

Relationship between the Sports Ability of Sports Tennis Players and Minerals and Vitamins

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Abstract: *High-intensity training and competition consume a lot of physical energy for tennis players. It is not enough to rely on exercise means, physics means and sleep for recovery. The substances consumed during exercise are mainly supplemented by the intake of nutrients in the diet. Although energy intake basically meets the demand, there are situations where carbohydrate intake is too low and protein intake is too high. In the intake of minerals and vitamins, half of athletes do not meet the recommended intake standards. Therefore, this article uses minerals and vitamins as the starting point to explore their impact on sports tennis athletes' athletic ability, and conduct simulation experiments on our city's tennis athletes. The experimental results show that only 54.3% of players know the correct three-meal ratio. The high concentration of vitamin C reduces the lipid peroxidation damage of the skeletal muscle cell membrane, thereby reducing the degree of muscle soreness and speeding up recovery. High-intensity training can increase the excretion of Ca in urine and decrease of Ca in blood below the clinical standard. Supplementing Mg additives can effectively enhance athletes' skeletal muscle and cardiac muscle function. Sports tennis players can enhance immune function and relieve fatigue and muscle aches by supplementing vitamin C.*

Keywords: *Tennis Player, Athletic Ability, Minerals and Vitamins, Sports Training, Dietary Nutrition*

1. Introduction

Tennis players often have delayed muscle soreness, especially in the amateur training of young volleyball players; muscle soreness is often accompanied by muscle stiffness and muscle function reduction, which greatly affects the normal training, competition and daily life. The intake of nutrients in the diet can supplement the nutrients consumed by athletes, so as to maintain the physiological health of the body and improve the adaptability of athletes to training and competition.

Tennis is a competition event composed of high-intensity movements in a long competition time. It requires athletes to have high-speed anaerobic explosive force and the ability of intermittent exertion of sub ultimate strength when attacking. The purpose of the plumm study was to assess the incidence and prevalence of injuries and diseases among elite young tennis players. The research of plumm shows that the incidence of overuse injury of excellent young tennis players is very high, which indicates that it is necessary to pay attention to the preventive measures in the early stage, especially to monitor and manage the workload [1,2]. The application of advanced engineering technology in tennis racket design affects the essence of tennis. Therefore, the International Tennis Federation has formulated rules to limit the performance of the game, in order to protect the nature of the game. Allen explained the influence of the change of racket on the racket system. Allen's research shows that the nature of the racket affects the bounce of the ball. The rebound speed of the ball increases with the increase of frame stiffness and the decrease of rope tension. Reduce the contact force between strings and increase rebound spin [3]. Thrower research aims to understand the education and support needs of British tennis parents in different situations and development stages. Thrower's theory is based on the idea that only by placing parents in a supportive learning environment and providing them with structured education, the effectiveness of such education will depend on parents' learning motivation and the continuous support of key stakeholders. Thrower discussed the content, structure and opportunity of parent education and support in high-level Tennis Center [4]. Tennis practice, especially at elite level, may expose athletes to the risk of musculoskeletal injury. The purpose of the maquirriain study was to analyze the epidemiological pattern of tennis players' retirement due to health status during the Davis

Cup competition from 2006 to 2013. The research results of maquirriain provide a scientific basis for the injury mode of Chinese male professional tennis players and help to formulate better injury prevention strategies [5].

Vitamins and minerals participate in various metabolism of the body. It plays an important role in maintaining human life activities [6]. Lack of vitamin and mineral intake, teenagers engaged in sports activities will increase the risk of health disorders. Beata evaluated the intake of vitamins and minerals in boys aged 13-15 years. The significant imbalance between the average intake and the percentage of undernutrition indicated that there were significant differences in vitamin and mineral intake among the boys studied, which was the reason for the dietary imbalance. Beata's study found inadequate intake of vitamin D, potassium, folic acid, calcium and a small amount of magnesium, vitamin C and E. Beata believes that in order to avoid nutritional errors in the future, it is necessary to carry out reasonable nutrition education for students, parents and teachers [7]. The peels of vegetables and fruits are treated as waste and thrown into the environment. However, some studies on the pericarp have shown that there are many important phytochemicals with various biological activities. Khattak determined the contents of vitamins and minerals in peel samples of seven underground vegetables. Khattak's research results confirmed that the peel is rich in minerals and vitamins, and can be used as food, feed and dietary ingredients after proper processing [8]. Sugiharto studied the effects of Multi Chain probiotics, vitamins and minerals on growth performance, hematological indexes and carcass traits of broilers. Sugiharto's study showed that 0.5% Multi Chain probiotics, combined with vitamins and minerals, could improve the digestive function and physiological status of broilers [9]. Diet has been considered to be a key factor affecting fetal and maternal health, and appropriate levels of substances such as cysteine, folic acid and vitamin B12 are associated with the success rate of infertility treatment. However, there are few data on the average levels of micronutrients in the blood of women of childbearing age, and there are no specific values for appropriate levels. The purpose of the La study was to measure folic acid, homocysteine, and certain vitamins and minerals in women who visited the infertility Department of an academic IVF hospital. La studies have shown that folic acid levels are seriously inadequate in women undergoing IVF at infertility clinics. Vitamin B12 levels were also found to be inadequate [10].

By using the method of systematic tracking test, this paper collects and sorts out the data of physiological and biochemical indexes of tennis players in our city during the training period. It aims to provide reference for scientific and high-level tennis training by analyzing the physical function state, index changes and nutritional recovery measures of high-level tennis players in China. It also makes a beneficial exploration for the establishment of training methods and nutrition supplement strategies suitable for Chinese high-level tennis players.

2. Tennis Player with Minerals and Vitamins

2.1 Tennis Players

Compared with other net sports, the tennis field is larger, which makes tennis more emphasis on flexible stop, change direction and faster translation speed. The competition time of high-level professional tennis competition is long, and the requirements for athletes' physical fitness and endurance are high [11]. In tennis, the speed of the ball is often the key to score, and strength, especially fast strength, that is explosive power, is one of the key physical qualities to improve the ball speed. Pace is an important part of tennis technology. Due to the large field of tennis, there are many ways to attack. This feature makes tennis emphasize flexible movement and fast braking, starting and changing direction, and requires players to quickly move to a good position to catch the ball, do well in defense and look for opportunities for defense and counterattack. Service score is one of the important channels of tennis score. Usually in a tennis match, a large proportion of the scores are directly won by serving. Therefore, in tennis, tennis players have been pursuing a high level of stable service and reception. Volleying is an aggressive hitting method in tennis, which belongs to the technology in front of the net. This kind of technique returns the ball the speed to be fast, the strength is bigger, the threat is also bigger, the high level athlete's utilization is also more common, but the good display depends on the athlete's speed quality and the explosive strength, especially in the high level professional competition field. High pressure ball in tennis is a standard strong offensive technique. Generally speaking, playing high pressure ball means scoring. Because the incoming ball is not controlled by your own side, it forces the batter to react quickly and move flexibly. It also has higher requirements for the batter's waist and abdomen strength and wrist control ability. Strength quality directly

determines the strength of the ball and the flying speed of the ball. The movement speed of speed quality determines the speed of running and the exertion of hitting power, while the reaction speed affects the success rate of receiving the ball. Endurance quality determines the duration of competitive ability of athletes [12].

The proportion of the world's top professional tennis players with higher height is far more than that with lower height, which also shows that in the high level of professional tennis, the high height players have obvious advantages over the lower height players in the competition. Height is a physiological index to evaluate the vertical growth and development level of human body. In tennis, serving is one of the most important scoring points, and it is also the only hitting skill that will not be affected by opponents in tennis competition. The height of players directly affects the landing point of service. Weight is a physiological index to evaluate the development level of human body's lateral development. For ordinary people, the greater the weight is, the greater the absolute strength is. The importance of strength quality in tennis matches is self-evident. Tennis attaches great importance to the speed of the ball, and the influence of weight index on strength quality ultimately lies in the strength and speed of the ball when hitting. BMI reflects the relationship between body height and weight. In the field of professional men's tennis in which the individual body fat ratio is not significantly different, players with larger BMI index have higher muscle mass and greater strength when hitting the ball, but their sports load naturally increases.

2.2 Dietary Nutrition of Athletes

For more than one hour's competition or training, athletes should maintain their normal blood glucose level; prevent dehydration and immune suppression reaction through sports drinks containing sugars and electrolytes. In half an hour after exercise, a certain amount of carbohydrate and protein should be added, and dinner should be arranged within 2 hours after exercise. Because during this period of time, the human body glycogen regeneration efficiency is the highest. When the athlete dehydrates to 2% of the body weight, the athletic ability will obviously decrease. When the athlete reaches 4% or more of the body weight, it may lead to heat failure, heat shock and even life-threatening. Athletes in training or competition, according to the actual situation, need liquid supplement. Therefore, every once in a while, athletes should supplement sports drinks; in addition, athletes should also pay attention not to wait for thirst before rehydration. During the period of weight loss, athletes should ensure a certain amount of energy, avoid high sugar and high fat food, and ensure the intake of various inorganic salts and vitamins; in the diet of energy control, you can eat food rich in dietary fiber before meals, and drink appropriate amount of water, because these dietary fiber has strong water absorption and expansion function, can bring strong satiety and inhibit appetite, Drinking water needs to be controlled daily, but not too little; carbohydrate intake must be sufficient to maintain muscle strength during weight loss. Athletes in the weight control period usually adopt the way of limiting diet. Limiting diet is not diet, but mainly to limit the intake of fat and excessive intake of carbohydrate. Essentially speaking, it is necessary to limit calorie intake, achieve negative balance and reduce weight. At the same time, comprehensive and balanced nutrition is very important to improve athletes' competitive ability and achieve excellent results. Reasonable nutrition can ensure that athletes have good physical fitness in training and competition, and help athletes quickly eliminate sports fatigue, help athletes successfully realize training plan and improve competition performance.

The fundamental difference between athletes and ordinary people is that athletes need to add extra fluid to make up for the loss of water caused by sweating, and they also need to eat more calories to supplement the energy consumed by physical exercise. Carbohydrates are the best source of extra energy, and in some projects additional nutrients are needed to meet excessive energy consumption. Therefore, in order to meet the needs of high energy intake, athletes should first choose the diet with carbohydrate as the main ingredient, carbohydrate food and so on. But for most athletes, the energy provided by these two dietary guidelines is always less than the athlete needs. In this case, in order to ensure the balance and diversity of dietary intake, these athletes can also increase the intake of dairy food and protein, and at the same time, ensure the proportion of the three major energy supply substances recommended in the dietary guidelines. On the contrary, athletes with low energy demand should choose foods with high nutritional density to ensure adequate intake of carbohydrate, protein and trace elements.

A high carbohydrate diet will increase glycogen storage, thus prolonging the exhaustion time, while a very low carbohydrate diet will reduce the athletic ability of athletes. The oxidation of carbohydrate is determined by the intensity and time of exercise. ATP is mainly provided by the latter under high exercise intensity. Due to the high intensity of exercise in the specific preparation stage and

competition stage, the demand for ATP provided by carbohydrate will increase under the condition of annual training cycle. However, considering the large amount of exercise reserves in the general preparation period, the absolute amount of carbohydrate required is very high, so carbohydrate rich food should be the main food during the training period. A diet with high carbohydrate content can contribute to the production and storage of muscle glycogen. In the long-term endurance exercise, the super compensated muscle glycogen level can improve the exercise ability compared with the ordinary glycogen level. However, for short-term exercise, the effect is small; time, type, daily protein intake and exercise cycle have a decisive role in protein synthesis and recovery after exercise. Protein also provides energy at rest and during exercise, but in athletes with adequate energy reserves, protein provides less than one twentieth of the total energy consumption. When the exercise time becomes longer, the protein will maintain the stability of liver glycogen through gluconeogenesis.

2.3 Minerals and Vitamins

Vitamins and minerals play an important role in energy supply, hemoglobin synthesis, bone health, promoting immune system and protecting body tissues from oxidative damage. After athletes exercise, vitamins and minerals are also involved in the formation and repair of muscle tissue. Theoretically speaking, sports training can enhance or change the utilization of vitamins and minerals in many aspects, and also cause the loss of many trace elements. Therefore, adequate intake of trace elements is the fundamental guarantee for athletes to repair and maintain lean weight. For athletes with strict diet control or acute weight loss, picky eating or high carbohydrate and low micronutrient diet will lead to extreme vitamin and mineral deficiency. Vitamin and mineral supplement need to pay attention to, should choose compound vitamin to improve the whole micronutrient condition. Single vitamin supplements are not recommended unless for clear medical, nutritional or health reasons.

For sports, B vitamins have two main direct effects: first, in sports, vitamin B1, vitamin B2, vitamin B3, vitamin B6, nicotinic acid, vitamin H and so on can be used as energy sources. Second, folic acid and vitamin B12 are involved in the synthesis of red blood cells, proteins, and tissue repair and maintenance. The research on whether exercise training will lead to the increase of vitamin B demand is still very limited. Exercise can double the amount of vitamin demand, which can be supplemented in the increase of diet after exercise; antioxidant vitamins also play an important role in protecting cell membrane from oxidative damage. Since exercise can cause a sharp increase in oxygen consumption, it is believed that long-term exercise leads to long-term oxidative stress on muscles and other cells. Muscle tissue damage is caused by exercise intensity, which can lead to lipid peroxidation of cell membrane. Acute exercise can cause the increase of lipid peroxidation by-products. Restricting exercise can strengthen the antioxidant system and reduce lipid peroxidation. Therefore, excellent athletes generally have better endogenous antioxidant system than ordinary athletes. Athletes with severe deficiency of antioxidant vitamins are often those who over control energy intake, low fat diet and serious lack of fruits and vegetables intake.

Minerals are the general term of various elements that constitute human tissues and maintain normal physiological functions. They are one of the six essential nutrients for human body. The human body contains various elements, in addition to carbon, oxygen, hydrogen, nitrogen and other mainly in the form of organic substances, the rest of the more than 60 elements are collectively referred to as minerals. Although the total amount of minerals in the human body is less than 5% of the body weight and can not provide energy, they can not be synthesized by themselves in the body, they must be supplied by the external environment, and play an important role in the physiological function of human tissues. Minerals are important raw materials to constitute the body tissues. Minerals are also necessary to maintain acid-base balance and normal osmotic pressure. Some special physiological substances in the human body, such as hemoglobin in the blood and thyroid, need iron and iodine to participate in the synthesis. Major elements are important components of human tissues; they regulate the permeability of cell membrane, control water content, maintain normal osmotic pressure and acid-base balance, and maintain neuromuscular excitability in the extracellular and extracellular fluid together with proteins; they constitute the components of enzymes or activate the activity of enzymes, and participate in material metabolism. The essential trace elements are the essential active factors of enzymes and vitamins, constitute some hormones or participate in the role of hormones, participate in nucleic acid metabolism, and assist major elements and macro nutrients to play a role. The minerals related to tennis players' sports ability mainly include potassium, calcium, magnesium, iron, etc.

3. Experiments Materials and Methods

3.1 Experimental Objects and Methods

In this paper, 15 tennis players who participated in the training period and competition period were randomly divided into three groups. Blank group, vitamin supplement group and mineral supplement group.

Through the retrieval and collation of relevant literature, collection of data, and classification of literature, focus on reading and analysis, gradually have a deep understanding and understanding of the research content. To understand the energy supply system and its characteristics of human body movement from the perspective of Biochemistry, understand the research progress of energy balance and personalized nutrition guidance, and provide theoretical basis and empirical basis for the research; for the subjects, weighing method is the main method, supplemented by 24-hour recall method, recording the consumption of all food except flavoring products, tobacco, wine and tea for three days, including one rest day, The amount of cooked food and surplus of each person were measured at meals for 3 consecutive days, and then converted into the amount of food per life.

3.2 Statistical Treatment

Through SPSS16.0 statistical analysis software, the dietary test data were sorted and analyzed to provide data support for the research results. The experimental data were expressed as mean \pm standard deviation "m + SD". Using one-way ANOVA, $P < 0.05$ showed statistical significance, and $P < 0.01$ showed statistical significance. The formula of mean and standard deviation is as follows:

$$\mu = A_n = \frac{a_1 + a_2 + a_3 + \dots + a_n}{n} \quad (1)$$

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2} \quad (2)$$

4. Analysis on the Relationship between Sports Ability and Minerals and Vitamins of Sports Tennis Players

4.1 Analysis of Dietary Nutrition K.A.P.

The results showed that only a small number of athletes knew the seven essential nutrients; all the players did not know what the three major energy supply substances were; only 15.8% of the team members could correctly choose the food rich in protein; 92.2% of the team members could not correctly select the food rich in carbohydrate; 54.3% of the team members knew the correct ratio of three meals. The results of dietary nutrition knowledge survey are shown in Table 1.

Table 1: Survey results of dietary nutrition knowledge

Nutrition knowledge	Know	Do not know
Seven essential nutrients	7.5%	92.5%
Three major energy supply substances	0%	100%
Foods rich in protein	15.8%	84.2%
Carbohydrate-rich foods	7.8%	92.2%
Intake ratio of three meals	54.3%	45.7%

The results of dietary nutrition behavior survey showed that 93.6% of the team members chose to drink water when they were thirsty, and 6.4% of the team members chose to drink sweet drinks to quench their thirst. 76.3% of the team members chose the food according to their own taste, only 16.0% of the team members considered the nutritional value of the food. The survey results of dietary nutrition behavior are shown in Figure 1.

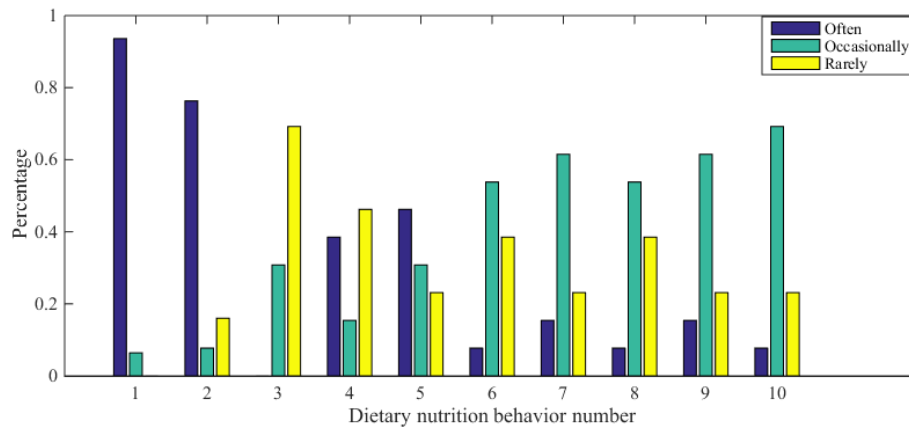


Figure 1: Investigation results of dietary nutrition behavior

Most athletes have realized the importance of dietary nutrition, but few people take the initiative to pay attention to nutrition knowledge. Among the vitamins needed, for tennis, which is a durable project and requires high concentration of nerves, the demand of vitamin B1 is far higher than that of other projects for mobilization. The demand for vitamin B1 is 1.3mg/d (female) and 1.4mg/d (male), while the demand of sports is much higher than that of ordinary people, 5-10mg / d, And according to the different amount of training can be adjusted. Some athletes don't like to eat fresh fruits and vegetables, and their vitamin C intake is far lower than other athletes. After dietary intervention, calcium intake and zinc intake of female athletes were significantly higher than those before dietary intervention, which may be due to the increase of egg milk food and meat in vitamin intake intervention.

4.2 Analysis of Changes of Serum Vitamin C Level

Compared with before exercise, the RPE of the blank control group was significantly increased immediately after exercise, one day and two days after exercise; compared with before exercise, the RPE of vitamin supplement group was significantly increased immediately, one day and two days after exercise. The changes of subjects' subjective physical sensation are shown in Table 2.

Table 2: Changes in subjects' subjective physical strength

	Blank control group	Vitamin supplement group
Before exercise	8.7±1.8	8.7±1.2
Immediately after exercise	16.6±1.7	16.7±2.6
One day after exercise	14.8±2.3	13.7±1.5
Two days after exercise	11.4±2.8	11.7±1.6
Three days after exercise	9.7±2.7	9.6±2.7

Compared with before exercise, the levels of muscle subjective soreness in the blank control group were significantly higher immediately after exercise, one day, two days and three days after exercise; compared with pre exercise, the levels of muscle subjective soreness in vitamin supplement group were significantly increased immediately, one day, two days and three days after exercise, The level of subjective muscle soreness in vitamin supplement group was significantly lower than that in blank control group. The changes of serum vitamin C levels were shown in Figure 2.

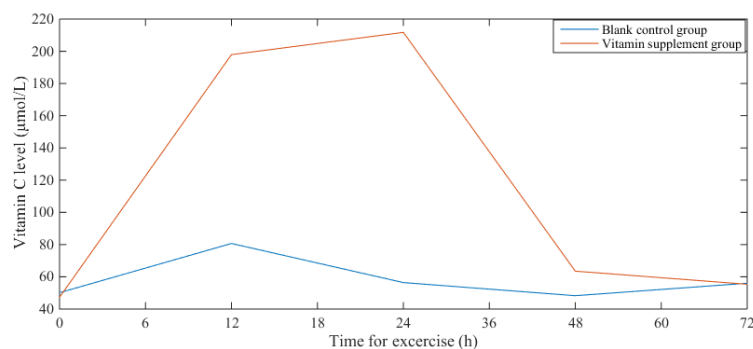


Figure 2: Changes in subjects' serum vitamin C levels

Compared with before exercise, the vitamin C level in the blank control group was significantly increased immediately after exercise; compared with that before exercise, the vitamin C level in the vitamin supplement group was significantly increased immediately after exercise, one day and two days after exercise. The level of vitamin C in vitamin supplement group was significantly higher than that in blank control group immediately after exercise and one day after exercise. In this experiment, the physical strength of the subjects before exercise was very relaxed, and immediately after exercise, they felt very tired, and did not return to the level before exercise two days after exercise, which indicated that although the subjects did not reach the level of exhaustion immediately after exercise, the exercise mode was a high-intensity load. After intensive exercise, the level of subjective muscle soreness increased significantly after exercise compared with that before exercise, and reached the peak one day after exercise, and then the symptoms gradually alleviated, indicating that the exercise induced delayed muscle soreness. The level of serum vitamin C in the blank control group immediately after exercise was significantly higher than that before exercise, which may be due to the physiological increase of blood antioxidant vitamin C caused by acute exercise itself. Vitamin C supplementation can significantly reduce the pain degree of exercise delayed muscle soreness and promote its recovery, but has no obvious effect on subjective physical feeling. High concentration of vitamin C alleviates the lipid peroxidation damage of skeletal muscle cell membrane, thus alleviating the degree of muscle soreness and accelerating the recovery.

4.3 Analysis of the Relationship between Minerals and Tennis Players' Sports Ability

Compared with the normal control group and the food restriction group, the K concentration in the athletes' blood is about 1.04 times of that in the food restriction group, which is significantly increased, and the Cu concentration is about 76% of that in the food restricted rats. However, the K concentration in the blood of the athletes in the food restriction group is also significantly higher than that in the normal control group, and there is no significant difference in the copper concentration. The level of each element in the athlete's body is shown in Figure 3.

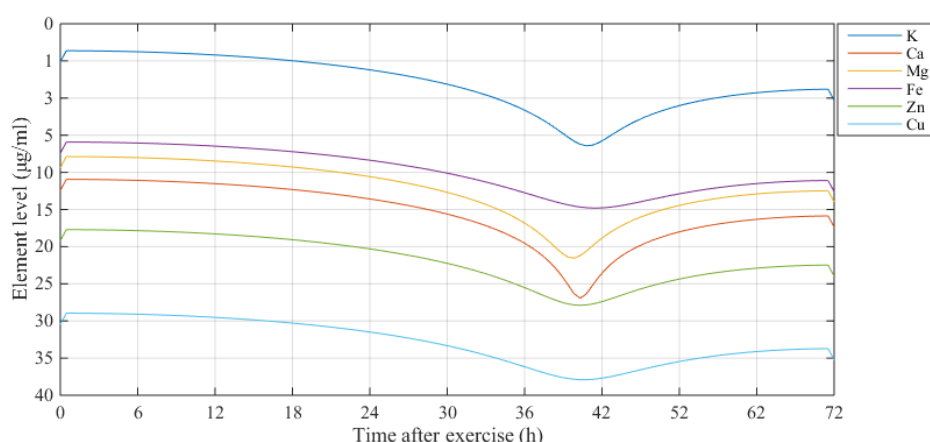


Figure 3: The levels of elements in athletes

The increase of K concentration in athletes may be partly caused by fatigue, while the decrease of Cu concentration may be caused by fatigue; the blood mg and Zn concentrations in the food restriction group are also significantly lower than those in the normal athletes. It is speculated that the decrease of Mg and Zn concentrations may be caused by compound fatigue. There was no significant difference of Ca and Fe in the blood of each group. The results showed that the serum K concentration increased significantly, while the Mg concentration decreased significantly after long-term exercise. After exercise, only the Fe concentration in liver and brain was significantly different from that in normal athletes. This may be due to the increase of myoglobin consumption caused by continuous muscle contraction, which released more Fe to transport to the liver for hemoglobin synthesis. In the absence of Mg additive, Cu may be utilized by antioxidant system during exercise, resulting in the increase of metabolic rate and redistribution of Cu in the body. The change of Zn after exercise may affect the metabolism of other elements. High intensity training can lead to the increase of urinary Ca excretion and the decrease of blood CA below the clinical standard. Supplement of Mg additive can effectively enhance the skeletal muscle and myocardial function of athletes.

4.4 Analysis of the Relationship between Vitamins and Tennis Players' Sports Ability

The intake of VA, VC, VB1, VB2, VE and folic acid of all athletes were lower than the recommended range. The vitamin intake of the subjects is shown in Figure 4.

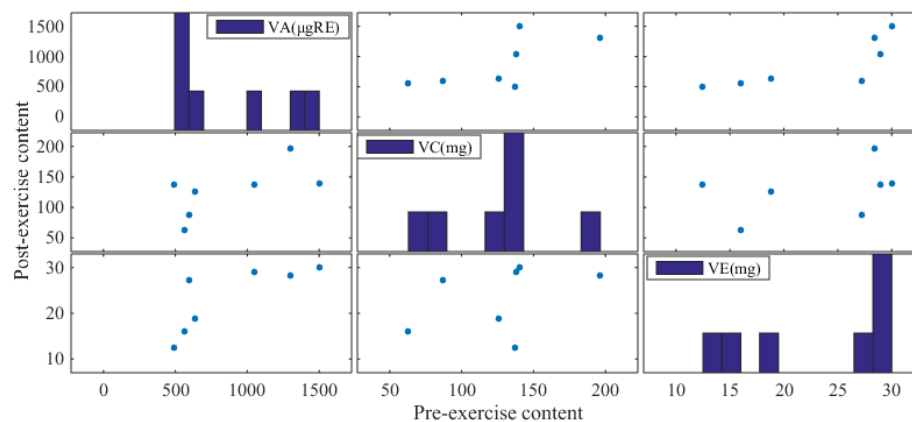


Figure 4: Subject's vitamin intake

Vitamin A, e and C are the main factors that affect the athletic ability of tennis players. Vitamin E can improve the sports ability of tennis players, improve the muscle nutrition and blood supply, improve the muscle quality of tennis players, improve the competitive ability of athletes, which is conducive to sports dance athletes to obtain excellent results in the competition. The lack of vitamin C in sports tennis players will cause weakness and iron deficiency anemia, which will damage the body's ability. Therefore, the supplement of vitamin C can enhance the immune function and reduce fatigue and muscle soreness.

5. Conclusions

In this paper, through long-term tracking and monitoring, according to the scientific research data of athletes during the training period, the scientific detection database before and after training and competition is systematically established. Through horizontal and vertical comparison, the internal relationship between sports training and scientific research data is analyzed and summarized, which is helpful to grasp and analyze the individual change characteristics of key athletes' indicators and find out the sensitive indicators of athletes. It provides the basis for the effect and mechanism of mineral and vitamin influence on Athletes' sports ability.

In this paper, we found that the B vitamins and vitamin C obtained by tennis players from the diet are low, and most athletes have the risk of calcium deficiency. In order to maintain a high metabolic rate during exercise, there may be a tendency of concentration of material metabolism in the body, so as to ensure that the body can output the maximum energy under the limited resources and cause the redistribution of mineral elements among tissues. Vitamin supplementation can significantly reduce the pain degree of exercise delayed muscle soreness and promote its recovery, but has no obvious effect on muscle contraction function and subjective physical feeling.

There are still some deficiencies in this paper. In the dietary survey, athletes' coordination degree is not high, most athletes can not insist on three or even two consecutive days to accept the survey, so the sample size is small. And the samples from dietary survey and body composition and laboratory tests did not match. In the future work, energy metabolism data should be refined to different degrees of training, and large-scale statistics and sorting data are needed for future scientific research.

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