

Investigation and Analysis on Sports Fatigue of Tennis Specialized Class Students in Wuhan Institute of Physical Education

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Abstract. Since the 1980s, many scholars have studied fatigue from physiological and biochemical aspects. Exercise fatigue is a physiological phenomenon caused by exercise stimulation. It reflects the tolerance of the body to exercise stimulation. It is a positive process for the body to regulate its own activities and has an alarming effect on the body's activities. Because of its appearance, it can reduce the intensity of exercise, or even stop the movement, in order to prevent excessive consumption of substances in the body and damage to the body function. The high intensity and high load of modern tennis training and competition will inevitably lead to sports fatigue. Energy consumption and lactic acid accumulation in muscle and blood are the main causes of tennis players' fatigue. How to eliminate fatigue quickly is the prerequisite for athletes to adapt to high-intensity training and competition. Starting from the characteristics and main diagnostic methods of tennis sport fatigue, combining with the principles of sport fatigue recovery, this paper will provide constructive suggestions for tennis athletes sport fatigue physical recovery by using the methods of pedagogy, nutrition, psychology, medicine and biology. Fatigue judgment and recovery is an important part of modern sports, and also an important factor affecting training effect and competition results. Aiming at the characteristics of athletic tennis players' fatigue, this paper investigates and analyses the sports fatigue and recovery of tennis players in the special tennis class of Wuhan Institute of Physical Education by using the methods of literature, expert interview, questionnaire and mathematical statistics. By using the theory of sports physiology, the mechanism, diagnosis and recovery methods of exercise physiology were discussed preliminarily. In order to improve tennis players' performance, improve the quality of training and grasp the law of training.

Introduction

Tennis requires athletes to be active, brave and tenacious, to run fast on the court, to concentrate their attention highly and to respond quickly, so that athletes can bear a greater physiological and psychological load. Especially, the hypertensive activity of the cerebral cortex not only decreases the body's motor function, but also disorders the functions of various visceral organs regulated and controlled by the cerebral cortex, and decreases the whole nervous activity, so it is easy to cause athlete fatigue. Therefore, it is of practical significance to explore the methods of diagnosis and recovery of athletic fatigue for improving the level of sports training and competition results.

Tennis class students in Wuhan Institute of Physical Education undertake a number of academic studies, even up to eight hours a semester every day, the training load and intensity are relatively large, easy to produce fatigue. Only scientific means of recovery can meet the needs of training. Russian Professor Siakov said: "At present, after training and competition, recovery of high-level athletes is regarded as an integral part of effective training." It can be seen that physical recovery is an indispensable part of scientific training. Therefore, to explore appropriate means of recovery can effectively ensure the scientific nature. Tennis requires athletes to be active, brave and tenacious, to run fast on the court, to concentrate their attention highly and to respond quickly, so that athletes can bear a greater physiological and psychological load. Especially, the hypertensive activity of the cerebral cortex not only decreases the body's motor function, but also disorders the functions of various visceral organs regulated and controlled by the cerebral cortex, and decreases the whole nervous activity, so it is easy to cause athlete fatigue. Therefore, it is of practical significance to explore the methods of diagnosis and recovery of athletic fatigue for improving the level of sports training and competition results.

Research Object and Method

Research Object

There are 30 students in the selective class of Wuhan Institute of Physical Education. The average age is 21.3 years (19-23). The training period is 3-11 years

Research Method

Literature Research Method. A large number of relevant documents were consulted through the library collection literature and the database of Chinese sci-tech periodicals to provide theoretical reference for discussion and analysis.

Expert Interview. Visit relevant experts of sports physiology and sports health science to understand the meaning of sports fatigue and its contents; Visit experts engaged in tennis training and teaching for many years to have in-depth conversation on various problems of tennis players in training, and explore the corresponding countermeasures for improvement.

Questionnaire Survey. A questionnaire was designed to investigate 30 students in tennis class of Wuhan Institute of Physical Education. A total of 30 questionnaires were issued, 30 were retrieved and 30 were valid.

Mathematical Statistics. After collecting and summarizing the relevant data of the questionnaire, the conventional percentage statistics were calculated.

Results and analysis

The Concept and Mechanism of Sports Fatigue of Tennis Players

The Concept of Sports Fatigue of Tennis Players. In 1982, at the 5th International Conference on Sports Biochemistry, fatigue was defined as "the physiological process of the organism can not sustain its function at a certain level and/or can not maintain the predetermined exercise intensity." Then, tennis players'sports fatigue refers to the physiological process in which the body's functional ability or work efficiency declines and cannot be maintained at a specific level in the course of tennis.

Causes of Sports Fatigue. The causes of sports fatigue are complex, and several representative hypotheses are as follows:

The theory of exhaustion: It is believed that the cause of fatigue is the exhaustion of energy substances in the body. At that time, the hypothesis was put forward based on the hypothesis that the ability to work during long-term exercise decreased while the blood sugar concentration decreased, and the ability to work after sugar supplementation improved to a certain extent.

Blockage theory: fatigue is caused by the accumulation of certain metabolites in muscle tissue.

Internal environmental stability imbalance theory: fatigue due to the decline in body acidity, water and salt metabolism disorders and changes in plasma osmotic pressure and other factors.

Protective Inhibitory Theory: According to the opinion of Bapulov School, whether physical or mental fatigue is the result of the development of cortical protection inhibition. When working, a large number of cortical corresponding cells are impulsed, and the long-term excitation of nerve cells leads to the increase of "depletion". In order to avoid further consumption, protection suppression will occur when consumption reaches a certain level.

Catastrophe theory: Edwards proposed a new fatigue theory, that is, the catastrophe theory of muscle fatigue. It is believed that the development of sports is generally a sudden decline in energy expenditure and excitability in order to avoid further decline in energy reserve. Therefore, in the overall situation, the causes of fatigue may be complex, and several factors influence each other. The causes of fatigue in different sports may be different. It is impossible to explain fatigue in all sports by one theory alone.

Free radical damage theory: Free radicals refer to the outer electronic orbitals containing paired electrons. Free radicals have active chemical properties and can react with carbohydrates, proteins, nucleic acids and lipids in the body, thus causing damage to the structure and function of cells.

During intense exercise, the level of lipid peroxidation in plasma increases, and the toxicity of oxygen free radicals plays an important role in the process of fatigue.

Purpose of Research. Based on the above, the tennis class students in Wuhan Institute of Physical Education undertake a number of academic studies, even up to eight hours a semester every day, the training load and intensity are relatively large, easy to produce fatigue. Only scientific means of recovery can meet the needs of training. Therefore, it is of practical significance to explore the methods of diagnosis and recovery of athletic fatigue for improving the level of sports training and competition results.

Investigation and Analysis of Fatigue in Teaching and Training Cycle

Investigation and Analysis of Mental Status before Training. From Table 1, we can see that most of the players are in good spirits before training, only one is in poor spirits, which may be related to their personal mood or physical condition. The overall mental condition of the team is quite good, which shows that the players are more suitable for the usual training.

Table 1. Pre-training mental status list (N=30).

Good		Preferably		Commonly		Not good		Poor	
Numbern/%		Numberne/%		Numbern/%		Numbern/%		Numbern/%	
9	30.00	9	30.00	9	30.00	2	6.67	1	3.33

Investigation and Analysis of Subjective Physical Sensation. The subjective physical sense scale (rpe) developed by Swedish physiologist Ganell was used to determine the fatigue degree of athletes by pointing out the level of self-feeling according to the RPE table in the course of exercise. In Table 2, 13 people chose subjective motor sensation as a little laborious, accounting for 43.33%, the corresponding RPE value was 13.10 people chose laborious, accounting for 33.33%, the corresponding RPE value was 15. The sensory level of the athletes ranged from 12 to 15, indicating that the load intensity was reasonable. It can be seen that the usual training intensity is adaptable for most players.

Table 2. A list of subjective physical sensations (N=30).

Be quiet		Very relaxed		Too Relaxed		Relaxed	
Numbern/%		Numberne/%		Numbern/%		Numbern/%	
1	3.33	1	3.33	4	13.33	1	3.33
Slightly laborious		Laborious		Very laborious		Too laborious	
Numbern/%		Numberne/%		Numbern/%		Numbern/%	
13	43.33	10	33.33	0	0.00	0	0.00

Investigation and Analysis of Sweat and Saline Supplement in Training. Tennis sports consume a lot of energy, because of excessive sweat in training, insufficient inorganic salt and water in the players, it may also lead to imbalance of the internal environment of the players, resulting in the occurrence of sports fatigue, so some inorganic salts and minerals should be properly supplemented in training. However, it can be seen from Table 3 that athletes seldom supplement inorganic salts in the process of sports training, and 18 people supplement saline less than the general level, accounting for 60.00%. In this case, sports fatigue may lead to the decline of movement quality. In Table 4, most of the players only think that their movement quality is general. It can be seen that the popularization of health knowledge in training is very important to improve sports performance.

Table 3. A list of sweats and saline supplements during training (N=30).

	Quite a lot		More		Commonly		Less		Few	
Numbern/%	Numberne/%	Numberne/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%
Sweat during training	7	23.33	9	30.00	13	43.33	1	3.33	0	0.00
Saline supplementation in training	0	0.00	3	10.00	9	30.00	9	30.00	9	30.00

Investigation and Analysis of the Quality of Self-Sensing Movements in Training

Table 4. A list of quality of self-sensing movements in training (N=30).

Excellent		Good		Commonly		Not good		Bad	
Numbern/%	Numberne/%	Numberne/%	Numberne/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%	Numbern/%
4	13.33	6	20.00	20	66.67	0	0.00	0	0.00

Investigation and Analysis of Athletes' Recovery after Training

Recovery process refers to the process of physiological function and energy substances gradually restoring to the pre-exercise level during and after exercise. During this period, the energy consumed and the functional status of organs and systems not only restored to the original level, but also exceeded the original level. This phenomenon is excessive recovery. In order to promote recovery and even achieve excessive recovery, there are sports, physical and nutritional means.

As far as sports means are concerned, collation activities refer to some relaxed physical exercises that accelerate the recovery of body function after exercise. From Table 5, we can see that most of the players do not attach importance to organizing activities after training, only occasionally or not. Positive rest is a method of eliminating fatigue by changing the position and type of exercise and adjusting the intensity of exercise after exercise. Because active rest can alleviate the mental and muscle fatigue caused by training, tennis players in selective classes pay less attention to active rest.

Hot water bath, massage, music and other physical means to promote recovery. Hot water bath and music can relieve physical and mental fatigue. Table 5 shows that 17 players take hot water bath every day, accounting for 56.67%, which is very helpful for the adjustment of mental state after training. Music means are more focused on personal hobbies. Three players who like music use it as a means to relax their spirit every day. Massage can promote telangiectasia, improve local blood circulation and nutritional status, help to eliminate lactic acid and other metabolites in muscle, and eliminate the reaction of muscle stiffness and pain after exercise. In addition, massage can play a soothing and analgesic role in the central nervous system. Most of the athletes in the school team only do massage occasionally or never, which may be related to conditions, lack of corresponding masseurs and team doctors.

Psychological guidance is of great significance to the recovery of physical fitness, especially mental state. Table 5 shows that the Tennis Team of Wuhan Institute of Physical Education has almost ignored the psychological status of athletes, up to 14 players have never done the corresponding psychological guidance.

The substances consumed during exercise should be supplemented by the nutrients in the diet, and a reasonable diet can accelerate the recovery of function. From Table 6, it can be seen that the diet and nutritional status of the team members are general, and they pay more attention to high-protein foods such as eggs and milk. Breakfast is very important for the human body. Without breakfast, it can easily lead to sports anemia, dizziness, heart deficiency and other symptoms. As many as 19 people only occasionally eat breakfast, and three athletes do not eat breakfast, this situation needs to be changed. Vitamin C enhances the anti-stress ability and immunity of the body to the external environment. Vitamin B12 is an indispensable and important element for the formation of red blood cells. Vitamin B6 is mainly used in human blood, muscle, nerve, skin, etc. Its functions include the synthesis of antibodies, the manufacture of gastric acid in digestive system,

the utilization of fat and protein, etc. These vitamins are beneficial to the recovery of fatigue. Vitamin supplementation is not popular during athletes' training. Summarizing the means of nutrition recovery, we can see that the whole nutritional status of the tennis team of Wuhan Institute of Physical Education is general, which may be related to the fact that all the players are college athletes, and there is no unified dietary nutrition expenditure as part of personal living expenses.

Investigation and Analysis of Recovery Means after Training

Table 5. List of means of recovery after training (N=30)
(Except for nutrition measures).

	Do everyday		Often do		Occasionally do		Never	
	Number	%	Number	%	Number	%	Number	%
Finishing exercise	1	3.33	3	10.00	24	80.00	2	6.67
Positive rest	6	20.00	10	33.33	14	46.67	0	0.00
Hot water bath	17	56.67	7	23.33	6	20.00	0	0.00
Massage	0	0.00	3	10.00	20	66.67	7	23.33
Music	3	10.00	9	30.00	15	50.00	3	10.00
Psychological	1	3.33	1	3.33	14	46.67	14	46.67

Investigation and Analysis of Nutrition Supplementation in Peacetime

Table 6. A list of nutritional supplements in peacetime (N=30).

	Quite a lot		More		Commonly		Few	
	Number	%	Number	%	Number	%	Number	%
肉	6	20.00	7	23.33	15	50.00	2	6.67
蛋	3	10.00	6	20.00	17	56.67	4	13.33
奶	5	16.67	7	23.33	14	46.67	4	13.33
蔬菜	3	10.00	6	20.00	17	56.67	4	13.33

Investigation and Analysis of Breakfast Situation

Table 7. Breakfast situation list (N=30).

Often		Occasionally		Never	
Number	%	Number	%	Number	%
8	26.67	19	63.33	3	10.00

Investigation and Analysis of Vitamin Supplementation

Table 8. List of vitamin supplements (N=30).

Often		Occasionally		Never	
Number	%	Number	%	Number	%
5	16.67	20	66.67	5	16.67

Conclusion and Suggestion

Conclusion

During the training period, the exercise load of the tennis class students in Wuhan Institute of Physical Education is appropriate, and most of the athletes express their adaptation.

Athletes' supplement of inorganic salt and water is insufficient in normal training. The

popularization of health knowledge in training needs to be improved.

Although the amount of training is appropriate, the recovery means of athletes after training are not scientific enough, which to some extent has become a factor restricting the further improvement of team performance.

Targeted supplementation of sports nutrition can promote the recovery of sports fatigue.

A combination of various means should be adopted to accelerate the recovery of fatigue, and the effect is better and more obvious.

Recommendations

On the basis of the existing training load, under the condition that most athletes can adapt to the load, coaches can make individual training plans according to the training conditions of the players, so as to explore the potential of the players more.

Coaches should strengthen athletes' consciousness of salt and water supplement. Schools should also strengthen the construction of relevant sports health courses to improve the theoretical level of sports health care for athletes.

Increase the proportion of organizing activities and active rest in training. For example, after strength training, do some stretching and relaxation exercises for the muscles with load; at the end of the training course, arrange some jogging, basic gymnastics, games and so on with the arrangement of activities.

While insisting on hot water bath, we should emphasize the rationality of water temperature. According to the oxygen consumption during bathing, the oxygen consumption is the lowest when the water temperature is 36 C. Oxygen consumption is the lowest when water temperature is 36 degree C. When the water temperature rises by 1 degree C, the pulse increases by 10 times per minute, so too long or frequent bathing can also cause fatigue. The ideal and effective way to take a bath is to take a massage or go to bed at the water temperature of about 40 degrees C.

Increasing the number of massage relaxation can provide corresponding massage courses for gymnasts to relax each other during rest time. Massage time should be arranged after the water bath, each massage can be carried out for 20 to 30 minutes, tennis players massage focus on lumbar muscles, back muscles and calves. The length, depth and intensity of massage are different for each athlete. Massage and kneading should be used during recovery, and tremor massage can also be widely used. The order of massage generally starts with light press, and gradually transits to push, massage, kneading, pressing and buttoning. Massage can cooperate with local shaking and passive activities so that the effect will be better.

Strengthen the psychological health guidance of tennis players. Psychological recovery means include relaxation training, hypnotic suggestion of breath adjustment, psychological adjustment and so on. Relaxation training uses supine posture, legs relax and straighten, arms naturally placed on the side of the body, gradually complete relaxation from head to foot, each relaxation about 10 times, adhere to once a day. Hypnosis is an important method to restore the working ability of athletes, which can make the organism eliminate fatigue or excessive tension in a short time and get full physical recovery.

Relatively improve the life allowance of college athletes to ensure the nutritional level. The importance of breakfast should be emphasized. After morning training, breakfast should be unified. We should strengthen supplementary training in the Department of Nutrition, guide vitamin supplementation and supplement it when necessary.

Reference

- [1] Writing Group of General Textbooks of National Institute of Physical Education. Tennis [M]. Beijing: People's Sports Publishing House, 1999:147-149.
- [2] Zhu Dapeng. Generation and Elimination of Sports Fatigue [J] Journal of Wuhan Institute of Physical Education, 2002 [5]: 50-51.

- [3] Yang Guanghui. Investigation and analysis of fatigue status of college calisthenics athletes [J]. Journal of Yang Normal University, 2007, 25 [2]: 269-272.
- [4] Ye Dongmao. Diagnosis and recovery of ball players' fatigue [J]. Beijing Sports Science and Technology, 2003, 22 [2], 185-187.
- [5] Yao Hongen. Sports Health Care [M]. Beijing: Higher Education Press, 2003:145-148.
- [6] Wang Ruiyuan et al. Sports Physiology [M] Beijing: People's Sports Publishing House, 2002:305-316.
- [7] Wang Jinwen, Liu Hanyang, Tong Qiliang. Sports Physiology [M]. Beijing: People's Education Press, 2000:240~246.
- [8] Yue Wenyu. Summary of research on the characteristics of sports fatigue. [J]. Sports Science and Technology of China, 2003 [10]: 50-53.
- [9] Hu Qi. On Sports Fatigue and Recovery [J]. Journal of Shanxi Normal University College of Physical Education, 2004 [1]: 87-89.
- [10] Climax. Analysis of Sports Psychological Fatigue [J]. Journal of Shanxi Normal University College of Physical Education, 2004 [1]: 87-89.
- [11] Chen Minxiong. Sports fatigue and special nutritional supplements for eliminating fatigue [J]. Anhui Sports Science and Technology, 2003 [9]: 52~54.
- [12] Fu Kecui, Chen Juping, Chen Yuanwu. Summary of Sports Fatigue [J] Sichuan Sports Science, 2004 [2]: 30-33.
- [13] Fatigue characteristics and physical recovery of Wang Wensheng's long-distance runners [J]. Journal of Military Institute of Physical Education, 2007, 26 [2]: 121-123.
- [14] Wanli. The effect of active rest on lactic acid clearance in exercise-induced fatigue [J]. Hubei Sports Science and Technology, 2003, 22 [1]: 54-55.
- [15] Liu Rongjuan. Summary of Sports and Freedom Base Research [J]. Hubei Sports Science and Technology, 2003, 22 [2]: 188-189.
- [16] Wang Xisheng and Liu Zhanjie. Tennis. People's Sports Publishing House. 1997.9.
- [17] Wang Zhijun. The influence of tennis players' EQ on competition [J]. Journal of Nanjing Institute of Physical Education, 2007, 6 [1]: 57-59.
- [18] Xu Yuanhua, Luo Yuanfang. A review of free radical theory on the mechanism of muscle fatigue and muscle injury [J]. Journal of Nanjing Institute of Physical Education, 2007, 6 [1]: 20-23.
- [19] [Liao Jianqi, Recovery Mechanism of Body Energy Substances after Exercise [J]. Journal of Wuhan Institute of Physical Education, 2003 (2).
- [20] Rong Jiaqin, Han Xiangping. Research on Fatigue and Recovery in Sports Training [J]. Journal of Wuhan Institute of Physical Education, 2001, 35 [6]: 61-62.
- [21] Tao Zhixiang, Tennis, Beijing Sports University Press. One thousand nine hundred and ninety-nine point eight.