EFFECTS OF SPORTS TRAINING ASSOCIATED WITH NUTRITIONAL INTERVENTION ON ATHLETES' POST-COMPETITION RECOVERY

EFEITOS DO TREINAMENTO ESPORTIVO ASSOCIADO À INTERVENÇÃO NUTRICIONAL SOBRE A RECUPERAÇÃO DOS ATLETAS PÓS-COMPETIÇÃO

EFECTOS DEL ENTRENAMIENTO DEPORTIVO ASOCIADO A UNA INTERVENCIÓN NUTRICIONAL EN LA RECUPERACIÓN POST COMPETICIÓN DE LOS DEPORTISTAS

ORIGINAL ARTICLE
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ABSTRACT

Introduction: The athletes' physiological capacity and psychological level are raised to the limit during the competition, which is necessary for adequate recovery after the dispute. Objective: Study the effect of sports training associated with nutritional intervention on athletes' post-competition recovery. Methods: In the first two weeks of the experiment, training was done in slow aerobic exercise, aerobics, and running. Strength training and a small amount of anaerobic training were added to the training with the gradual practice of the experiment. Results: The proportion of breakfast, lunch, and dinner was 25.33%, 42.55%, and 32.12%, respectively; protein intake decreased from 34.23% to 20.13%, and the proportion of fat intake decreased from 15. 56% to 12.3%, and IgG content changed from 7.654 ± 0.283 (mmol/L) at the end to 8.586 ± 0.651 (mmol/L); IgM content changed from 3.382 ± 0.875 (g/L) at the end to 3.169 ± 1.002 (g/L). Conclusion: Athletes can effectively, through sports training and nutritional intervention, adjust body changes caused by competition while maintaining a good exercise level. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Physical Education and Training; Nutrition Therapy; Recovery of Function.

RESUMO

Introdução: A capacidade fisiológica e o nível psicológico dos atletas são elevados ao limite durante a competição, sendo necessária uma recuperação adequada após a disputa. Objetivo: Estudar o efeito do treinamento esportivo associado à intervenção nutricional para a recuperação dos atletas após a competição. Métodos: Nas duas primeiras semanas da experiência, realizou-se o treinamento na forma de exercício aeróbico lento, aeróbica e corrida. O treinamento de força e uma pequena quantidade de treinamento anaeróbico foram adicionados ao treinamento com a prática gradual do experimento. Resultados: A proporção de café da manhã, almoço e jantar foi de 25,33%, 42,55% e 32,12% respectivamente, a proporção de ingestão de proteínas diminuiu de 34,23% para 20,13%, a proporção de ingestão de gordura diminuiu de 15,56% para 12,3%, e o conteúdo de IgG mudou de 7,654 ± 0,283 (mmol/L) no final para 8,586 ± 0,651 (mmol/L); o conteúdo de IgM mudou de 3,382 ± 0,875 (g/L) no final para 3,169 ± 1,002 (g/L). Conclusão: Os atletas podem de maneira eficaz, através de treinamento esportivo e intervenção nutricional, ajustar as alterações corporais ocasionadas pela competição, mantendo um bom nível de exercício. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

***Descritores*:** *Educação Física e Treinamento; Terapia Nutricional; Recuperação de Função Fisiológica.*

RESUMEN

Introducción: La capacidad fisiológica y el nivel psicológico de los atletas se elevan al límite durante la competición, siendo necesaria una adecuada recuperación tras la disputa. Objetivo: Estudiar el efecto del entrenamiento deportivo asociado a la intervención nutricional para la recuperación de los deportistas tras la competición. Métodos: En las dos primeras semanas del experimento, el entrenamiento se realizó en forma de ejercicio aeróbico lento, aeróbic y carrera. El entrenamiento de fuerza y una pequeña cantidad de entrenamiento anaeróbico se añadieron al entrenamiento con la práctica gradual del experimento. Resultados: La proporción de desayuno, comida y cena fue del 25,33%, 42,55% y 32,12% respectivamente, la proporción de ingesta de proteínas descendió del 34,23% al 20,13%, la proporción de ingesta de grasas descendió del 15. 56% a 12,3%, y el contenido de IgG pasó de 7,654 ± 0,283 (mmol/L) al final a 8,586 ± 0,651 (mmol/L); el contenido de IgM pasó de 3,382 ± 0,875 (g/L) al final a 3,169 ± 1,002 (g/L). Conclusión: Los atletas pueden ajustar eficazmente, mediante el entrenamiento deportivo y la intervención nutricional, los cambios corporales provocados por la competición, manteniendo un buen nivel de ejercicio. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

***Descriptores*:** *Educación y Entrenamiento Físico; Terapia Nutricional; Recuperación de la Función.*

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INTRODUCTION

Competition is a very important link in the athletes' sports career, but the auxiliary work before and after the competition is also indispensable.[1] Only make preparations before the competition, let the athletes participate in the competition in the best state, and do a good job of recovery in time after the competition, so that the athletes can effectively recover their bodies that have been consumed a lot during the competition, and fully summarize the experience and lessons of the last competition, And make efforts in the follow-up training, in order to get progress again and again.[2] Therefore, the recovery of athletes after the game is very important in the career of athletes, and it is also an important topic for coaches and related staff to study. In terms of the research on athletes' recovery after the competition, many literatures have been discussed.[3] The literature suggests that the application of traditional Chinese massage and acupuncture to athletes' recovery after the competition can effectively alleviate the fatigue problem of athletes in the competition; The literature suggests that after the competition, strengthening the intervention in nutrition, regulating the diet of athletes and choosing more food suitable for athletes can comprehensively adjust the physical conditions of athletes; There are also documents that the athletes should pay attention to controlling the amount of exercise after the competition.[4] It is necessary to carry out relatively gentle sports to ease the excessive consumption of athletes during the competition, and also pay attention to the maintenance of athletes' training state to prevent excessive relaxation and its impact on athletes' competitive level.[5] Based on the previous research results and the author's own work experience, the article believes that both pure sports training and pure nutrition intervention can make athletes achieve a good recovery effect after the competition, but both are relatively one-sided.[6] Therefore, it is necessary to study how to combine sports training with nutrition intervention, so that athletes can not only maintain a good nutritional state, but also obtain physical relaxation after the competition, And targeted to ensure the sports state, so that athletes can really recover after the game.[7]

METHOD

Selection of research objects

In terms of the selection of research objects, some professional athletes were selected from a sports school and professional sports team. The study and all the participants were reviewed and approved by Ethics Committee of China Jiliang University (NO.CJLU21-FUD105). The inclusion and exclusion criteria are as follows:

First, the included standard athletes are in good health, without sports injury or genetic disease, as well as cardiovascular disease, which will affect the experimental results.

Second, the athletes have a good acceptance of food, without food allergy or pickiness, and can carry out catering experiments according to the experimental plan of the researchers.

Third, the athletes will compete in the near future, and the completion time of the competition is almost the same, with a relatively unified experimental time.

Fourth, the athletes have good obedience. They can complete relevant sports training plans and nutrition intervention plans according to their needs, and can cooperate with researchers to complete the follow-up data collection. They can maintain close contact throughout the experimental period, and are not subject to external interference, so as to prevent the deviation of experimental results caused by various factors.

Sports training program design

In the aspect of experiment design, because the recovery process of athletes after the competition is very important for the maintenance of athletes' competitive level and the stability and improvement of their physical quality, the method of intra group comparison was selected in this study. Through the comparative analysis of the data before and after the experiment, the experimental results were judged, and no control group was set.

The sports training program of the athletes refers to the sports training program proposed by predecessors. The whole exercise process is dominated by relatively gentle aerobic exercise. In the first two weeks of the experiment, it is carried out in the form of soothing aerobic exercise, aerobics and jogging, so that the athletes' muscles and joints that are too tense due to competition training can be relaxed. With the gradual practice of the experiment, strength training and a small amount of anaerobic training are added to the training, so that the basic competitive state of athletes can be effectively continued.

Nutrition intervention plan

Firstly, the diet of athletes was investigated and analyzed. In the design of the nutrition intervention program, two aspects were selected: on the one hand, the proportion of athletes eating breakfast, lunch and dinner was adjusted, and on the other hand, the proportion of nutrients consumed in each meal.

As shown in Figure 1, the pre intervention of the athletes' diet and nutrition is shown in Table 1. Figure a shows the distribution of the athletes' three meals before the three times of intervention. It can be seen that before the nutrition intervention, the athletes ate lunch most, accounting for 43.11%, followed by dinner, which accounted for 42.20%, and the athletes' breakfast accounted for only 12.55%. Through the interview and analysis with athletes, it can be seen that in the post competition stage, many coaches have reduced their control over athletes, and athletes sleep late and get up late, which is mainly reflected in the fact that they will take part in some entertainment activities to relax in the evening, and they will choose to sleep late in the morning. This relaxation method will lead to the athletes taking too many meals for dinner and too little or no breakfast, which will affect the absorption of nutrients and is not conducive to recovery after the game. After the dietary intervention, the proportion

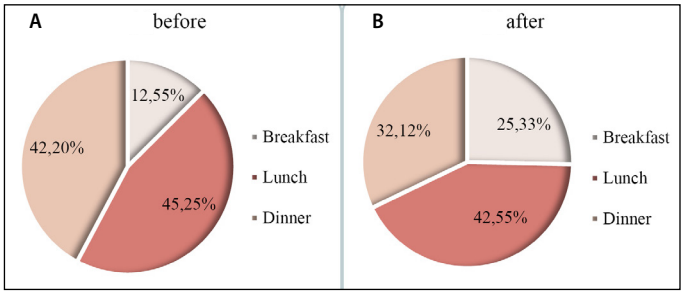

Figure 1. Intervention strategy of meal ratio in athletes' diet and nutrition.

Table 1. Analysis of basic situation of athletes.

Number	Age (y)	Height (cm)	Weight (kg)	Training years (y)
1	17.3	172.7	57.4	6.2
2	18.3	173.0	65.3	8.0
3	18.2	175.4	60.9	7.4
4	17.6	170.8	65.3	6.9
5	15.2	178.2	58.2	7.5
6	19.4	172.9	63.6	5.8
7	18.8	172.0	57.8	6.6
8	17.5	176.5	69.1	6.1
9	18.5	176.8	65.7	7.1
10	18.6	175.2	57.3	8.2
11	17.8	173.2	58.4	6.6
12	18.0	172.1	66.1	7.0

of nutritious meals of athletes after the intervention is shown in Figure b. It can be seen from the figure that the proportion of breakfast, lunch and evening meals is 25.33%, 42.55% and 32.12% respectively, and the overall proportion is close to 3:4:3 of the scientific catering ratio, which can be slightly adjusted according to the actual situation of sports mobilization. Through diet adjustment, it can be seen that the proportion of athletes' dinner intake has been greatly reduced, while the proportion of breakfast intake has been significantly increased. Lunch has been slightly reduced on the original basis, so that the proportion is close to the scientific proportion. However, it can still be seen that the proportion of dinner is higher than that of breakfast. It means that athletes will still retain some bad habits in the stage of recovery and rest after the game, but relatively speaking, Diet has made some progress.

As shown in Figure 2, the intervention strategy of the energy ratio of athletes' food nutrition. The diet is rich in a variety of nutrients, which cannot be enumerated in this study. Therefore, protein, carbohydrate and fat are selected as the representatives. It can be seen from Figure a that before the nutrition intervention, the athletes' nutrition intake was 34.23% protein, 50.21% carbohydrate and 15.56% fat. As a whole, the carbohydrate intake was low and the protein intake was excessive. Through communication with athletes, they believe that protein is an indispensable part of providing muscle development, and can also achieve a good effect of increasing muscle and reducing fat. Therefore, athletes will consciously intake more protein in their diet, and even increase some protein powder as a nutritional supplement, which makes the proportion of protein intake significantly high. In terms of carbohydrate, some athletes also have some misunderstandings about carbon water. They eat more meat and protein in their diet. Carbon water is only used as a regulation, which makes the athletes' carbohydrate intake insufficient and fat intake high. Therefore, it is necessary to make certain adjustments. As shown in Figure b, the highest proportion of adjusted energy is carbohydrate, which is 67.56%. The main types of intake are brown rice, coarse grains and other high-quality carbon water. The proportion of protein intake has decreased from 34.23% to 20.13%. With the help of nutritionists, the intake of relevant supplements has been scientifically absorbed. The intake of fat has also been controlled, which has decreased from 15.56% to 12.3%, mainly reflected in the choice of food types. Some meat with high fat content has been reduced, and beef, beef Replace fish and other healthy meat.

RESULTS

Effect of sports training combined with nutritional intervention on athletes' heart rate after competition

As shown in Figure 3, the athletes' heart rate changes immediately after exercise during the intervention process. In order to better analyze the effect of the combination of sports training and nutrition intervention on the recovery of athletes after the competition, we chose to measure it once every Friday and draw its change trend chart. It can be seen from the figure that at the end of the competition, the athletes' heart rate immediately after exercise is relatively high, and in the following week, the athletes' heart rate immediately becomes higher, which is far higher than the heart rate at the end of the competition. The reason is that the athlete's body is still in a state of relative tension and disorder, so the heart rate increases instead of decreasing one week after the competition. Although the data decreased in the following two and three weeks, the heart rate change immediately after the competition was slightly higher, and the data in the second and third weeks were almost consistent. During this period, with the combination of nutrition intervention and sports training, the athletes' bodies gradually recovered and began to adapt to the recovery and accumulation stage after the competition. The third week is the turning point of the immediate heart rate change. In the following four weeks, the value dropped significantly, and the immediate heart rate change after the competition was lower, indicating that the athletes' bodies had basically adapted and began to show an optimized state. In the fifth week, the range of change slowed down, but it still showed a downward trend, indicating that the heart rate of the body immediately after exercise was in a relatively calm state, and the body had basically recovered completely.

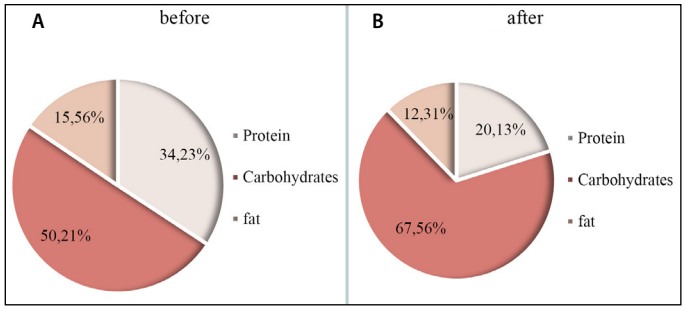

Figure 2. Intervention strategy of energy ratio in athletes' diet and nutrition.

Effect of sports training combined with nutritional intervention on athletes' post competition metabolic indicators

As shown in Table 2, the changes of metabolic indicators of athletes after the end of the competition and the end of the experiment. It can be seen from the table that the hemoglobin content changes from 160.678 ± 0.880 (g/L) at the end to 122.508 ± 0.455 (g/L); Blood urea nitrogen content changed from 7.099 ± 0.597 (mmol/L) at the end to 9.201 ± 0.506 (mmol/L); The content of creatine kinase changed from 102.624 ± 0.238 (U/L) at the end to 182.021 ± 0.258 (U/L); The content of IgA changed from 1.891 ± 0.383 (g/L) at the end to 2.053 ± 0.511 (g/L); IgG content changed from 7.654 ± 0.283 (mmol/L) at the end to 8.586 ± 0.651 (mmol/L); The IgM content changed from 3.382 ± 0.875 (g/L) at the end to 3.169 ± 1.002 (g/L).

DISCUSSION

After the competition, many athletes have the problem of insufficient energy intake and excessive protein and fat intake, which will not only

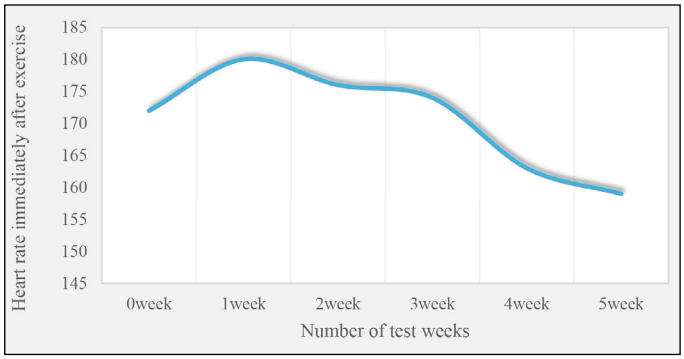

Figure 3. Changes of athletes' heart rate immediately after exercise during intervention.

Table 2. Analysis on the Changes of Metabolic Indexes of Athletes.

Relevant indicators	After the competition	After the experiment
Hemoglobin (g/L)	160.678±0.880	122.508±0.455
Blood urea nitrogen (mmol/L)	7.099±0.597	9.201±0.506
Creatine kinase (U/L)	102.624±0.238	182.021±0.258
IgA(g/L)	1.891±0.383	2.053±0.511
IgG(mmol/L)	7.654±0.283	8.586±0.651
IgM(g/L)	3.382±0.875	3.169±1.002

lead to unbalanced nutrition intake of athletes, but also have a certain negative impact on the growth and development of athletes. Therefore, in the later stage, we should strengthen the energy intake and eat more high-quality carbon water, such as coarse grains, brown rice, sweet potatoes, etc., so as to improve the total energy intake, maintain good physical strength and endurance, and maintain the overall sports level in a relatively good state. In addition, it is also necessary to improve the high-fat eating habits and reduce the impact of fat on the absorption of protein and trace elements. For example, some fish, seafood and beef with low fat content will replace meat with meat with high fat content, and moderate consumption of bean products and vegetables will achieve the goal of scientific absorption of fat and protein. It can also increase the intake of high-quality protein such as milk, Reduce the loss of body protein during the competition.

In addition to the three major nutrients mentioned above, the supplement of trace substances is also something that athletes should pay attention to after the competition. During the competition, with the discharge of sweat, many trace substances in athletes' bodies are lost. Therefore, the intake of trace substances and vitamins should be purposefully increased after the competition, such as appropriately eating animal liver, dairy products and foods rich in carotene to supplement the intake of vitamin A; Eat fresh fruits and vegetables properly, supplement vitamin C, prevent cell membrane from being oxidized, reduce the damage to muscle tissue caused by intense exercise during the competition, and adjust the body state as soon as possible during the recovery period after the competition. In addition, vitamin B group and vitamin PP can also be supplemented in the form of nutritional supplements, so as to ensure normal metabolism and nerve conduction, enhance the endurance of athletes, keep their attention and reaction ability in a good state, and maintain good exercise ability after the end of the competition. In terms of absorption of minerals, we can improve the supply of minerals, maintain the ability of muscle movement, and maintain a good competitive state through supplement and diet intervention.

CONCLUSION

In order to cope with the intense and complex competition, the physiological function and psychological state of the athletes have been adjusted to the limit. Therefore, if the athletes can not recover effectively after the competition, it will have a certain impact on the body and psychology. Therefore, through sports training and nutrition intervention, athletes can effectively adjust their disordered bodies, maintain a good sports level, and do a good job of accumulation and promotion in the post competition stage to cope with the subsequent competitions.

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