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Assessment on the Immune Function Status of Various Excellent Athletes' Cellular Fluid

Zhang Zhen-Feng*

P.E. Department, Zhengzhou Institute of Aeronautical Industry Management, China

Abstract: Purpose: Explore the parameters of excellent athletes' body immune status for various sports and better understand athlete's immune function status, thus providing guidance for athlete's daily training, adjusting exercise load timely, and adopting scientific exercise methods to improve various body functions. Method: Choose 186 athletes from various provinces and cities in China, including basketball players, weight lifters, fencers, track men, modern pentathletes, and military pentathletes. And then comparative analysis should be conducted on 186 athletes and 173 control personnel from physical examination center. Determine the T, B and NK lymphocyte subsets and other immune parameters of various athletes, divide the athletes into groups based on their sports events, take them as the experimental group, and then compare them with the control group. Result: Comparing the immune indexes of various athletes with that of the normal people, it can be found that the indexes of T suppression lymphocyte (CD3+CD8+) and NK lymphocyte (CD3-CD56+) are both lower than that of the control group ($P < 0.05$), while the body immune function status is of no statistical significance ($P > 0.05$). It can be seen by comparing the various athletes' immune indexes that the CD3+ and CD3+CD4+ indexes of Group 2 and Group 3 are higher than that of Group 1 ($P < 0.05$); the CD3-CD56+ index of Group 3 is lower than that of Group 1 ($P < 0.05$); the CD3-CD19+ index of Group 1 and Group 3 is lower than that of Group 2 ($P < 0.05$). Conclusion: Various athletes have different immune indexes, Compared with the normal people, athletes have lower basic immune parameters of T, B and NK lymphocyte.

Keywords: Cellular fluid, excellent athletes, immune function, status assessment.

1. INTRODUCTION

To enhance the competitive ability training better and improve sport performance, we need to understand athlete's immune function, timely master the variation of various functions, and take correct training measures, thus preventing athletes from the decline in immune function [1]. It is of great significance to study the immune function of athletes. Dividing the athletes into groups and determining and assessing their lymphocyte subsets and other indexes based on the event group theory and according to the type, skill and various comprehensive indexes of different sport events are able to master athlete's immune function status better and provide some help for further study of various excellent athletes' immune function status.

2. INFORMATION AND METHOD

2.1. General Information

Randomly select 186 athletes from various provinces and cities in China, including basketball players, weight lifters, fencers, track men, modern pentathletes and military pentathletes of 13-45 years old (average age 19.52±4.51). See Table **1** for the number of athletes for each sport event.

Divide the 186 athletes into three groups according to different event groups, namely, Group 1 (focusing on physical ability: weight lifting and track and field), Group 2 (focusing on skills: basketball+ fencing), and Group 3 (comprehensive: modern pentathlon and military pentathlon). The control group is composed of 173 people from the physical examination center of our institute, with the age of 18-42 years old and average age of 20.13.52±5.65 years old.

2.2. Method

Collect venous blood from the two groups on an empty stomach, and utilize the flow cytometer to detect six immune parameters of T lymphocyte (CD3+), assistant T lymphocyte (CD3+CD4+), T suppression lymphocyte (CD3+CD8+), body immune function status (CD4/CD8), B lymphocyte (CD3-CD19+) and NK lymphocyte (CD3-CD56+) [2].

3. SELECTION OF REAGENT

Optilyse C imported from America, four-color monoclonal antibodies CD3/ CD45 /CD8/ CD43/ CD19/ CD56 marked by FITC/RDL/PC5/ECD, sheath fluid, etc. are selected.

4. STATISTICAL TREATMENT

The detection result is expressed by the mean standard deviation "±", sPss19.0 statistical software system is adopted, and LSD analysis is used for the comparison among

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Table 1. Number of athletes for various sport events.

Sport event	Basketball	Weight lighting	Fencing	Track and field	Modern pentathlon	Military pentathlon
Number of athletes	32	40	34	22	38	20

Table 2. Various immune indexes comparison between athletes and control group ($\bar{X}$±s/%).

Group	Case/n	$CD3^+$	$CD3^+CD4^+$	$CD3^+CD8^+$
Athletes	186	63.78±7.26 *	33.21±5.89 *	26.77±9.07 *
Control	173	67.21±8.09	36.71.±7.43	29.42±8.06

Group	Case/n	CD4/CD8	$CD3^-CD19^+$	$CD3^-CD56^+$
Athletes	186	1.43±0.94	13.21±7.65	12.06±5.32 *
Control	173	1.31±0.53	16.43±7.83	19.11±9.62

Note: Compared with the control group, * $P < 0.05$;

Table 3. Impact comparison of various athletes' immune indexes ($\bar{X}$±s/%).

Group	Case/n	$CD3^+$	$CD3^+CD4^+$	$CD3^+CD8^+$
1	62	59.12±6.29	30.212±3.88	24.98±7.06 *
2	66	64.57±7.75 *	32.98.±8.15 *	26.14±5.08
3	58	65.13±7.84 *	31.76±6.43 *	27.17±6.17

Group	Case/n	CD4/CD8	$CD3^-CD19^+$	$CD3^-CD56^+$
1	62	1.22±0.47 *	311.54±5.41 **	15.79±8.09
2	66	1.45±0.53	12.99±6.05	14.02±6.74
3	58	1.40±0.37	10.4±3.76 **	11.42±5.73 *

Note: Compared with different groups, * $P < 0.05$;

groups. When $P < 0.05$, the difference is of statistical significance.

5. RESULT

5.1. Various Immune Indexes Comparison between Athletes and Control Group

It can be found through blood index inspection that when various immune indexes are compared between the athletes from sports event group and the normal people, the CD3+CD8+ and NK lymphocyte (CD3-CD56+) are both lower than that of the control group and the difference is of statistical significance ($P < 0.05$), while the body immune function status (CD4/CD8) is of no statistical significance ($P > 0.05$). See Table **2** for details.

5.2. Immune Index Comparison of Various Athletes

Through comparison, it can be seen that CD3+ and CD3+ CD4+ indexes of Group 2 and Group 3 are higher than that of Group 1 ($P < 0.05$); CD3-CD56+ index of Group 3 is lower than that of Group 1 ($P < 0.05$); and CD3-CD19+ index of Group 1 and Group 3 is lower than that of Group 2 (Table **3**).

6. DISCUSSION

Exercise exerts a significant impact on the variation of T cell and B cell. Authoritative literature studies indicate that the rise in epinephrine and cortisol concentration in blood can restrict the functions of T cell [3]. Meanwhile, cortisol can restrain the normal function of mononuclear cell, thus reducing the release of IL-2, preventing lymphocyte from entering a cycle and the lymphocyte in cycling blood from transferring to peripheral lymphoid tissue, and reducing the number of cycling T cell and B cell [4].

This study preliminarily indicates that the athletes' various indexes of T lymphocyte (CD3+), assistant T lymphocyte (CD3+CD4+), T suppression lymphocyte (CD3+ CD8+), B lymphocyte (CD3-CD19+) and NK lymphocyte (CD3-CD56+) are lower than that of the normal people when compared with the control group. This phenomenon may be closely related to the increasing epinephrine and corticosteroid caused by mechanism and exercise. Relevant study materials indicate that after lots of exercise, human body's CD4/CD8 value may decline, which means that the body shows a decline in immune function, but it is transient. In this study, various athletes' CD4/CD8 is compared with that

of the control group, with no statistical significance. Maybe it is because these athletes are at the status of high-intensity and heavy-load exercise for a long time, resulting in the stress response of body, which is the result of an adaptive performance. This study also finds that the T lymphocyte (CD3+) and assistant T lymphocyte (CD3+CD4+) of athletes from Group 2 and Group 3 are obviously more than that of Group 1 ($P < 0.01$); the NK lymphocyte (CD3-CD56+) of Group 3 is less than that of Group 1; B lymphocyte (CD3-CD19+) of Group 1 and Group 3 is less than that of Group 2 ($P < 0.05$). Therefore, it can be seen that due to the large amount of exercise and many items, the event group focusing on physical ability and the comprehensive event group have a large number of free radicals in their body that cannot be scavenged by the body antioxidant enzyme system, thus accumulatively excessive free radicals attack and break the double-molecular structure of cell membrane lipid, mitochondrial membrane and other membrane system structures and functions, cause damage to cells, and inhibit T and B lymphocyte [5]. The vitality and quantity of NK cell are important indexes, mainly reflecting the function of body immune system; however, CD3-CD56+ represents its surface differentiation antigen. The studies conducted by Tvede, a famous scholar, and relevant personnel in foreign relevant fields indicate that moderate exercise and training can make the quantity of NK cells increase, thus improving the body immune function. However, excessive training may cause the decrease in NK, thus inhibiting the body immune function [6]. In this study, the NK lymphocyte (CD3-CD56+) of athletes from Group 3 is obviously less than that of Group 1 ($P < 0.05$), further indicating that the NK lymphocyte of athletes focusing on physical ability is more than that of athletes from comprehensive event group, which corresponds to the previous reports [7].

Low-oxygen environment may cause the change of body and involves many human body systems. There is a complex relation between the physiology and pathology of many organs. In different environment, the dwelling time, sensitivity, and altitude all may affect the immune function of athletes. After blood system changes, it can reflect the specific index of low-oxygen environment and in low-oxygen environment, human body adjust itself through the change in the number of red blood cells, thus enhancing the oxygen carrying ability of blood and solving the anoxic problem. In order to avoid the toxic effect produced during oxygen metabolic process, aerobe has developed the ability to adapt to the environment after long-time evolution. In case blood viscosity increases, blood flow resistance rises, thus changing the feature of red blood cell membrane and reducing the fluidity of cell membrane. The international blood study report indicates that when in low-oxygen and oxygen-deficient environment, the SOD vitality of plasma in human body may reduce and energy metabolic disturbance and product accumulation may occur. And when xanthine and hypoxanthine react with oxidase, O2- may be produced, thus red cell membrane is peroxided and the fluidity of cell membrane declines continuously, which may result in the constant accumulation of red cells, deformability is affected, blood viscosity increases, and the metabolism of red blood cell is influenced. According to the analysis on influencing factor of altitude, it can be found that the object of study may suffer from mitochondria damage and increasing kompensatorisch and ATPase of experimenters is inhibited, thus resulting in the decline in ion transport ability and abnormal energy metabolism of red blood cells. The study shows that when human is at low-oxygen and oxygen-deficient status, the vitality of ATPase of red blood cell membrane declines continuously, cell Na+ and Ca2+ increase and K+ Mg2+ decrease. The function maintenance of red blood cells needs to be based on the concentration difference of high cell ions. If the concentration difference is changed, lipid peroxidation may occur when free radicals clean up the obstacles, and the accumulated MDA will affect the vitality of C3b receptor on the surface of red blood cells and react with the free radical of protein to cause the cross-linking of protein molecules as well as that of biogenic amines and phospholipids, breaking the normal structure of biological molecular and biological membrane, declining the immune function of cells, making the immune complex in blood circulation deposited on blood vessel wall, and causing a series of pathological changes. SOD goes through the red cell membrane damaged by lipid peroxidation and spills, reducing the vitality and accelerating the aging and death of red blood cells. The decreased deformability of red blood cells can result in the microcirculation disturbance, increased blood viscosity, and other changes in blood rheology, thus reducing oxygen supply and metabolism, gradually making cell and organization aged, and resulting in the difference of self-regulation between organ and individual complement system of changes and antibody and T cell through the damage of dissolution and homologous restriction. Most microorganisms have no complement control protein, nor resistance to the damaging effect caused by complement activation. However, the normal body cells have varied complement control protein, which can inhibit complement activation. On the one hand, CD55 can prevent C3 and C5 invertases from assembly through the classic pathway and alternative pathway; on the other hand, it can induce the catalytic units of C2a and Bb to dissociate rapidly, thus making the existing invertases of C3 and C5 lose stability and inhibiting the activation of complement attack unit. The high sensitivity to the haemolysis induced by complement can result in the haemolytic anaemia.

In order to better master athlete's immune function status, we need to enhance the study on athlete's basic immune parameters, monitor and assess various indexes, and master the change rule of immune function, thus providing guidance for the daily training of athletes. Besides, we should scientifically arrange the training activity and timely adjust exercise load in combination with the change law of athlete's physical ability; gradually enhance sport skills and improve sport performance under the premise of athletes' being in good health. In a word, it is of great significance to study the immune function status of athlete's cellular fluid, thus we should pay high attention to it, continuously enhance study based on practice, and strengthen the scientificity of athletic training.

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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