IMPACTS OF LOWER LIMB FLEXIBILITY EXERCISE ON AEROBIC GYMNASTICS PERFORMANCE

IMPACTOS DO EXERCÍCIO DE FLEXIBILIDADE PARA MEMBROS INFERIORES SOBRE O DESEMPENHO DA GINÁSTICA AERÓBICA

IMPACTOS DEL EJERCICIO DE FLEXIBILIDAD PARA LOS MIEMBROS INFERIORES EN EL RENDIMIENTO DE LA GIMNASIA AERÓBICA

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Xiaoqing Kan[1]
(Physical Education Professional)
Yifan Yang[1]
(Physical Education Professional)
Meng Lian[2]
(Physical Education Professional)

1. Tangshan Normal University, Tangshan, Hebei, China.
2. Xingtai Medical College, Tangshan, Hebei, China.

Correspondence:
Meng Lian
Tangshan, Hebei, China. 054000.
lianmeng666666123@163.com

ABSTRACT

Introduction: Aerobic gymnastics is a sport that involves a sense of beauty, rhythm and dance, with high artistic expressiveness, characteristics that have favored a strong population adherence. It is believed that the specific flexibility exercise can add a greater visual impact to their artistic movements, raising their competitive performance. Objective: Verify the impacts of lower limb flexibility exercise on the performance of aerobics athletes. Methods: Six aerobics athletes were selected to perform an 8-week experiment, adopting the PNF methodology for training. The impacts on lower limb flexibility were measured before and after the experiment, these data were analyzed and studied statistically. Results: The results of the long jump in the physical quality index of the athletes increased by 0.1209 m; the added value in the two-minute, 10-m backstroke test was 1.46. The movement performance indexes showed expressive increases: flexion increased by 2.62; right angle support increased by 0.78; split leg jump increased by 1.95; standing jump with eyes closed and the foot balance quality index was 4.63. Conclusion: Lower limb flexibility exercise can positively impact the performance of aerobic gymnastics athletes. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Gymnastics; Lower Limbs; Range of Motion, Articular; Proprioceptive Neuromuscular Facilitation (PNF) Stretching.

RESUMO

Introdução: A ginástica aeróbica é um esporte que envolve senso de beleza, ritmo e dança, com alta expressividade artística, características que favoreceram uma forte adesão populacional. Acredita-se que o exercício específico de flexibilidade possa adicionar um maior impacto visual aos seus movimentos artísticos, elevando o desempenho competitivo. Objetivo: Verificar os impactos do exercício de flexibilidade dos membros inferiores sobre o desempenho dos atletas de aeróbica. Métodos: Seis atletas de aeróbica foram selecionados para realizar uma experiência de 8 semanas, adotando a metodologia PNF para o treinamento. Os impactos sobre a flexibilidade dos membros inferiores foram aferidos antes e depois do experimento, esses dados foram analisados e estudados estatisticamente. Resultados: Os resultados do salto em distância no índice de qualidade física dos atletas aumentaram em 0,1209 m; o valor agregado no teste de dois minutos e 10 m de recuo foi de 1,46. Os índices de desempenho do movimento apresentaram aumentos expressivos: de flexão teve um aumento de 2,62; apoio em ângulo reto aumentou 0,78; salto de pernas divididas aumentou 1,95; salto de pé com os olhos fechados e o índice de qualidade de equilíbrio dos pés foi de 4,63. Conclusão: O exercício de flexibilidade para membros inferiores pode impactar positivamente o desempenho dos atletas de ginástica aeróbica. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Ginástica; Membros Inferiores; Amplitude de Movimento Articular; Alongamento por Facilitação Neuromuscular Proprioceptiva (FNP).*

RESUMEN

Introducción: La gimnasia aeróbica es un deporte que envuelve un sentido de belleza, ritmo y danza, con alta expresividad artística, características que favorecieron una fuerte adhesión de la población. Se cree que el ejercicio específico de la flexibilidad puede agregar un mayor impacto visual a sus movimientos artísticos, elevando el desempeño competitivo. Objetivo: Verificar los impactos del ejercicio de flexibilidad de los miembros inferiores en el desempeño de atletas de aeróbica. Métodos: Seis atletas de aeróbic fueron seleccionados para realizar un experimento de 8 semanas, adoptando la metodología PNF para el entrenamiento. Los impactos en la flexibilidad de los miembros inferiores fueron medidos antes y después del experimento, estos datos fueron analizados y estudiados estadísticamente. Resultados: Los resultados del salto de longitud en el índice de la calidad física de los atletas aumentaron en 0,1209 m; el valor añadido en la prueba de dos minutos y 10 m de espalda fue de 1,46. Los índices de rendimiento de movimiento mostraron aumentos expresivos: de flexión tuvo un aumento de 2,62; apoyo en ángulo recto aumentó 0,78; salto de pierna dividida aumentó 1,95; salto de pie con los ojos cerrados y el índice de calidad de equilibrio de

los pies fue de 4,63. Conclusión: El ejercicio de flexibilidad de los miembros inferiores puede influir positivamente en el rendimiento de los atletas de gimnasia aeróbica. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Gimnasia; Extremidades Inferiores; Rango del Movimiento Articular; Ejercicio de Estiramiento PNF.*

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INTRODUCTION

Aerobics is a sports competition project, and has become a leisure sports project of global concern.[1] The project has the characteristics of group exercise, sports, dance and music as a whole, with a sense of beauty, rhythm and high artistry and expressiveness. The dance movements of the aerobics project are various, which can strengthen the body, and its music is beautiful and comfortable, which can cultivate sentiment. Therefore, the aerobics project has become a popular fitness sport. The forms of performance of aerobics are also varied, but when professional aerobics athletes conduct sports competitions, the performance of movement is the key factor that directly affects the performance of athletes.[2] Aerobics dance movements have continuity, diversity and high difficulty. It requires athletes to complete dance movements with high quality, and must also ensure stability and balance, which requires aerobics athletes to have high flexibility and balance quality. The expressive force of aerobics can reflect the artistry and beauty of the sport. Athletes express their inner feelings through their own muscle control and movement modeling, and convey the artistic value of aerobics to the audience.[3] The expressive force of movement can also be transmitted to the audience through the athletes' body movements, expressions, music rhythm, clothing, etc. This expressive force can be simply described as the aesthetic feeling expressed by the athletes and the artistic emotion felt by the audience.[4] Aerobics athletes show their joyful emotion and youthful vitality to the audience through their high performance, so the performance combines the physical and psychological emotions of the athletes, thus infecting the audience. The improvement of action expression is an important means to improve the skill level of athletes, so more and more researchers have paid attention to the exercise of action expression.[5] The lower limb flexibility exercise can improve the range of motion and the pulling ability of the muscles, joints and ligaments of the human body. For aerobics, the athletes' muscle control, joint and ligament flexibility will directly affect the completion of the action. Therefore, the lower limb flexibility exercise for aerobics athletes can increase the athletes' physical quality, especially the flexibility and balance quality, and then improve the athletes' performance.[6] PNF method is different from the traditional stretching method and has better stretching effect. It has played a positive role in muscle contraction, joint and ligament traction, and has been applied in flexibility training. Aiming at the performance of aerobics athletes, this paper adopts the PNF method of lower limb flexibility exercise model, and carries out an intervention experiment, aiming to explore that lower limb flexibility exercise can improve the physical quality of athletes, thus promoting the improvement of movement performance, and providing a certain scientific theoretical basis for further improving the competitive level of aerobics athletes and developing aerobics.[7]

METHOD

In this experiment, six aerobics athletes were randomly selected as experimental subjects in a university, and the height, weight and BMI of all experimental subjects were statistically analyzed. The study and all the participants were reviewed and approved by Ethics Committee of Tangshan Normal University (NO.TSNU21F105). The specific data are shown in Table 1. All subjects have a certain foundation of aerobics, have received professional aerobics training, are healthy, have no obvious physical and psychological diseases, can actively participate in this experiment, and cooperate to complete all experimental training.

Six subjects were trained in lower limb flexibility for 10 weeks. Before and after the experiment, the physical fitness index, flexibility index and balance index were tested respectively, and the performance of the subjects was scored. The physical fitness index mainly includes 4 items: standing long jump (m), 2 min 10 m touchdown turn back run, 800 m run (min), and sitting forward bend (cm); The flexibility quality index includes 6 items: push-up, push-up high-fives, right-angle support, bending and split-leg jump, standing and turning 360 °, and continuous vertical high kicking. The above indexes are tested within 30s; The balance quality index includes four items: standing with eyes open and feet closed, standing with eyes open and feet closed, standing with eyes open and feet open (left), and standing with eyes open and feet open (right).

The duration of lower limb flexibility exercise is 8 weeks, 3 times a week, 90 minutes each time, including 10 minutes of warm-up exercise, 60 minutes of lower limb flexibility exercise, 10 minutes of relaxation exercise and 10 minutes of rest (divided into two times, 5 minutes each time). The lower limb flexibility training mainly adopts PNF method, which adjusts the muscles through muscle traction and contraction, and exercises the athletes' muscles, joints, ligaments, etc. through joint traction and compression. Compared with the traditional stretching method, this training method can stimulate the muscles at a deeper level, pull the ligaments more significantly, and have a better stretching effect.

RESULTS

Effect of lower limb flexibility exercise on physical fitness of aerobics athletes

After the lower limb flexibility training, the analysis of the physical fitness indicators of aerobics athletes is shown in Table 2. By comparing the physical fitness index results of aerobics athletes before and after the experiment, we can see that after the experimental intervention, the P values of standing long jump and 2 min 10 m touchdown turn back run are 0.0000 and 0.0010 respectively, which are less than 0.01,

Table 1. Basic information of aerobics athletes.

Number	A	B	C	D	E	F
Height	165.68	168.7	160.95	169.11	160.53	161.16
Weight	53.54	52.55	55.57	57.76	50.63	58.52
BMI	21.24	20.8	21.25	21.24	21.58	21.14

Table 2. The Influence of Lower Limb Flexibility Exercise on the Physical Fitness of Aerobics Athletes.

Index	Before experiment	After experiment	Growth value	T	P
Standing long jump	1.856±0.122	1.977±0.108	0.1209	10.1614	0.0000
2 min 10 m touchdown turn back run	9.034±1.003	10.499±0.899	1.4652	5.5735	0.0010
800m run	3.365±0.050	3.361±0.061	-0.0040	-1.2951	0.2270
Sitting forward flexion	22.118±3.485	22.973±3.331	0.8552	0.5641	0.6037

showing very significant differences. After the lower limb flexibility training proposed in this paper, the results have improved to a certain extent, indicating that this training has a positive impact on the physical quality of aerobics athletes.

In this experiment, the flexibility quality of aerobics athletes was tested before and after the experiment, including six indicators, including push-ups, push-ups, high-fives, right-angle support, bending and split-leg jump, standing and turning 360 °, and continuous vertical high kicking. The above indicators were tested within 30s, and the specific data are shown in Table 3. According to the data comparison, it can be concluded that except for the P value of the two indicators of vertical rotation of 360 ° and continuous vertical high kick, which are more than 0.05, there is no difference, the four indicators of push up, push up high-five, right-angle support, and bending split-leg jump have statistical significance. Through the comparative analysis of the data in Table 3, it can be proved that the lower limb flexibility exercise in this experiment can effectively increase the flexibility quality of aerobics athletes.

In this experiment, the flexibility quality of aerobics athletes was tested before and after the experiment, including four items: standing with eyes open, standing with eyes closed, standing with eyes open, standing with one foot (left), standing with eyes open, standing with one foot (right). The specific data are shown in Table 4. Through the comparative analysis of the data, it can be seen that only the performance of standing with eyes closed and feet increased from 34.906 ± 2.448 before the experiment to 39.536 ± 2.227 after the experiment, with an increase of 4.6307, P=0.0010, showing a very significant difference. The scores of the three indicators of standing with eyes open, standing with two feet, standing with eyes open, standing with one foot (left) and standing with eyes open, standing with one foot (right) increased by 2.5873, 5.2984 and 7.8591 respectively, with P values of 0.4307, 0.0737 and 0.1270 respectively, without any difference. Among them, it was 127.276 ± 4.797 before and 129.863 ± 4.544 after standing with eyes open and feet open; With eyes open, standing with one foot (left) was 81.592 ± 3.689 before the experiment, and 86.891 ± 3.263 after the experiment; With eyes open, standing with one foot (right) was 81.266 ± 3.813 before the experiment, and 89.125 ± 3.953 after the experiment; Through data analysis, it can be seen that the lower limb flexibility exercise has a certain role in promoting the balance quality of aerobics athletes, but the role is not obvious.

The effect of lower limb flexibility exercise on the performance of aerobics

Through the experimental intervention in the above chapters, it can be seen that the physical quality index, flexibility quality index and balance quality index of aerobics athletes have been improved to a certain extent, and the flexibility quality has the largest room for improvement. The above three qualities can improve the performance of aerobics athletes and improve their competitive level. In this experiment, six subjects were scored on the performance of aerobics before and after the experiment. The specific content of the score is shown in Figure 1. Through the comparison of the two scores, it can be seen that the performance scores of the six athletes have been improved to different degrees, and the improvement effect is good. The score of athlete A before the experiment was 79.51, and after the experiment was 82.93, with an increase of 3.42; Athlete B's score before and after the experiment was 77.55 and 81.97, which increased by 4.42; The score of athlete C was 76.49 before the experiment and 80.83 after the experiment, which increased by 4.34; The score of athlete D before the experiment was 77.44, and after the experiment was 78.72, the score increased by 1.28; The score of athlete E before the experiment was 73.21, and the score after the experiment was 83.08, with an increase of 9.87; The score of athlete F before the experiment was 77.15, and the score after the experiment was 84.05, which increased by 6.9; The above scoring results show that athlete E has the best effect in improving the performance of aerobics, followed by athlete F, followed by athlete B, athlete C, and athlete A, and athlete D has the least effect in improving the performance of aerobics.

Table 3. Effect of lower limb flexibility exercise on flexibility quality of aerobics athletes (within 30s).

Index	Before experiment	After experiment	Growth value	T	P
push-up	8.248±2.480	10.874±1.340	2.6268	6.0383	0.0000
Push Up High Five	0.555±1.184	1.464±0.379	0.9082	2.9124	0.0208
Right-angle support	0.219±0.149	1.003±0.335	0.7843	2.7766	0.0229
Straddle jump	9.531±0.528	11.481±0.241	1.9502	2.6242	0.0335
Vertical rotation 360 °	11.292±0.659	11.390±0.436	0.0983	0.5569	0.5855
Continuous vertical high kick	21.615±0.611	21.707±0.508	0.0920	0.6988	0.5007

Table 4. The Influence of Lower Limb Flexibility Exercise on the Balance Quality of Aerobics Athletes.

Index	Before experiment	After experiment	Growth value	T	P
Stand with your eyes open	127.276±4.797	129.863±4.544	2.5873	1.5278	0.4307
Stand on both feet with eyes closed	34.906±2.448	39.536±2.227	4.6307	1.0154	0.0010
Stand on one foot (left) with eyes open	81.592±3.689	86.891±3.263	5.2984	3.4211	0.0737
Stand with one foot (right) open	81.266±3.813	89.125±3.953	7.8591	2.6019	0.1270

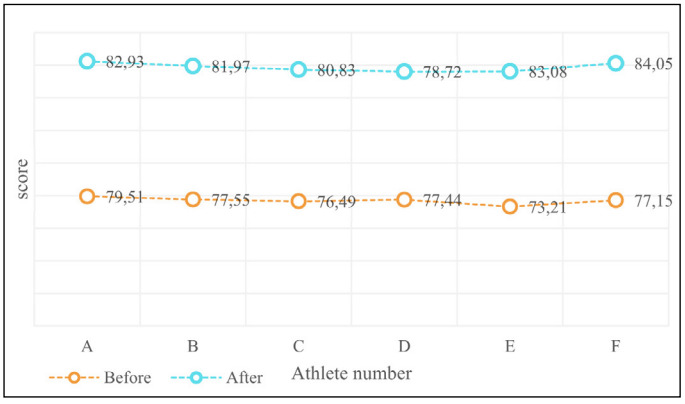

Figure 1. The effect of lower limb flexibility exercise on the performance score of aerobics.

DISCUSSION

The performance of aerobics can be reflected in many dimensions, such as athlete's body movements, dance design, music perception, and so on. The physical quality of athletes is a direct influence factor. If the physical quality of athletes is poor, their muscles, joints and other control ability and flexibility are poor, they can not complete the dance movements perfectly, and can not complete the dance movements with high difficulty and strong performance with high quality, Therefore, it will directly affect the result of aerobics competition, and it is impossible to show the artistry of aerobics. Therefore, the performance of the action depends on the physical quality of the athletes. From the above discussion and analysis, we can see that the six athletes who have undergone the lower limb flexibility exercise have improved their physical

quality indicators to a certain extent. This experiment also scored the performance of the action of the six subjects. From the scoring results, we can see that the performance of the action of all the experimental subjects has improved, That is to say, the lower limb flexibility exercise not only has a positive effect on the physical quality of athletes, but also has a better effect on improving the performance of actions. More and more people have paid attention to the performance of action. The methods to improve the performance of athletes are different. However, the lower limb flexibility exercise based on PNF method proposed in this paper has been confirmed by experiments and has a positive effect. The improvement of movement performance cannot be separated from the control of the body, especially the athletes' muscles, joints and ligaments. Through the exercise of the athletes' muscle groups, the control and flexibility can be improved to ensure that the athletes have high flexibility and balance, and can complete the aerobics performance with high quality, showing high artistic value.

CONCLUSION

Aerobics is of high artistry and appreciation. The expressive force of athletes' movements can better convey the emotional value of aerobics to the audience, so the expressive force of movements will directly affect the competitive level of athletes. The flexibility quality of aerobics athletes has a great impact on their performance. In aerobics events, athletes need to rely on good flexibility quality to complete dance movements to ensure accurate and efficient performance, and at the same time have good artistry and beauty, so improving the performance of athletes is the focus of this study. In this paper, the lower limb flexibility exercise of PNF method is used to improve the physical quality of athletes. By comparing and analyzing the data, it can be seen that the lower limb flexibility exercise has a good promoting effect on the physical quality index, flexibility index and balance index, especially the athletes' standing long jump, 2 min and 10 m touchdown turn-back run, push-up performance, and closed-eye bipedal standing performance show very significant differences after experimental intervention, There is great room for growth. In addition, this experiment also tested the action performance of six athletes, and made statistical analysis of their scoring results. The scoring results of the six athletes have improved to a certain extent. The score of athletes E before the experiment was 73.21, and the score after the experiment was 83.08, and the score increased by 9.87. It can be seen that the lower limb flexibility exercise has a very good promotion effect on the improvement of aerobics action performance.

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