THE ROLE OF MUSCLE RELAXATION IN BADMINTON PLAYERS

O PAPEL DO RELAXAMENTO MUSCULAR EM JOGADORES DE BADMINTON

EL PAPEL DE LA RELAJACIÓN MUSCULAR EN JUGADORES DE BÁDMINTON

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ABSTRACT

Introduction: In training, fatigue and recovery are antagonistic factors. Physical rehabilitation of athletes and elimination of sports fatigue have gradually become essential factors in improving competitiveness. Muscle relaxation exercises can reduce badminton players' physical effort, allowing them to recover quickly. Objective: Analyze muscle relaxation's effect on fatigue relief until the normalization of physical strength in badminton players. Methods: Twelve badminton players were grouped in cross-sectional tests. During the three weeks of physical training, players performed two training methods: muscle relaxation and complete rest. Laboratory analysis encompassed blood biomarkers such as urea and creatine kinase. Data were collected before and after the interventions, confronted, and studied mathematically and statistically. Results: The proportions of leukocytes and lymphocytes in the muscle relaxation group after resistance exercise were lower than before. The decrease of morning leukocytes in the muscle relaxation group on the second day was less than in the resting group. The recovery effect of the lymphocyte ratio was also better. After special strength training, the value of creatine kinase was significantly higher than before exercise in both the muscle relaxation group and the complete rest group. Conclusion: Muscle relaxation can reduce exercise fatigue in badminton players. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: *Badminton; Fatigue; Muscle Contraction; Muscle Relaxation.*

RESUMO

Introdução: No treinamento, fadiga e recuperação são fatores antagônicos. A reabilitação física dos atletas e a eliminação da fadiga esportiva tornaram-se gradualmente fatores essenciais para melhorar a competitividade. O exercício de relaxamento muscular pode reduzir o esforço físico dos jogadores de badminton, permitindo ao jogador recuperar-se rapidamente. Objetivo: Analisar o efeito do relaxamento muscular sobre o alívio da fadiga até a normalização da força física nos jogadores de badminton. Métodos: Foram agrupados 12 jogadores de badminton em testes transversais. Durante as três semanas de treinamento físico, os jogadores realizaram dois métodos de treinamento: relaxamento muscular e repouso completo. A análise laboratorial englobou biomarcadores sanguíneos, como ureia e creatina cinase. Os dados foram coletados antes e após as intervenções, confrontados e estudados de forma matemática e estatística. Resultados: As proporções de leucócitos e linfócitos no grupo de relaxamento muscular após o exercício de resistência foram menores do que antes. A diminuição dos leucócitos matinais no grupo de relaxamento muscular no segundo dia foi menor do que no grupo de repouso, e o efeito de recuperação da relação de linfócitos também foi melhor. Após o treinamento especial de força, o valor da creatina quinase foi significativamente maior do que antes do exercício tanto no grupo de relaxamento muscular quanto no grupo de repouso completo. Conclusão: O relaxamento muscular pode reduzir a fadiga do exercício nos jogadores de badminton. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Badminton; Fadiga; Contração Muscular; Relaxamento Muscular.*

RESUMEN

Introducción: En el entrenamiento, la fatiga y la recuperación son factores antagónicos. La rehabilitación física de los atletas y la eliminación de la fatiga deportiva se han convertido gradualmente en factores esenciales para mejorar la competitividad. El ejercicio de relajación muscular puede reducir el esfuerzo físico de los jugadores de bádminton, permitiendo que el jugador se recupere rápidamente. Objetivo: Analizar el efecto de la relajación muscular en el alivio de la fatiga hasta la normalización de la fuerza física en jugadores de bádminton. Métodos: Se agruparon doce jugadores de bádminton en pruebas transversales. Durante las tres semanas de entrenamiento físico, los jugadores realizaron dos métodos de entrenamiento: la relajación muscular y el descanso completo. Los análisis de laboratorio incluían biomarcadores sanguíneos como la urea y la creatina quinasa. Los datos se recogieron antes y después de las intervenciones, se confrontaron y se estudiaron matemática y estadísticamente. Resultados: Las proporciones de leucocitos y linfocitos en el grupo de relajación muscular tras el ejercicio de resistencia fueron menores que antes. La

disminución de los leucocitos matinales en el grupo de relajación muscular en el segundo día fue menor que en el grupo de reposo, y el efecto de recuperación de la proporción de linfocitos también fue mejor. Después del entrenamiento especial de fuerza, el valor de la creatina quinasa fue significativamente mayor que antes del ejercicio tanto en el grupo de relajación muscular como en el de reposo completo. Conclusión: La relajación muscular puede reducir la fatiga del ejercicio en los jugadores de bádminton. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Badminton; Fatiga; Contracción Muscular; Relajación Muscular.*

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INTRODUCTION

Muscles are the foundation of body structure. It supports a variety of activities and activities of the body. Previously, some scholars believed that muscle contraction and contraction were caused by the elongation and shortening of proteins and molecules in the body. The length of a protein in human tissue is due to the folded molecular weight that increases the protein's folds. The helical spacing of a protein molecule, or its diameter when compressed, causes the body's muscles to atrophy.[1] Myofilament slip theory believes that myofilament slip is caused by the movement of myosin bridges in the muscle and the interaction of other muscle cells. When the muscle fibers are of the same length, the corresponding sliding occurs spontaneously when the muscle fibers are deformed.

The game of badminton changed a lot in the early 1921s. In particular, the game is a new scoring system. This results in a reduction in the length of the game and an increase in speed. In this high-intensity confrontation, the body and mind of athletes will be significantly stressed. In badminton, athletes have significant competitive advantages in terms of technology, tactics, physical fitness, and psychology. Whether an athlete can maintain high morale and physical fitness on the field is the key to determining whether an athlete can win the game.[2] This article compares two methods of eliminating fatigue: muscle relaxation training and direct rest. The research results of this paper provide experimental data for establishing the optimal fatigue elimination model in badminton.

METHOD

General information

This article uses 12 outstanding players as a research sample. There were no significant differences between the athletes in terms of primary data. Athletes usually have a focused workout on Fridays. These include morning physicals and afternoon special strength endurance exercises.[3] The strength training program includes three aspects: upper body, lower body, and core strength. It takes 120 minutes in total.

Training method

In the experiment, 12 players were randomly divided into group A and group B. One set was a muscle relaxation set. The other is a complete rest set. 2 groups of muscle relaxation and adequate rest are two ways to eliminate fatigue.

Muscle relaxation training was performed after physical training. Hip-backward side of both lower limbs-back-back-double front side-upper extremity massage treatment. The whole process is 40 minutes. Do a period of muscle relaxation training at 20-minute intervals between each set. The order is the hip joint - the posterior outside of the two legs - the front of the two thighs.[4] Massage methods include moderate to severe kneading, pressing, acupuncture, and stretching. Twenty minutes at a time, for a total of 80 minutes.

The fully rested group returns to their dorms in the morning. And at noon, they would stay silent in their rooms.

The first test (BT) takes 1.5 hours before the Friday morning 7:00 strength class. At 12:30 p.m.a second test (2AT) takes place two hours after the physical strength class. The third test (3AT) was conducted 3 hours after the local strength training session at 7:30 p.m. Finally, a fourth test (TM) was performed at 7:00 am on Day 2. The four test items were blood routine, urea, and creatine kinase (CK).

Using the inverse dynamics method to simulate the action response of the athlete's legs

In this paper, the static optimal solution based on inverse dynamics in the anybody modeling system is used to simulate the motion response of the athlete's legs.

$$\min Q(R^U) = \min\left[\max(Y_i^U)\right] = \min\left[\max\left(\frac{R_i^U}{P_i}\right)\right] \quad (1)$$

$$CR^U = S \quad (2)$$

$$0 \le R_i^U \le P_i, i = 1,2,\mathrm{L}\ ,n^U \quad (2)$$

In this mode R^U is muscle strength. P_i is muscle strength, which is the maximum force a muscle can produce in the shortest amount of time. Y_i^U is the muscle activity. C is the system coefficient matrix. S is the external force on the system. n^U is the number of muscles in the model.

Data Statistics

This paper uses SPSS11.0 and Excel 2016 software to conduct statistics on all data. This paper is expressed as mean ± standard value.[5] The three-factor variance was statistically processed. P<0.05 was considered statistically significant. P<0.01 is exceptionally significant.

ETHICAL COMPLIANCE

Research experiments conducted in this article with animals or humans were appr Liaoning Normal University oved by the Ethical Committee and responsible authorities of following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Changes in white blood cells (WBC) and (percentage of lymphocytes) LY%

It can be seen from Table 1 that there is no significant difference in the WBC value of badminton players after strength exercise compared with before exercise. The athletes in the muscle relaxation training and

rest groups decreased slightly, but the difference was not significant (P>0.05). Both groups in the muscle relaxation training and rest groups had significantly higher WBCs after exercise than before exercise. Athletes with muscle relaxation training had lower WBC levels than at rest (P<0.05). On the second day, the WBC of the two groups in the morning was significantly lower than that before exercise (P<0.05). The rest group had statistical significance compared with the muscle relaxation training group (P<0.05). In both experimental groups, the LY% after intensive exercise in the morning was significantly lower than before training (P<0.05). The LY% between the two groups continued to decrease in the afternoon. This is significantly different from the pre-training comparison (P<0.01). Although the LY% of the muscle relaxation training group was slightly lower, the LY% was higher than that of the rest group.

Changes in red blood cells (RBC), hemoglobin (Hb), and hematocrit (Hct)

From Table 2, it can be seen that the RBC of the muscle relaxation training group and the rest group did not change significantly after the end of the load training.[6] There were significant differences in RBC values between the two groups and those before the exercise (P<0.05). The changes in Hb in the two groups were similar to RBC, and there was a significant difference between the two groups in the morning after exercise and before exercise (P<0.05). The Hct values in the muscle relaxation training group and the rest group were statistically significant compared with before and after training (P<0.05). The Hct of morning exercise on the 2nd day increased slightly but was significantly lower than before training (P<0.05).

Changes in urea nitrogen (BUN) and creatine kinase (CK)

The BUN of the two groups showed an upward trend after training in the morning, middle and evening and gradually decreased on the second day. The results showed that the difference between muscle relaxation training and rest exercise after exercise in the morning was statistically significant (P<0.05). BUN between the two groups was significantly improved compared with the control group.[7] On the second day's morning, the BUN of both groups decreased. In contrast, the two control groups of muscle relaxation training and rest exercise were significantly higher than the control group. The CK values of the two groups were similar to those of BUN. Muscle relaxation training and resting CK values increased significantly after exercise in the morning. There was a statistically significant difference between the muscle relaxation training and rest groups after exercise (P<0.01).

DISCUSSION

In badminton or competition, the various tissues, organs, and functions of athletes will be temporarily reduced, which is a normal mental response of the human body and suppression of self-protection. Badminton is a technical net game. It requires a high level of unique technology and an excellent overall quality. The energy source of badminton is aerobic and anaerobic and dominated by aerobic. Athletes need a long rest to replenish their strength after physical exercise and competition. The consumption of energy and the accumulation of fat in the local muscles and blood are essential factors that cause the fatigue of badminton players.[8] An excessive amount of exercise, excessive stimulation during exercise, and two external factors such as psychological tension can lead to long-term fatigue.

Doing some muscle relaxation exercises between games can delay the onset of fatigue. This reduces the stress on the muscles caused by intense competition and thus reduces physical injury from fatigue. Badminton players bounce more in the middle and back stages, and their legs are heavily burdened. Players can hold their thighs with both hands while resting and swing from bottom to top. Players who hit a lot can relax their hitting arms and shoulders.[9] The badminton player uses one hand to keep pressing down from the shoulder to the wrist. The third game is the badminton final. The gap between the two teams' skills and techniques is usually insignificant. The next step is the athletes' psychology, will, and physical strength competition. Coaches, team doctors, and teammates should assist athletes with massage and relaxation of shoulders, backs, legs, and other parts. Rubbing the tense and tired parts can promote the stretching of capillaries and local blood flow to eliminate fat and other bodily metabolites. This can achieve the purpose of repairing and improving body function. The method of massage is along with the flow of lymph. The trainer can do it by rubbing, tapping, pressing, shaking, etc. The movements should be brief and gentle. It is best not to rub the injured area with your hands. Be careful not to sit on the board or floor for an "absolute" rest before the game ends. Athletes do active physical relaxation rehabilitation exercises. Physiologists believe that nerves innervate human mental and physical functions. They influence each other. Both mental and physical can be adjusted by relaxing the muscles.

CONCLUSION

Muscle relaxation exercises can reduce the changes in the ratio of white blood and lymphocytes caused by strength training. Muscle relaxation

Table 1. Effects of 2 Different Consumption Methods on Leukocyte and LY Percentages.

Content		BT	2AT	3AT	TM
WBC (×109/L)	Rest group	6.37 ± 1.43	6.18 ± 2.1	8.27 ± 1.24	5.61 ± 1.98
	Muscle relaxation training group	6.75 ± 2.06	6.27 ± 1.33	7.32 ± 2.11	6.18 ± 1.71
LY%	Rest group	41.75 ± 17.4	35.45 ± 9.42	22.73 ± 5.83	33.14 ± 13.26
	Muscle relaxation training group	42.71 ± 19.43	35.15 ± 8.67	28.59 ± 5.06	39.14 ± 9.33

Table 2. Changes in RBC, Hb, and Hct values for two fatigue reduction method groups.

Content		BT	2AT	3AT	TM
RBC ($\times 10^{12}$/L)	Rest group	4.65 ± 0.07	4.59 ± 0.16	4.53 ± 0.35	4.54 ± 0.22
	Muscle relaxation training group	4.73 ± 0.27	4.72 ± 0.47	4.56 ± 0.34	4.57 ± 0.35
Hb (g/L)	Rest group	152.38 ± 3.79	145.35 ± 7.89	141.08 ± 8.14	148.49 ± 5.32
	Muscle relaxation training group	152.29 ± 8.39	144.5 ± 14.87	144.78 ± 6.93	149.91 ± 8.97
Hct (%)	Rest group	43.32 ± 1.14	42.47 ± 2.09	41.99 ± 3.55	41.61 ± 1.84
	Muscle relaxation training group	43.13 ± 2.61	42.56 ± 3.71	42.18 ± 3.17	42.28 ± 3.09

training during high-intensity exercise can boost the body's metabolism. Muscle relaxation training can promote the recovery of blood indicators. Athletes can relieve fatigue during badminton games through muscle relaxation training.

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