effect on improving and regulating the body composition of practitioners

The measuring instrument used for body composition measurement in this experiment is a body composition analyzer. The instrument inputs data such as sex, age, height, and weight of the tested person. The bioelectrical resistance method is used to measure the body composition status of the subject indirectly. The content includes body fat percentage, body mass index, abdominal obesity rate, visceral fat level, and body age.

As shown in Table 2, the BMI value of 66.7% of the subjects after practicing sports dance decreased based on the normal value. 16.7% of the practitioners' BMI value decreased slightly based on the original thinness. The BMI value of 8.3% of the practitioners increased from very thin to thin. Another 8.3% of the practitioners' BMI values rose slightly within the normal value. In addition, 83.3% of the practitioners have different degrees of body fat percentage decline. 20% of the practitioners have reduced their body fat percentage by more than 5%. The test values of abdominal obesity rate and visceral fat level also decreased to varying degrees. Among them, boys have the most obvious changes. The above changes indicate that sports dance has a positive effect on improving the body composition of the conditioning practitioners.

Table 1. Changes in body weight after an average of 1.3-3 hours of sports dance practice per day for half a year.

	Male		Female	
Date	**Dec-20**	**May-21**	**Dec-20**	**May-21**
Weight	65.65±10.75	64.25±8.6	51.18±8.05	50.58±7.08

Table 2. Changes in body composition after an average of 1.3-3 hours of sports dance practice per day for half a year.

	Male		Female	
Date	**Dec-20**	**May-21**	**Dec-20**	**May-21**
Body fat percentage (%)	19.73±5.37	16.72±2.33	23.53±2.54	21.87±2.11
BIM(kg/m^2)	21.28±2.38	20.65±0.62	19.07±2.04	18.611±1.58
Abdominal obesity rate	0.77±0.11	0.73±0.02	0.71±1.22	0.72±0.11
Visceral fat level	6.67±1.25	6.51±1.12	3.00±1.00	2.67±0.25
Body age	21.33±1.65	21.64±1.25	20.57±0.24	20.51±0.51

DISCUSSION

After athletes undergo systemic training, there will be some changes in the formation of blood. Because the hemoglobin index is relatively stable and can sensitively reflect the physical function state, the amount of hemoglobin can reflect the physical function of the athlete to a certain extent. Long-term adherence to aerobic exercise can increase the amount of hemoglobin in the body. This can improve the body's resistance, anti-aging and enhance the work efficiency of the cerebral cortex and cardiopulmonary function. In the experimental test, the content of subjects' hemoglobin was mostly increased. Among them, the average hemoglobin index of boys in the first test was 152.3g/L. The average hemoglobin index in the second test was 169.2g/L. This shows that the hemoglobin content of boys who often practice sports dance is relatively high and does not fluctuate much, and their aerobic endurance level is relatively high.

Sports dance allows most practitioners to get moderate exercise. This can prevent and reduce the incidence of various joint diseases. Sports dance enhances the physical coordination of the practitioners. Sports dance can cultivate the vertical and straight body lines of the practitioners. At the same time, it can effectively prevent the occurrence of various spine diseases. Sports dance has a significant effect on the exercise of the abdomen, marrow, and buttocks. Sports dance improves the mental state and facial lines of the practitioners.

CONCLUSION

Sports dance promotes the improvement of college students' physiological and biochemical indicators. Sports dance can improve a person's body composition. In training, the physical fitness test and evaluation system should be perfected, and the body composition of the practitioners should be tested in time. This is convenient for teachers to teach following their aptitude and adjust the teaching and training plan in time. This enables practitioners to improve their physical fitness and body composition through sports dance.

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