EXERCISE PRESCRIPTION FOR INJURY REDUCTION IN BALLROOM DANCING

PRESCRIÇÃO DE EXERCÍCIOS PARA REDUÇÃO DE LESÕES NA DANÇA DE SALÃO

PRESCRIPCIÓN DE EJERCICIOS PARA REDUCIR LAS LESIONES EN LOS BAILES DE SALÓN

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ABSTRACT

Introduction: Ballroom dancing is a high-intensity sport. Exaggerated training plans and an overtraining range can easily cause sports injuries. Athletes should take the necessary protective measures when training or competing, including exercises with preventative intent. Objective: This research paper thoroughly investigates the current status of ballroom dance injuries in colleges and universities. Methods: This research selects 28 students who majored in ballroom dancing as experimental subjects. The volunteers were divided into a control group and an experimental group. The experimental group received an exercise prescription for 12 weeks of exercise. The control group did not do any exercise for 12 weeks. Injury statistics were performed after a 12-week comparative trial. The effect of exercise prescription on injury reduction in ballroom dancing was discussed. Results: The incidence of sports injuries in the experimental group decreased significantly after 12 weeks (P<0.01). Compared to the control group, the incidence of muscle, ligament and joint injuries in the experimental group was significantly lower (P<0.01). The waist and ankle injuries incidence in the experimental group was lower than in the control group, and the data had significant differences (P<0.01). Conclusion: Dance athletes who choose the appropriate exercise prescription can effectively reduce the likelihood of injuries during training. Training can effectively improve performance in athletic competitions. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Dancing; Preventive Medicine; Sports; Injuries, Sports.

RESUMO

Introdução: A dança de salão é um esporte de alta intensidade. Planos de treinamento exagerados e um leque de treinamento excessivo podem facilmente causar lesões esportivas. Os atletas devem tomar as medidas de proteção necessárias ao treinar ou competir, incluindo exercícios com intuito preventivo. Objetivo: Este artigo investiga minuciosamente a situação atual das lesões na dança de salão nas faculdades e universidades. Métodos: Esta pesquisa seleciona 28 estudantes que se especializaram em dança de salão como disciplinas experimentais. Os voluntários foram divididos em um grupo de controle e um grupo experimental. O grupo experimental recebeu uma prescrição de exercício durante 12 semanas de exercício físico. O grupo de controle não fez nenhum exercício durante 12 semanas. As estatísticas de lesões foram realizadas após um ensaio comparativo de 12 semanas. Foi discutido o efeito da prescrição de exercícios sobre a redução de lesões na dança de salão. Resultados: A incidência de lesões esportivas no grupo experimental diminuiu significativamente após 12 semanas (P<0,01). Em comparação com o grupo controle, a incidência de lesões nos músculos, ligamentos e articulações no grupo experimental foi significativamente menor (P<0,01). A incidência de lesões na cintura e tornozelo no grupo experimental foi menor do que no grupo controle, e os dados tiveram diferenças significativas (P<0,01). Conclusão: Os atletas de dança que escolhem a prescrição apropriada para o exercício podem efetivamente reduzir a probabilidade de lesões durante o treinamento. O treinamento pode efetivamente melhorar o desempenho em competições esportivas. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Dança; Medicina Preventiva; Esportes; Lesões Esportivas.*

RESUMEN

Introducción: El baile de salón es un deporte de alta intensidad. Los planes de entrenamiento exagerados y el sobreentrenamiento pueden provocar fácilmente lesiones deportivas. Los deportistas deben tomar las medidas de protección necesarias cuando entrenen o compitan, incluyendo ejercicios con intención preventiva. Objetivo: Este documento investiga a fondo la situación actual de las lesiones en los bailes de salón en los colegios y universidades. Métodos: Esta investigación selecciona como sujetos experimentales a 28 estudiantes que se especializan en bailes de salón. Los voluntarios se dividieron en un grupo de control y un grupo experimental. El grupo experimental recibió una prescripción de ejercicio durante 12 semanas. El grupo de control no hizo ningún ejercicio durante 12 semanas. Las estadísticas de lesiones se realizaron tras un ensayo comparativo de 12 semanas. Se analizó el efecto de la prescripción de ejercicios en la reducción de lesiones en los bailes de salón. Resultados: La incidencia de lesiones deportivas en el grupo experimental disminuyó significativamente después de 12 semanas (P<0,01). En comparación con el grupo de control, la incidencia de lesiones musculares, ligamentosas y articulares en el grupo experimental fue significativamente menor (P<0,01). La incidencia de las lesiones de cintura y tobillo en el grupo experimental fue menor que

en el grupo de control, y los datos presentaron diferencias significativas (P<0,01). Conclusión: Los atletas de danza que eligen la prescripción de ejercicios adecuada pueden reducir eficazmente la probabilidad de lesiones durante el entrenamiento. El entrenamiento puede mejorar eficazmente el rendimiento en las competiciones deportivas.
Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.

***Descriptores*:** *Baile; Medicina Preventiva; Deportes; Lesiones en Deportes.*

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INTRODUCTION

In 1986, China began to implement sports. In 1991, "China Sports and Dance Association" was established. At this time, China officially listed sports dance as a national event. Then China held its first national sports dance competition in 1992. Since then, the sports dance career has flourished for over 20 years. However, compared with the big countries of sports dance, there is still a lack of related theories on the scientific research and exercise prescription of sports dance in China. There are few studies on the injury mechanism and prevention methods of sports dance. This paper investigates and makes statistics on the sports injuries of 28 college sports dancers.[1] At the same time, this paper takes some effective prevention and control measures for athletes' sports injuries.

METHOD

Objects

This paper surveys 28 college students majoring in dance sports. The subjects were 14 boys and 14 girls. The subjects were in the age range of 17-19 years.

Research methods

In this paper, 28 athletes were randomly divided into two groups. The experimental group consisted of 14 people. The control group consisted of 14 people. The control group conducted daily study and life according to the school's requirements. The experimental group was guided by exercise prescription.[2] All experimental group members exercised according to the exercise prescription for 12 weeks. The frequency of exercise is 50 minutes per day. The course is organized: The warm-up phase is 8 minutes long. This exercise focuses on stretching the joints, waist, and legs of the whole body. The primary training time is 36 minutes. The training focuses on strengthening the lower back, leg, and ankle strength. Six minutes of relaxation training time. The focus of training at this point is relaxation exercises and stretching exercises.

The exercise intensity is arranged as follows: Athletes use a staged exercise method when executing the exercise prescription. The intensity gradually increases with the actual state of the exercise.[3] The athlete exercises in small increments during the first training cycle (1-2 weeks). In this way, the athlete's physical fitness can initially recover and improve. During the second training cycle (3-6 weeks), the athlete's exercise capacity increased, and function leveled off. The primary purpose of training at this time is to improve sports skills and overall quality. Perform a physical fitness and exercise technique test during three training cycles (weeks 7-9). At this time, the experiment mainly evaluates its cardiopulmonary function, exercise ability, and physical function. At the same time, the exercise program is adjusted accordingly according to the physical fitness response of the athletes. This ensures that each athlete is always at the best training level. In the fourth training cycle (10-12 weeks), the athletes perform the maximum exercise to improve the competitive dancer's overall technical level, muscle extension, and specific motor skills.

The study is Purely observational studies which no need to registry ID of ICMJE, and all the participants were reviewed and approved by Ethics Committee of Xinxiang Vocational and Technical College, China (NO. 2022011).

Preliminary identification of sports injuries based on edge segmentation

If you want to improve the accuracy of damage further, then this paper must first extract its edges from the image. In this paper, an adaptive threshold method is used in image segmentation. At the same time, this paper uses surface fitting to obtain a damaged contour.[5] The contour of the fractured body tissue is a snake-like structure. In this paper, the shape of the damaged area is obtained by identifying this structure. The energy in this region is in a short range. At this time, the damage shape obtained in this paper will be compressed within a specific range. Therefore, this paper must have a shallow value to determine the athlete's injury area. The equivalent energy expression formula is:

$$\xi(R)=[\frac{\gamma\xi_{in}(R)+\theta\xi_{ex}(R)}{\gamma\xi_{in}(R)-\theta\xi_{ex}(R)}]G(\alpha,\beta) \quad (1)$$

γ and θ represent a weight. $\xi_{in}(R)$ and $\xi_{ex}(R)$ represent external energy and internal energy. After obtaining the shape of the damage, the K-L transformation analysis method was used to identify the fracture position. The experiment can obtain damaged pixels in the image and other related data at this point. This article can then use this data to build a digital matrix. The author had to divide the image into 64 feature vectors when determining the fracture site. The goal is to improve accuracy.[6] The arrangement in this eigenvector is made in column concatenation. In this way, this paper has obtained the number of n pictures, $B=\{b_1, b_2,\cdots b_n\}$, and then this paper can find the equation of the average vector of the whole image:

$$\Omega=\frac{1}{n}\sum_{\alpha=1}^{n}b_\alpha\cdot\xi(R) \quad (2)$$

This paper arranges the eigenvalues Z in decreasing form. First, the attribute σ_α of J must be selected, and this characteristic value is a non-zero value. It is then extracted from its corresponding vector v_α. In this paper, the eigenvector Ω_α of the covariance matrix can be obtained by the following formula. Choose the first 60% of the feature volume to save most of the damaged image, $Z=b_1-\Omega, b_2-\Omega,\ldots,b_n-\Omega]$.

$$q_\alpha=A\frac{1}{\sqrt{\sigma_\alpha}}B\cdot v_\alpha\cdot\Omega \quad (3)$$

All the image and training samples to be identified are projected into the feature space Q respectively. The projection factor is calculated by the following formula:

$$f_\alpha=Q^T\cdot q_\alpha \quad (4)$$

Then this paper uses the following equation to sample the image to be identified and the training image.[7] At this time, the distance between each point is calculated separately, and finally, the shortest image is selected for sampling identification.

$$s(b,f)=\left[\sum_{\alpha=1}^{n}(b_\alpha-f_\alpha)^2\right]^{1/2} \quad (5)$$

n is the number of training examples. The Euclidean distance is referred to by $s(b, f)$. According to the above data, although we can roughly determine the location of the fracture, we cannot determine the specific location. At this time, a new method is adopted in this paper for further classification so that a more specific injury site can be obtained. This paper now regards each solution as a fish and solves all of them into a solution set. Find the last two methods in the solution set: the solution with the cluster center and the clustering result as the solution. All cluster center points are regarded as a school of fish. In this paper, any pixel point of the fish school can be expressed by the position status of the fish school. Therefore, the fish school function can be expressed by the following formula:

$$\beta_g=\sum_{\alpha=1}^{g}\left\|R_\alpha-b_c\right\|^2\cdot s(b,f') \quad (6)$$

g represents the number of centers of the cluster. b_h represents a cluster of objects. R_α represents the center of the pixel cluster. After obtaining the minimum value of β_g, this paper sets it as the optimal set to realize the division of damage patches. In this paper, the grayscale pixels of the image are obtained after clustering. After the clustering process, the pixels are rendered in color.[9] The color changes in the image show their characteristics. From this paper, the value of the pixel RGB feature is obtained. It does this by adding up each pixel value GRB flux and dividing by the total number of pixels. For this reason, the following formula can be used to express the relative ratio area of the damaged image:

$$Area_{total}=\left(\frac{L'}{S'}\right)\cdot 3.11\cdot\left(\frac{K}{S}\right)\cdot 3.11 \quad (7)$$

S' stands for image resolution. K' and L' represent the number of pixels in each direction. The vertical orientation is represented by K'. L' indicates the horizontal direction. In this paper, in the process of clustering and dividing the original image, the corresponding ratio is used to obtain the area of the damaged area. The formula for the ratio of the total number O of damage points to the total pixels O' at this moment is as follows:

$$Area_\alpha=\frac{O}{O'}\cdot Area_{total}\cdot\min J_g \quad (8)$$

During dance movements, there are specific injuries to the shoulder joints, lower back, etc. In this paper, the above method can accurately identify the athlete's injury location.

Mathematical analysis

In this paper, the mathematical statistics method is used to carry out data statistics. Based on the questionnaire survey method, this paper analyzes the sports injuries of the participating athletes.[10] Movement dance is divided into Latin dance and modern dance. Because the range of dance steps and changes in Latin dance is too extensive, this paper takes the four most commonly used dances of rumba, cha-cha, cowboy, and samba as the research object. This paper uses the Excel processing tool to perform a t-test on the data. P<0.05 and P<0.01 indicate significant differences between the data.

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

RESULTS

Comparative analysis of injuries in different dance competitions

Table 1 shows that the incidence of injury in the experimental group is lower than in the control group, and there are significant differences in the two experiments of Samba and Chacha (P<0.01).

Different types of sports injuries

Table 2 shows that the experimental group has a higher incidence of muscle injury, ligament injury, and knee joint injury than the control group. The data showed a significant difference (P<0.01).

Comparative analysis of the location of sports injuries

The incidence of low back and ankle injuries in the realistic experimental group was significantly reduced. The results showed a significant difference (P<0.01). (Table 3)

DISCUSSION

Sports and dance injuries are divided into two types: acute injuries and chronic injuries. Studies have found more acute injuries than chronic injuries in athletic dancers. The study's results show that the length of sports dance learning time will also significantly differ in sports injuries. A study of sports and dance injury types indicates that acute injuries are most likely to occur when the study period reaches three to four years. Students who study longer in specialized courses have greater levels of chronic impairment.

Movement dance is divided into Latin dance and standard dance. These two dances also include five dance types. Their movements and

Table 1. Comparative analysis of the damage degree of each type in the two groups.

	Test Group		Control group	
	n	%	n	%
Rumba	3	21.43	5	35.71
Precisely	2	14.29	3	21.43
Cowboy	4	28.57	6	42.86
Samba	1	7.14	2	14.29

Table 2. Classification of different sports injuries in 2 groups.

	Test Group		Control group	
	n	%	n	%
Muscle damage	3	21.43	5	35.71
Ligament injury	2	14.29	4	28.57
Joint damage	2	14.29	3	21.43
Bone damage	1	7.14	2	14.29
Other	1	7.14	1	7.14

Table 3. Comparative analysis of the incidence of sports injuries in two groups of athletes.

	Test Group		Control group	
	n	%	n	%
Lower back	4	28.57	7	50.00
Ankle joint	2	14.29	5	35.71
Other parts	1	7.14	3	21.43

beats are varied. Seventy-five percent of the students in the study participated in Latin dance. Both dance forms have their characteristics in movement and music. Because the Latin dance moves are more active and faster, students spend a lot of physical effort in practice. Standard dance is based on a brisk and sustained tempo.[12] Many students prefer to devote their energy to training in Latin dance. This dramatically increases the chances of injury to Latin dance athletes. Due to the students' relatively weak muscles, physical strength, and reaction abilities, their awareness of self-protection is not strong. Dance Sports students practice some simple movements before entering school. When athletes do intricate movements, they will ignore the protection of their bodies and cause injuries. Since most of the students have not participated in formal dance training, the flexibility and physical performance of the students are very different from those of the professional players.

In regular training, many students feel that preparatory activities are not prominent enough in physical education. Students have an insufficient understanding of the function of preparatory activities. As a result, students lack sufficient preparatory activities during dance training. If the student's body has not fully stretched, it is also likely to cause damage to his body. College students' physical fitness, flexibility, and stability are poor. It can also lead to sports injuries. Students' proficiency in professional techniques is not enough, and their mastery of movements is not standard enough. It is also easy to cause sports injuries to athletes.[13] In Latin dance, there are various dance forms and distinct rhythms. In particular, vigorous rotation and extension of the waist and hips are likely to cause local overwork. When learning modern dance, students must master and maintain dance postures. This requires students to train their muscles for a long time without moving. This can also cause physical damage.

The principle of overloading develops muscle strength. Dancers use maximal and sub-maximal strength with fewer repetitions to improve maximal strength. Dancers use a low-weight, high-repetition approach to best develop muscular endurance. The training of sports dancers requires the balanced development of maximal strength and endurance of the body. For this reason, the author recommends that dancers take moderate strength training and repeat 8 to 12 times. When performing strength exercises, attention should be paid to the balanced development of the flexion and extension of the ankle joint, the agonist and antagonist muscles of rotation. At the beginning of the test, athletes can perform unloaded, passive, and active joint flexion, extension, and rotation movements. In the later stage, athletes can perform weight-bearing, passive, and active traction joint exercises. Athletes need to maintain as much joint motion as possible. This will not cause new muscle damage. In training, athletes perform stretches in a combination of rocking and static stretches. Rocking stretches are stretches that are accomplished through repeated rocking motions. Static stretches stretch the athlete's body into an uncomfortable position for 30 seconds. Gradually increase from a small amount to a large amount. The training frequency is three times a week. Muscle lengthening can help avoid re-injury to the body. Muscle spindles irritate the back during intense and rapid stretches and cause the protector muscles to contract. This causes minor damage to the muscle fibers and increases the load on the damaged tissue. However, prolonged muscle stretching removes this protective contraction mechanism. Athletes should use slow stretches during the trauma recovery phase. At the same time, athletes must avoid sudden violent impacts and bounces. Athletes need to avoid stimulating antagonist muscles that can cause a stretch response and lead to new injuries.

CONCLUSION

The incidence of sports injury in the experimental group decreased significantly after 12 weeks. Compared with the control group, the incidence of damage to muscles, ligaments, and joints in the experimental group was significantly lower. The waist and ankle injury incidence in the experimental group was lower than in the control group, and the data had significant differences. The training method of the exercise prescription for dancers can effectively reduce the incidence of injury. Coaches must pay attention to the use of exercise prescriptions in sports dance teaching and strengthen teachers' and students' mastery of exercise prescriptions. Dancers need to conduct repeated discussions and research in the training process. The research results of this paper are expected to assist athletes in better mastering the correct training methods. This can reduce the injury rate of athletes and achieve safe and effective training purposes.

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