AEROBIC TRAINING METHOD IN THROWING APPLICATION

APLICAÇÃO DO MÉTODO DE TREINAMENTO AERÓBICO EM ARREMESSOS

APLICACIÓN DEL MÉTODO DE ENTRENAMIENTO AERÓBICO EN LOS LANZAMIENTOS

Original Article
Artigo Original
Artículo Original

Luyun Li[1]
(Physical Education Professional)
Qiao Chen[2]
(Physical Education Professional)

1. Department of Sports Chengdu University, Chengdu, Sichuan, China.
2. Department of Sports, Chengdu University of Technology, Chengdu, Sichuan, China.

Correspondence:
Qiao Chen.
Chengdu, Sichuan, China. 610059.
chenqiaoherb@126.com

ABSTRACT

Introduction: Strength training is a vital training modality for sports. Upper body strength training is critical for throwing. Aerobic activity can effectively develop upper body strength in throwing athletes. Objective: Analyze the effect of aerobic training on upper body strength in throwing athletes. Methods: Several ball pitchers were selected as research volunteers. They were randomly divided into control and experimental groups. The study adopted the method of establishing statistics to analyze the strength and performance of throwing athletes before and after aerobic training. This work also analyzed the relationship between aerobics and throwing ability. Results: There were significant differences in the upper limb strength of throwing athletes after aerobic intervention (P<0.05). The strength of the experimental group was significantly improved (P<0.05). Conclusion: The aerobic intervention method is an effective way to improve upper limb strength in throwing athletes. It is recommended that athletes apply upper limb strength training to their daily training. The aerobic training method is a safe and effective choice. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Gymnastics; Athletes; Sports; Strength Training.

RESUMO

Introdução: O treinamento de força é uma modalidade de treinamento vital para a prática de esportes. O treinamento de força da parte superior do corpo é fundamental para o arremesso. A atividade aeróbica pode efetivamente desenvolver a força nos membros superiores de atletas arremessadores. Objetivo: Analisar o efeito do treinamento aeróbico sobre a força dos membros superiores de atletas arremessadores. Métodos: Selecionou-se vários arremessadores de bolas como voluntários de pesquisa. Estes foram divididos aleatoriamente em grupo de controle e experimental. O trabalho adotou o método do estabelecimento de estatísticas para analisar a força e o desempenho dos atletas arremessadores antes e depois do treinamento de aeróbica. Paralelamente, este trabalho também analisou a relação entre a aeróbica e a capacidade de arremesso. Resultados: Houve diferenças significativas na força dos membros superiores dos atletas arremessadores após a intervenção aeróbica (P<0,05). A força do grupo experimental foi significativamente aperfeiçoada (P<0,05). Conclusão: O método de intervenção aeróbica é uma maneira eficaz de melhorar a força nos membros superiores de atletas arremessadores. Recomenda-se aos atletas aplicar o treinamento da força dos membros superiores ao treinamento diário. O método de treinamento de aeróbica é uma escolha segura e eficaz. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Ginástica; Atletas; Esportes; Treinamento de Força.*

RESUMEN

Introducción: El entrenamiento de fuerza es una modalidad de entrenamiento vital para la práctica deportiva. El entrenamiento de la fuerza de la parte superior del cuerpo es fundamental para el lanzamiento. La actividad aeróbica puede desarrollar eficazmente la fuerza en los miembros superiores de los atletas de lanzamiento. Objetivo: Analizar el efecto del entrenamiento aeróbico en la fuerza de la parte superior del cuerpo de los atletas de lanzamiento. Métodos: Se seleccionaron varios lanzadores de pelota como voluntarios para la investigación. Se dividieron aleatoriamente en grupos de control y experimental. El trabajo adoptó el método de establecer estadísticas para analizar la fuerza y el rendimiento de los atletas de lanzamiento antes y después del entrenamiento aeróbico. Paralelamente, este trabajo también analizó la relación entre el aeróbic y la capacidad de lanzamiento. Resultados: Hubo diferencias significativas en la fuerza de las extremidades superiores de los atletas de lanzamiento después de la intervención aeróbica (P<0,05). La fuerza del grupo experimental mejoró significativamente (P<0,05). Conclusión: El método de intervención aeróbica es una forma eficaz de mejorar la fuerza de las extremidades superiores en los atletas de lanzamiento. Se recomienda que los deportistas apliquen el entrenamiento de fuerza de las extremidades superiores en su entrenamiento diario. El método de entrenamiento aeróbico es una opción segura y eficaz. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Gimnasia, Atletas, Deportes; Entrenamiento de Fuerza.*

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0361
Article received on 06/08/2022 accepted on 07/15/2022

INTRODUCTION

Aerobics is a comprehensive sport. It includes dance, music, aerobics, and other elements. Aerobics training can enhance physical fitness, improve posture, and strengthen the athlete's nervous system skills. The throwing movement is mainly supported by speed and strength. It uses the throwing form and distance of the athlete as the judging criteria.[1] Whether it is aerobics or throwing sports, it is necessary to strengthen athletes' muscle strength through strength training to improve strength quality. This paper studies the changes in kinematic indicators of athletes' throwing ability after aerobics intervention. This explores the impact of motor interventions on basic throwing motor skills. These kinematic characteristics can accurately evaluate the effect of sports intervention on the development of the throwing ability of athletes. These provide a quantitative basis for monitoring the developmental maturity of an athlete's throwing motion.

METHOD

Research objects

This paper takes throwing athletes aged 16 to 28 as the research object. The time is from November 1, 2019, to July 31, 2020. The control group received traditional exercise training.[2] The experimental group carried out aerobics exercise training.

Training method

In this experiment, the two-dimensional plane fixed-point measurement method was used to take a lateral fixed-point shooting of the athlete's throwing action. This paper uses DV Coach software for video capture.[3] At the same time, this paper uses the DV racker motion analysis system to perform technical analysis on the captured video.

A dynamic model of forearm throwing motion and analysis of force pattern

Point O represents the elbow joint. $\overrightarrow{F_1}$ represents the force of the triceps. Its point of action on the forearm is A. $\overrightarrow{F_2}$ represents the force of the biceps. Its point of action is B. θ represents the angle of rotation of the forearm around the elbow. $\overrightarrow{r_1}, \overrightarrow{r_2}$ represents the position vector from point O to the corresponding point of action of the two forces, respectively. P, Q represents the origin of the two forces. s_1, s_2 respectively represent the distance from point O to the corresponding force-generating point.[4] Here it is assumed that the force $\overrightarrow{F_1}$ is more significant than $\overrightarrow{F_2}$ and the forearm swings clockwise around the elbow. In the swing process of the upper arm acting on the forearm, the following dynamic model of the rotation of the forearm around the elbow is obtained by Euler's law of rotation:

$$\overrightarrow{I\ddot{\theta}} = \sum_{i=1}^{2} \vec{r_i} \times \overrightarrow{F_i} \tag{1}$$

I is the moment of inertia. We analyze the effect of force $\overrightarrow{F_1}, \overrightarrow{F_2}$ on the forearm. From Equation 1 and the resultant moment theorem, we can get:

$$I\ddot{\theta} = \frac{r_1 s_1 \sin\theta}{\sqrt{s_1^2 + r_1^2 + 2s_1 r_1 \cos\theta}} F_1 - \frac{r_2 s_2 \sin\theta}{\sqrt{s_2^2 + r_2^2 - 2s_2 r_2 \cos\theta}} F_2 \tag{2}$$

Assuming $x_1 = \theta, x_2 = \dot{\theta}$, Equation 2 can be transformed into:

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} x_1 \\ \frac{r_1 s_1 \sin x_1}{I\sqrt{s_1^2 + r_1^2 + 2s_1 r_1 \cos x_1}} F_1 - \frac{r_2 s_2 \sin x_1}{I\sqrt{s_2^2 + r_2^2 - 2s_2 r_2 \cos x_1}} F_2 \end{pmatrix} \tag{3}$$

The output is:

$$y(t) = x_2(t) \tag{4}$$

Assuming $x = (x_1\, x_2)^T$, $u = (F_1\, F_2)^T$, equations 3 and 4 can be written as general expressions:

$$\begin{cases} \dot{x}(t) = f(x(t), u(t)) \\ y(t) = h(x(t)) \end{cases} \tag{5}$$

Data processing

This paper uses Excel and SPSS18.0 statistical analysis software to organize and analyze the results.[5] The independent samples t-test was used for comparison between the two groups.

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

RESULTS

Changes in throwing distance of athletes

After a certain period of aerobics fitness program intervention, there was a significant statistical difference between the experimental and control groups in the shot-put throwing distance. (Table 1) The shot-put throwing distance of the experimental group was significantly enhanced. This shows that reasonable aerobics exercise can significantly enhance the throwing ability of athletes' upper and lower limbs.[6] The athletes in the experimental group improved the explosive power and flexibility of the upper limbs through basic aerobics exercises. Because the experimental group often performed throwing exercises such as hook and arm swing in practice.

Changes in upper limb joint angle during throwing

During the implementation and intervention of the aerobics fitness program, the shoulder angle of the athletes in the experimental group tended to increase during the throwing process gradually. The changes in the shoulder joint angle of the athletes in the experimental group were significantly different before and after the experimental intervention ($P<0.05$). (Table 2) This indicates that the range of motion of the shoulder joint has increased significantly during the fitness intervention.[7] In this way, the muscles involved in the work are stretched longer. At this time, the elastic potential energy generated by the muscle is more tremendous.

The changes of the elbow joint index were the same as the changes in the shoulder joint. During the intervention period, there was no

Table 1. Athlete's shot-put throwing distance test results (m).

Group	Test one	Test two
Test group	13.12±1.13	14.67±1.34
Control group	13.16±0.87	13.69±1.11

Table 2. Changes of upper limb joint angles in female athletes during the throwing phase. (°)

Testing time	Group		Shoulder joint	Elbow joint	LOL
Test one	Test group	Mean	38.12	88.68	38.21
		SD	18.65	25.84	12.32
	Control group	Mean	38.25	88.45	38.08
		SD	18.68	25.62	12.2
Test two	Test group	Mean	56.08	88.28	45.1
		SD	22.51	18.82	13.85
	Control group	Mean	48.65	85.5	44.43
		SD	18.08	16.11	14.01

significant difference in the changes in elbow joint angle between the experimental group and the control group at each monitoring time point (P>0.05). (Table 3) But after the intervention, the female athletes in the experimental group had a very significant difference before and after the intervention (P<0.01). This means that the elbow joint angle changes synchrony with the shoulder joint. It also increased significantly during the fitness intervention.[8] The experimental group of athletes in the second test was slightly more excellent than the control group. Although the difference was not significant, the influence of the aerobics fitness program on the variation of the elbow joint angle of athletes cannot be ruled out.

During the implementation and intervention period of the aerobics fitness program, the changes in the wrist joint angle during the throwing process of the athletes in the experimental group showed a gradually increasing trend. During the intervention period, there was no significant difference between the experimental and control groups in the changes in the wrist angle of the athletes at each monitoring time point (P>0.05). There were significant differences in the changes in the wrist angle of girls before and after the experimental intervention (P<0.05). This indicates that the wrist joint range of motion has increased significantly during the fitness intervention.[9] The experimental group of athletes in the second test was significantly more significant than the control group. The aerobics fitness program has a more significant impact on the increase in the change of the angle of the wrist joint of the athletes.

DISCUSSION

The athletic characteristics of the throwing event determine the importance of the level of rapid strength in the components of competitive ability. Rapid strength is mainly to complete the corresponding action in a short time to output the maximum strength. This creates a powerful explosive force.[10] Explosive force and strict force sequence are the main characteristics of muscle force in throwing sports. Therefore, in carrying out the special training in rapid strength, we must pay special attention to the technical requirements that must be followed when completing a particular movement. Strength training is mainly based on static and dynamic training in aerobics. Make sure that dynamic and meditative strengths complement each other in training. We generally take direct and effective methods to form a standard bodybuilding posture in a short period. There are many strength training methods in aerobics that can play an important role and value for throwing. The following principles should be strictly followed in the training process: First, strength training must be based on the basic principle of teaching students following their aptitude. There are often significant differences in the muscle strength of different athletes. Athletes must carry out targeted training and combine different movement stages.[11] Athletes need to adopt a training method of corresponding intensity. Second, in strength training, it is necessary to ensure that the strength of each part of the body can be balanced and developed. The human body is a coherent whole. The strengths of different parts must cooperate. If there is a lack of strength in one body part, it will directly impact the overall training effect. The third strength training is ultimately also the training of strength and speed. Throwing movements are not only closely related to muscle strength but also to muscle explosiveness. Therefore, in strength training, it is necessary to moderately increase speed training while ensuring the strength of muscle training. This can improve the athlete's muscle power.

Table 3. Changes in the joint angle of the upper limbs of female athletes during the throwing phase (°).

Testing time	Group		Shoulder joint	Elbow joint	LOL
Test one	Test group	Mean	30.33	67.74	31.33
		SD	18.65	16.83	8.85
	Control group	Mean	30.44	67.41	31.31
		SD	18.78	16.51	8.73
Test two	Test group	Mean	40.56	83.47	45.10
		SD	14.18	13.3	13.85
	Control group	Mean	37.68	80.43	44.43
		SD	18.78	16.01	15.01

Upper and lower body strength training

Wide-distance push-ups are mainly to train the upper body strength of athletes. The muscle groups that can be exercised include the deltoid, biceps, and triceps. When applying these aerobics training method, throwing athletes must ensure that their backs are straight, chests and abdomens are raised, and their hands are more expansive than their shoulders.[12] If the push-up width is too large, it will easily cause injury to the shoulder of the athlete. In the process of push-ups, the athlete's shoulder width should be less than 1.5 times as much as possible. Stretch your shoulders out and keep them within 45°.

Lower body strength training

Skipping rope in aerobics training can exercise the lower body strength of athletes and help burn fat and maintain a beautiful body. We apply the training method of fast rope skipping to the throwing sport, which can be limited by the coach for a time.[13] This allows the athlete to jump rope as much as possible within the allotted time. In this way, it helps to enhance the athlete's explosive power while also improving their anaerobic capacity. During the jump rope, the athlete's hands and upper arms should be tightly close to the body. Wrist force minimizes the movement circumference of the skipping rope as much as possible. At the same time, in participating in the rapid rope skipping training, the athlete should use the toes and forefoot to take off with force.

CONCLUSION

The effect of aerobics fitness program intervention on throwing distance was statistically significant. Aerobics fitness program intervention has a greater impact on the range of motion of athletes' shoulder, elbow, and wrist joints. The influence of aerobics fitness program intervention on the range of motion of the elbow joint of athletes is more significant than that of the other two links of the upper limbs. The effect of the intervention on elbow flexion and extension in boys was more substantial than that in girls. The intervention had a more negligible effect on the range of motion of the wrist joint.

ACKNOWLEDGMENT

Research on the Construction of Recessive Education Path of Integrating Party History into Fitness Group Exercise Course. Project number: 2021KCSZ14 Department of Social Sciences, Chengdu University.

Research on the Cultivation Path of Physical Education Professionals in Colleges and Universities in Sichuan Province from the Perspective of" Curriculum ideology and politics". Project number: TCCXJY-2021-c14. Research Center for Coordinated Urban and Rural Education Development.

Fitness Club Comprehensive Skills Practice (2) , Project number:CDYLKC2021095.

All authors declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. Luyun Li: writing; Qiao Chen: data analysis, article review and intellectual concept of the article.

REFERENCES

1. Masruroh AD, Puspodari P, Herpandika RP. Survey of Interest and Talent in Participating in Aerobic Gymnastics on the Nusantara Aerobic Gymnastics Team in 2021. J Phys Educ Sport Stud Res. 2022;1(1):29-37.
2. Moshenska T, Petrov D. Improving the physical qualities of volleyball players using aerobics at the stage of specialized basic training. Slobozhanskyi Her Sci Sport. 2020;8(1):50-3.
3. Pour Hosein Jafari Z, Aghdasi MT, Ghiami Rad A. The Effect of Training, Individual Mode or Couple Mode, on The Extent of Learning Aerobics Among the Elderly. Mot Behav. 2020;12(42):111-30.
4. Разуваева И. Efficiency of the use of multimedia tools in the learning process for the physical education of students by using means of handball. EJSS. 2021;1(2):79-85.
5. Wood AP, Imai S, McMillan AG, Swift D, DuBose KD. Physical activity types and motor skills in 3-5-year old children: National Youth Fitness Survey. J Sci Med Sport. 2020;23(4):390-395.
6. Heorhiivna TV, Oleksandrivna O, Oleksandrovich KV. Actual Tasks of Choreographic Training in Gymnatic Sports. Int J Appl Exerc. 2020;9(6):210-5.
7. Chernenko S, Jagiello W, Ivashchenko O, Khudolii O, Pashkevich S. Discriminant analysis: peculiarities of impact of sports specialization on 3rd-year female students' functional and motor fitness. Physical Education of Students. 2021;25(6):374-81.
8. Salin K, Huhtiniemi M, Watt A, Mononen K, Jaakkola T. Contrasts in fitness, motor competence and physical activity among children involved in single or multiple sports. Biomed Hum Kinet. 2021;13(1):1-10.
9. Olajos AA, Takeda M, Dobay B, Radak Z, Koltai E. Freestyle gymnastic exercise can be used to assess complex coordination in a variety of sports. J Exerc Sci Fit. 2020;18(2):47-56.
10. Moon J. Connecting sport coaching, physical education, and motor learning to enhance pedagogical practices. J Phys Educ Sport. 2022;22(1):3-12.
11. Tarnichkova M. Example Program for Improving Coordination Skills and Spatial Orientation in Children from Primary School Age. Trakia J Sci. 2021;19(1):582-8.
12. Tosho S. Effects of Anthropometric Variables on Sport Performance of Male University Champion--Handballers in West Africa (Nigeria). JIPES. 2020;6(02):26-35.
13. Samijonovich TS, Abdullaev MJ, Tolybaevich NA, Yurievna NO. Improving Methodology of Action Games in Training Athletes of Different Ages. Eur J Mol Clin Med. 2021;8(1):806-14.