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Antioxidant Effect of Vitamins in High-intensity Cross-country Running and the Effect of Physical Strength Supplement

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Abstract: This research mainly explores the antioxidant effect of vitamins in high-intensity cross-country running and the effect of physical supplementation. The subjects were all athletes in trail running sports. Before the experiment, the maximum oxygen uptake of each athlete was measured to predict the exercise intensity in the formal exercise test. After resting for 1 hour, go on high-intensity cross-country racing. During 0, 10, 20, and 30 minutes of exercise, supplement vitamins at 2 mL/kg of body weight. Venous blood is collected within 10, 20, and 30 minutes, and urine is collected within 10 and 60 minutes. Within 20 minutes after the end of the cross-country race, supplement the vitamin content at 5mL/kg body weight. The test subjects had a standard meal at noon that day. The second exercise starts 1 hour after the first exercise, and the exercise plan is the same as the first exercise. The test subjects were the same, cross-country running to exhaustion, the time was recorded, and vitamin supplements were added. The subjective fatigue ratio score is recorded every 10 minutes, and the venous blood fluid balance and urine test indicators are also measured. After 60 minutes of exercise, the SOD content in the control group was 144.87±20.12 (U/ml), and the experimental group was 134.85±10.44 (U/ml), which was statistically significant (P>0.05). Research results show that vitamins help neuronal cells to build more ion channels, replenish consumed energy, achieve prolonged exercise time, stimulate the response of target cells, improve the body's nerve conduction efficiency, and improve the body's exercise capacity and antioxidant capacity ability.

1. Introduction

Endurance exercise reflects the body's ability to exercise for a long time. In many sports, the game will last a long time. In order to maintain a specific intensity or exercise quality throughout

the game, athletes must have the ability to accumulate and resist deep fatigue during continuous exercise. Enduring exercise includes muscle endurance and cardiovascular endurance, which is also divided into aerobic exercise and anaerobic exercise for the body. Research on the quality relationship between vitamins and endurance is mainly focused on the relationship between vitamins to improve cardiovascular endurance. Most studies have shown that vitamins can improve athletic performance and can play an appropriate role in endurance training.

Vitamins have attracted a lot of attention due to their anti-tumor properties, reduction of drug toxicity and side effects, improvement of tumor resistance, and improvement of body damage. At the same time, it can reduce excess free radicals in the body, improve the body's antioxidant capacity, and reduce myocardial damage. Skeletal muscle injury is a change in the microstructure of skeletal muscle fibers that occurs after high-intensity or long-term exercise. The purpose of this study is to provide experimental evidence for scientific use of nutritional supplements. From the perspective of morphology and biochemistry, the mechanism of skeletal muscle injury and the effect of vitamin intervention after high-intensity exercise and long-term heavy-duty exercise are studied.

Heart disease is caused by hidden scurvy and chronic diseases and can be cured with high doses of vitamin C without the need for heart surgery and expensive medication. Mao believes that elevated serum homocysteine levels have been proven to be hypertension. He studied the levels of these serum biochemical indicators in 9311 Chinese patients (mean age: 79.50±13.26 years) with T2DM (N = 839), hypertension (N = 490) or CVD (N = 7925). Use analysis of variance to compare demographic and serum biochemical data. He used Pearson linear regression to perform a stratified analysis to investigate the correlation between different variables in the T2DM, CVD and hypertension groups, and patients <50, 50 to 64, 65 to 80, and 80 years old. A subgroup analysis was also performed to identify the correlation between serum biochemical markers. A hierarchical chi-square analysis was performed based on the levels of folic acid and total vitamin D. His research group is not clear [1]. Visual impairment is a global epidemic. Mccusker believes that the nutrients in the AREDS2 study (lutein, zeaxanthin, vitamin C) are still the most effective nutritional therapy for reducing fat intake. And has an advanced AMD rate. His research lacks a specific experimental process, and the research process has no practical value [2]. A retrospective analysis of randomized controlled trials showed that in patients with cardiovascular disease, antiplatelet therapy may change the potential benefit of reducing the B vitamin homocysteine on the cerebral blood vessels. Park evaluated the effect of vitamin B supplementation on subsequent stroke risk in people at high cardiovascular risk who were not taking antiplatelet drugs. He systematically searched the cochrane controlled trials center register, pubmed, internet stroke trials and clinical trial gov from 1966 to April 2015. Inclusion criteria include: randomized controlled trials of B vitamin homocysteine reduction therapy; people with high cardiovascular risk, follow-up for ⩾1 year. Among the 11 randomized controlled trials that met the inclusion criteria, 3 studies evaluated stroke as an outcome and reported event rates based on whether the individual was taking antiplatelet drugs. There is no experimental control in his research process [3]. There is insufficient information on the concentration of nutrients in human milk. Hampel believes that for certain nutrients, including B-vitamins, maternal intake will affect their concentration in human milk, but the extent to which maternal dietary inadequacy affects B-vitamin content is rarely documented. He uses methods of analysis of vitamin B (usually microbiological methods, radioisotope dilution methods or recently used chromatography) as well as ultraviolet, fluorescence and MS detection of complex human milk matrix. His research has no actual control, and the experimental process is not rigorous [4].

Research results at home and abroad show that vitamins improve the susceptibility to free radicals during exercise, but only on the indicators of mouse body weight and visceral index, and

the mechanism of capturing free radicals is still unclear. This study explored the signaling mechanism of vitamins affecting free radicals. Before the experiment, the maximum oxygen uptake of each athlete was measured to predict the exercise intensity in the formal exercise test. After resting for 1 hour, go on high-intensity cross-country racing. Trail running to exhaustion, record the time and supplement vitamins. The subjective fatigue ratio score is recorded every 10 minutes, and the venous blood fluid balance and urine test indicators are also measured. It provides an experimental method for the further development of new health products.

2. Vitamins

2.1. Acute Exercise on Free Radical Metabolism

Now, most studies show that acute exercise will greatly reduce the body's antioxidant capacity, greatly increase the generation of free radicals, and may cause lipid peroxidation damage. On the other hand, when intense exercise increases significantly, various organs consume a lot of oxygen, and the body is in an anaerobic state. On the other hand, the accumulation of metabolites (lactic acid, etc.) caused by hypoxia in the tissues reduces the function of mitochondria and produces a large amount of singlet oxygen. Vitamin E is an important antioxidant substance widely seen in cell membranes and lipoproteins. Vitamin E was originally discovered due to reproductive ability and its effects on development, so it is also called tocopherol. There are 8 subtypes of natural vitamin E. Among them, tocopherol has high biological efficiency and stable structure, and is often used as food and feed additives. Tocopherol is a hydrogen peroxide trap that protects cell membrane stability and prevents lipid peroxidation. In addition to antioxidant effects, vitamin E has also been reported to improve immune response, regulate DNA repair systems and signal transmission pathways. However, studies have shown that vitamin E supplementation may affect the mortality of diseases, indicating that vitamin E will have a beneficial effect on the incidence of chronic diseases [5].

The results of animal experiments show that vitamin E supplementation may reduce the activity of antioxidant enzymes such as SOD and tyrosinase (CAT) in rat red blood cells. The uncertainty of the antioxidant effect of vitamin E is also related to the increase in the concentration of 8-EPI-PGF2A. The results of the pathological section showed that the solvent had no inhibitory effect on the infiltration of inflammatory cells in the lung tissue of rats caused by the capillary congestion of the interstitial lung and the expansion of the interstitial lung. Fish oil can reduce the cell membrane infiltration caused by PM2.5. The concentration of inflammatory cells in fish oil+PM2.5 lung tissue sections was lower than the PM2.5 infection group and solvent+PM2.5 group. Vitamin E has no effect on the inflammatory cell infiltration, alveolar wall hypertrophy, capillary blood stasis and pulmonary interstitial expansion caused by PM2.5 in rat lung tissue [6].

2.2. Vitamins Improve Cell Tolerance

Under normal conditions, due to the selective permeability of the cell membrane, the enzyme components in the cell will not be transferred to the blood through the membrane. However, thermal pressure increases the transparency of the cell membrane and increases the possibility of certain enzymes in the cell entering the blood. Therefore, as a method to determine cell damage such as blood creatinase (CKP), LDH, AST, several indicators of serum enzyme content can be used to determine calories as an indicator of stress-induced damage [7].

Cells are stimulated by various pressures, which will promote the induction of Hsp synthesis, generate cell protection functions, and improve cell tolerance. According to whether Hsp can be activated normally, it is determined whether to develop tolerance to stress. The appearance of Hsp

has a positive correlation with the tolerance of cells to stress. Studies have shown that giving a gentle stimulus before a strong stimulus improves the animal's tolerance to strong stimuli. The high performance of Hsp70 or the excess performance of Hsp70 in response caused by drug stimulation (such as aspirin, coenzyme Q10, etc.) can improve the survival rate of cells under the same thermal stress. Cells treated with Hsp70 inhibitors (Kelsetin) or Hsp70 monoclonal antibodies will greatly reduce the possibility of cells being able to withstand thermal stress [8].

2.3. Vitamin Antioxidant Effect

ROS is a biological by-product of cell metabolism. It contains hydroxyl radicals, superoxy radicals, organic and inorganic peroxide functional groups, and has very strong biological activity. In the body, an appropriate amount of free radicals has a positive effect on cell division, differentiation, reproduction, and anti-inflammatory properties, but excessive free radicals can cause damage to the body. Reactive oxygen species destroy biological macromolecules, destroy the combination of DNA and protein, affect cell function, and may promote damage caused by oxidative stress. SOD is a kind of free radical scavenger widely existing in biology, which is an enzyme based on superoxy radicals. Due to its powerful free radical elimination function, SOD has become an important indicator of antioxidant capacity. As we all know, free radicals disrupt the balance of the body and may cause damage to the body by oxidative stress. Free radicals catalyze the peroxidation of acrylic acid, producing a series of protogenic compounds called isoacrylic acid. 8-EPI-PGF2U is produced in the cell membrane through the action of free radicals. The cell membrane is dissolved by the action of phosphatase, and isopropyl acid is released into body fluids [9]. The production of 8-EPI-PGF2A does not require enzyme catalysis, and it continues to be secreted into body fluids immediately after production, so the content of 8-EPI-PGF2U in body fluids is very stable. Therefore, 8-EPI-pGF2U is now used to judge the degree of free radical oxidation in the body, and it can also be used to clinically evaluate the effectiveness of antioxidants [10].

Free radicals are produced during biological metabolism. The removal of oxygen free radicals mainly depends on enzymes in the body. Mainly endogenous antioxidant enzymes such as glutamate dioxygenase (GSH-PX), hydrogen superoxide (SOD), and tyrosinase (CAT). Different organs have different levels of SOD. The function of SOD is to non-homogenize oxygen free radicals, generate peroxides to undergo oxidation reaction, and block the formation of hydroxyl groups. The latter is the most active in nature, can attack all biological target molecules, and is very toxic to the human body. The half-life of superoxyphosphatase is very short, and the SOD content between cells and mitochondria exceeds that of extracellular fluid. Superoxide hydrogenase (SOD) is stable through pH, thermal protease hydrolysis, etc [11].

2.4. Vitamins in the NF-KB Pathway

Vitamins increase the appearance of anti-apoptotic proteins by activating the transforming factor NF-KB, leading to the death of anti-TNF-A. When cells are stimulated by stress, TNF-A and vitamins will increase, and TNF-A will be toxic to cells. The appearance of vitamins is a process of balance and protection. In order to understand the relationship between vitamin protein and increased TNF-A, mouse tendon bud cells are usually used to express the excess of vitamins to study the effect on TNF-A-induced apoptosis and NF-KB activation. Vitamins rely on phosphoric acid to promote the activation of NF-KB and protect myoblasts from the cytotoxicity of TNF-A. After TNF-A treatment, vitamins interact with IKK. This interaction increases the kinase activity of IKK, causing phosphorylation and subsequent decomposition of IkB (negative regulator of NF-KB), and promoting nuclear transfer of transforming factors. The target protein of vitamin-induced

NF-KB activation is the transcriptional regulation of the anti-starch protein Bcl-2. In this way, vitamins can protect cells from cytotoxicity induced by TNF-A [12].

In the vitamin family, the most important component of biofilm is vitamin E, mainly in the internal mitochondria. Vitamin E is an indispensable substance for the human body. It can only be ingested from food and cannot be synthesized by the organism itself. In nature, vitamin E has four structural forms. The sixth carbon atom group of its ring structure can provide electrons and has a reducing ability. The benzene ring with electronic resonance capability is contained in organisms that stabilize the biological properties and structure after vitamin E oxidation. The main function of vitamin E is to protect the integrity of cells. It is mainly to block the effect of free radicals on cell membranes and form polyvalent unsaturated fatty acids. This is done by blocking the chain reaction of lipid peroxidation. Vitamin E also reacts with singlet oxygen to reduce damage to cells.

3. Vitamin Supplement Experiment

3.1. Subject

The basic situation of the experimental subjects is shown in Table 1. Considering that high-intensity cross-country running is a comprehensive sports event, this experiment selects 60 athletes as the subjects of this experiment. First, the subjects accept the experiment and agree to directly sign the informed consent form. All test subjects are 176.55±1.33cm in height, 66.56±2.33kg in weight, 20±2 years old, and participate in special training (2 hours, 5 times a week) as needed, before and during the experiment , prescription drugs COMT inhibitors and other antidepressants are forbidden to take in order to avoid the impact on vitamin activity, in accordance with the requirements of experimental tests to ensure the completion of exercise. Avoid sympathetic amine (L-DOPA) and MAO inhibitors, appetite suppressants and other dopamine metabolites, phenols, cyclophosphamine, etc. Smoking, alcohol, tea (especially green tea), coffee,may hinder research.

Table 1. Basic situation of the experimental subjects

Number of subjects	Age	Height	Weight	Training years
(n)	(yr)	(cm)	(kg)	(yr)
30	20±2	176.55±1 .33	66.56±2.33	4.99±0.62
30	20±2	176.55±1 .33	66.56±2.33	5.01±0.33

3.2. Determination of Vitamin Content

Pour the vitamin extract into a 20mL test tube and dilute it with 2% oxalic acid. Take 8 mL of the diluted extract, add 0.3 g of activated carbon and shake for 2 minutes for oxidation treatment and filtration. Take 4mL of the filtrate, add 4mL of 2% sulfate solution, shake, and stir well. Take 3mL of the mixture, add 1% of 1% 4-dichlorophenylhydroxyl 1mL, mix evenly, and heat in a constant temperature water tank at 35℃ for 2 hours. After taking it out, put it in ice water, shake, and add 5ml of 85% sulfuric acid solution. After being taken out of the ice water, the wavelength of visible light was measured at room temperature.

3.3. Sports Program Design

3.3.1. The First Exercise

The test subjects arrived at the designated place at 8 o'clock on the day of the experiment, rested

for 5 minutes, ate breakfast, and rested quietly for 2 hours after meals. Start a cycle of exercise for 1 hour. The vitamin solution was supplemented at 2 mL/kg body weight within 0, 10, 20 and 30 minutes. Venous blood is extracted within 10, 20, and 30 minutes, and urine is extracted within 10 minutes, 60 minutes. Within 30 minutes after running, you need to use 10mL/kg of body weight to supplement vitamins. The test subjects ate a standard lunch at noon that day.

3.3.2. The Second Exercise (Exercise Ability Test)

Start the second practice 6 hours after the initial practice, plus additional incentives to let the participants do their best. The supplementary plan in the exercise is the same as the first experiment. The subjective fatigue ratio score is recorded every 10 minutes. The index of fatigue is that the test subject cannot hold for more than 60 seconds, and the subjective fatigue score exceeds 18.

3.4. Exercise Cardiopulmonary Function Test

During exercise, respiratory components are continuously measured and analyzed by the highed exercise cardiopulmonary function test analyzer (Smax58ce model, Hana Nanjing). During the ventilation process, indicators such as carbon dioxide emissions and breathing factors began to deviate from the original straight track, and the rapidly rising exercise intensity was defined as the anaerobic threshold intensity[13-14]. The maximum oxygen uptake is defined as the exercise intensity of the second maximum oxygen uptake. Through the above test, after the anaerobic threshold rising speed (TRAIR speed) is obtained, the anaerobic threshold rising speed is converted into a benchmark for anaerobic valve rising speed training for test subjects in the maximum muscle strength and physical strength training phase.

3.5. Blood Sample Preparation

1 mL of venous blood was extracted, put into an EDA anticoagulation tube (VACUETTE, Japan), mixed thoroughly, and left to stand to obtain plasma for measuring osmotic pressure and blood lactic acid. Then, 3 mL of whole blood was extracted using a vacuum sterilization tube containing a blood coagulation promotion catalyst (VACAITE, USA), left to stand for 20 minutes, centrifuged for 10 minutes, and the upper serum was separated. Serum and plasma are stored at -10℃ for determination of total protein, Na+, K+, Cl ion and sarcosine.

3.6. Urine Sample Preparation

To measure urine osmotic pressure, urine was collected in uniform batch containers before and after exercise. The remaining part is stored at -10℃ for measuring Na+ and K+.

3.7. Determination of Protein Concentration in Sample Extract

Absorb 0.2ml of the extract and put it into the test tube. Add 3ml of light blue G250 protein reagent and mix thoroughly. After being left for 3 minutes, the colorimetric value was recorded in a 40mm optical diameter cuvette at 675nm.

3.8. MDA Determination

Measuring principle: thiobarbituric acid colorimetry. The maximum absorption of the chemical reaction compound is 436nm, which can be measured by colorimetry. Quantitative method: The TBA colorimetric method is adopted, and the quantification is carried out in strict accordance with

the operation sequence of the MDA test box. Take 0.2ml serum, add 1ml hydrochloric acid (0.1mol/L) and 2ml sulfuric acid solution (0.2%), the total volume is 4.4ml. Heat at 80℃ for 30 minutes, add 3.0 mL of allyl alcohol after water cooling, centrifuge at 2000 rpm for 15 minutes, take 1 mL of the supernatant, perform colorimetric analysis at 667 nm, and read the OD value. The above-mentioned measurements are all carried out with supporting components, and the operation is carried out according to the instructions.

3.9. Data Statistics and Analysis

In this study, the mean + standard error of the data (MEAN ± SE) indicated that the statistical analysis used the statistical software SPSSforwindows17.0. GLM Repeated Measures is used for the difference of the same set of data at different time points. Multivariate dispersion analysis (GLM Multivarite) was used to simultaneously test the differences between different groups[15]. For the differences between the corresponding indicators of different groups, regular identification is carried out. If the two data sets to be compared satisfy the normal distribution, the T test of the corresponding specimen is used. If the data does not conform to the normal distribution, use the corresponding specimen symbol sequence verification. $P<0.05$ is considered as a statistically significant difference, and $P<0.01$ is considered as a statistically significant difference[16].

4. Impact of Vitamins on Athletes' Bodies

4.1. Vitamin Supplementation on the Performance of Athletes' Muscle Mechanics

There is a statistically significant difference in the urine sodium concentration before water intake. There is no significant difference between the calm state and the urine sodium concentration after exercise. There are no statistical differences between different vitamin supplement plans. The serum SOD content of the calm control group and the experimental group were 133.36±20.34 (U/ml) and 167.15±14.77 (U/ml), respectively, and there was no significant difference. After 60 minutes of exercise, the SOD content in the control group was 144.87±20.12 (U/ml) and the experimental group was 134.85±10.44 (U/ml), there was no significant difference ($P>0.05$). 30 minutes after exercise, the serum SOD levels of the control group and the experimental group were 158.47±10.88 (U/ml) and 156.16±17.89 (U/ml), $P>0.05$, there was no significant difference. The statistical results of exercise work of the experimental group and the control group are shown in Table 2. It can be seen from the table that the total exercise work of the control group is 400.22±33.61 (J), and the total exercise work of the experimental group is 422.45±55 (J), there is basically no statistical difference. After 60 minutes of exercise, the exercise work of the control group decreased to 388.00±33.17 (J). In contrast, the total exercise work of the control group increased to 443.82±367.40 (J). The T test of the corresponding experiment showed $P>0.05$, there was no significant difference. The total exercise work of the control group after 60 minutes of exercise was 455.40±32.13 (J), and that of the experimental group was 500.09±130.37, $P>0.05$. This indicates that there is no significant difference between the total exercise work of the experimental group and the control group 60 minutes after exercise.

Table 2. Statistical results of exercise work between the experimental group and control group

Groups	0min	60min
A	133.36±20.34	167.15±14.77
B	144.87±20.12	134.85±10.44
C	158. 47±10.88	156.16±17.89
D	211.26±10.07	189.13±16.33

4.2. Analysis of Vitamins to Improve Lactic Acid Metabolism

The changes of lactic acid in blood over time are shown in Table 3. It can be seen from the table that the concentration of lactic acid in the blood is 3.10±0.13 (mmol/l), 3.12±0.10 (mmol/l), 3.07±0.09 (mmol/l), 3.05±0.07 (mmol/l) (after exercise 0 minutes, 10 minutes, 30 minutes, 60 minutes). The blood lactic acid concentration in the experimental group was 3.20±0.12 (mmol/l), 3.22±0.11 (mmol/l), 3.37±0.19 (mmol/l), 3.24±0.05 (mmol/l) (0 minutes after exercise, 60 minutes, 30 minutes, 60 minutes). By comparing the differences between the experimental group and the control group at the same time, the analysis showed that the difference between the first 0 minutes and 60 minutes after exercise was slightly larger but not significant, and there was no significant difference at the other 3 time points. There is no significant difference in serum potassium levels before taking vitamins. Serum potassium concentration increased significantly at 3 different moments during exercise ($P<0.05$). The serum potassium value during mid- and late exercise was significantly different from the steady state serum potassium value ($P<0.05$), and the serum potassium value during the late exercise period was significantly higher than the serum potassium value during the mid-term exercise ($P<0.05$). There is no obvious difference between the 4 plans. However, the impact of lactic acid accumulation on body metabolism increases as the concentration of lactic acid increases. The purpose of this study is calm silence and immediate centrifugal separation, which are 0 minutes, 60 minutes, 30 minutes, and 60 minutes (3.59±0.10mol/l, 365±0.06 mmol/l, 3.65±0.06 mmol/l) , 3.55±0.09mmol/l). Soon after exercise, there was a significant difference between the control of the quiet group and a single point in time. The blood lactic acid value of some test subjects exceeded 28mmol/l at a specific time. The reason that can be considered is that there are blood lactic acid and mature red blood cells in the epithelial cells and retina. High-intensity exercise intensity. The action of lactic acid becomes the main energy supply channel, which causes tissue fiber laceration to some extent. Sugar is the main force, and a large amount of lactic acid in the blood is quickly transported to the blood, causing the lactic acid in the blood to rise sharply. Further studies have shown that in the experiment of lactic acid ion in a single muscle cell, the muscle contractility is reduced due to the presence of lactic acid ion.

Table 3. Changes of lactic acid in blood over time

Groups	0min	30min	60min
A	3.10±0.13	3.59±0.10	3.68±0.1 1
B	3.12±0.10	36.5±0.06	3.58±0.06
C	3.07±0.09	3.65±0.06	3.63±0.16
D	3.05±0.07	3.55±0.09	3.59±0.11

4.3. Analysis of Iron Content in Blood

The iron content in the blood is shown in Figure 1. It can be clearly seen from the figure that before the start of the exercise training, the exercise group and the hemoglobin content are the same, but after 4 weeks of training, the hemoglobin content of the control group decreased. The hemoglobin content of the control group in a quiet state tends to increase. In order to reduce the body's hemoglobin level, the load of sports training increases. According to the data, the ratio of hemoglobin to red blood cells is reduced, accompanied by the clinical symptoms of iron-deficiency anemia, that is, the third stage is judged as the iron-deficiency anemia stage. Through continuous monitoring of changes in body weight and hemoglobin, the measurement data showed a consistent downward trend, indicating that the modeling was successful. In the second stage, the sports training group that had already experienced symptoms of anemia was given different doses of

vitamins. Set up a quiet control group, except for the exercise group, no vitamin supplementation, and other groups supplemented with different doses of vitamins. After 6 days of intense heavy-load exercise, the hemoglobin content of the exercise group was still very low, but the hemoglobin of each vitamin supplement group showed an increasing trend. Dispersion analysis showed that replenishment and exercise had a significant effect on serum iron ($p>0.05$). In the exercise group, serum iron showed a decreasing trend, especially in the exercise group with insufficient vitamins. The serum iron content was significantly lower than the exercise group and much lower than the quiet control group. The figure can confirm the specificity of the average change of each group.

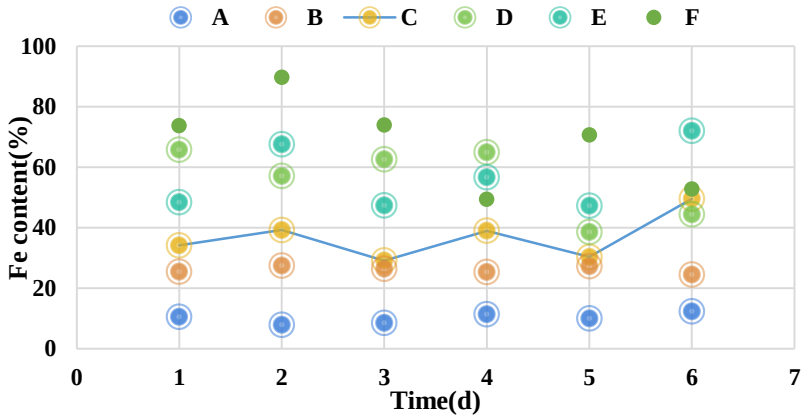

Figure 1. Fe in the blood

4.4. Analysis of Lactic Acid Recovery Test Indicators

The lactic acid content of the experimental group and the control group is shown in Figure 2. The results showed that there was no significant difference in the weight of athletes between the groups before the experiment ($P>0.05$). From the third day after the start of the experiment to the end of the experiment, the weight of the players in group A was significantly lower than that of the players in group B ($P<0.05$). From day 4 to the end of the experiment, the weight of athletes in group C was significantly lower than that of group B ($P<0.05$). After the 8th day, the weight gain rate of group D was slower than that of group B, but there was no statistical difference. In addition, it can be seen from the figure that compared with group D, the weight gain rate of athletes in group A slowed down from the 5th day of the experiment, especially on the 6th day, until the end of the experiment ($P<0.05$) . The weight gain rate of group C athletes slowed down from day 3, but there was no statistical difference compared with group D athletes. In the experiment, the weight gain curves of the athletes in group C and A were separated from day 8, but the weight gain rate of athletes in group A decreased, which was the most obvious on day 5 ($P<0.05$). After supplementing with vitamins for a certain period of time, it was found that the athlete's weight gain rate decreased. Combined with increased exercise, the rate of weight gain gradually decreases. Compared with the experimental group (A), the blood lactic acid value after 10 minutes of exercise 3 days later is lower than that of 3 days ago, which is a significant difference. The blood lactic acid value and blood lactic acid value after 4 days of exercise 8 minutes after the peak value was significantly lower than 4 days ago. Compared with the control group, the lactic acid clearance rate of the experimental group (A) was higher than that of the control group after 4 days, and there was a significant difference. In the experimental group (B), the blood lactic acid clearance rate was higher than 4 days after the second lactic acid test. Compared with the control group, the lactic acid clearance rate of the experimental group (B) was higher than that of 4 days ago, which was significantly different. In the two 100-meter sprint tests, the blood lactic acid recovery test of the experimental group (A)

showed that the blood lactic acid value at 6 minutes after exercise and 10 minutes after exercise was lower than that of 4 days ago, with significant differences. The peak value of lactic acid in the blood after 4 days was lower than that of 4 days before, and a very obvious difference was seen. Compared with the control group, the peak value of lactic acid in the blood of the experimental group (A) after 4 days was lower than that of the control group, which was a significant difference. Compared with the blood lactic acid value recovery test of the experimental group (B), the lactic acid clearance rate after 4 days was higher than that of 4 days before, showing a significant difference. After 3 minutes of exercise 4 days later, the peak value of lactic acid in the blood was lower than 4 days ago, which is a very significant difference. In the comparison between the experimental group (B) and the control group, the clearance rate of serum lactic acid at the experimental speed (F) after 4 days was higher than that of the control group, which was significantly different.

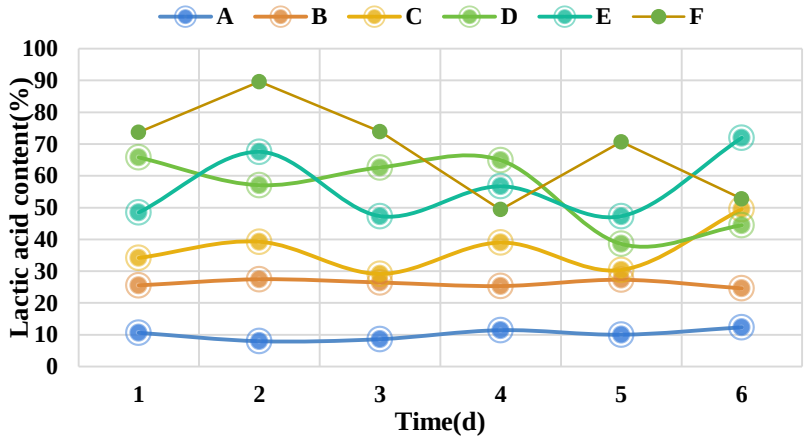

Figure 2. Lactic acid content in experimental group and control group

4.5. Analysis of Athletic Ability

The athletic ability of each group of athletes is shown in Figure 3. The results showed that on the third day of the experiment, there was no significant difference in the weight load between the two groups in the comprehensive exercise time. By the end of day 5, the exercise time consumed by group D was slightly longer than that of group E, but there was no statistical difference ($P>0.05$). When using the T measurement, in the two exercise time consumption tests of the athletes in the E and D groups after statistical analysis, there is no significant difference between the athletes in each group before and after the thorough exercise time ($P<0.01$). The results show that the two groups The fatigue exercise time of athletes has been prolonged to some extent, indicating that vitamin supplements are not harmful to athletes' sports ability. It can be seen from the figure that after 4 days of vitamin supplementation, the peak value of experimental group (B) was significantly higher than the peak value of anaerobic work 3 days ago. However, there was no significant difference compared with the control group. This shows that vitamin supplementation can improve the maximum strength of muscles during anaerobic exercise. The maximum anaerobic exercise reflects the energy supply efficiency of the ATP/CP system. The improvement in the maximum output of male athletes during anaerobic work within 10 seconds shows that vitamins can improve the energy supply efficiency of the ATP/CP system and increase the ATP/CP ratio. After supplementing athletes with vitamins, there was no significant difference between the experimental group (A) and the control group (B), indicating that vitamin supplementation did not improve the average anaerobic capacity. After 3 days of nutritional supplementation, the fatigue index of the experimental group (F)

3 days ago was significantly lower than that of the control group, but there was no significant difference. Vitamin supplementation can accelerate the rate of nucleotide synthesis in skeletal muscle and the recovery of ATP melanin in the body. Inhibit skeletal muscle fatigue and reduce fatigue index, which can exert a certain anti-fatigue effect. The above results show that by supplementing an appropriate amount of vitamins, the anaerobic exercise capacity of anaerobic athletes can be improved within 10 seconds.

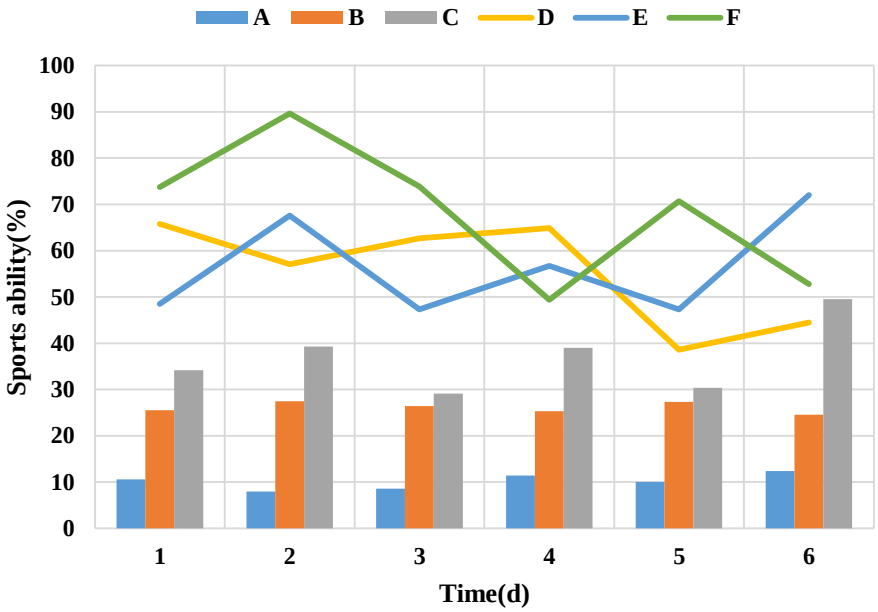

Figure 3. Athletic ability of each group

4.6. Analysis of Vitamin Antioxidant Capacity

The antioxidant capacity of each group of vitamins is shown in Figure 4. After quantitative load exercise, compared with group C, the SOD activity of the tissue holders of group E, group D and group F increased significantly ($P<0.05$), and the SOD activity of group F was significantly higher than that of group D ($P< 0.05$). Compared with group D, the SOD activity of tissue isotope in group E increased, but it was not significant ($P>0.05$). The results of the study show that the MDA content in the body may increase through exercise, and vitamins hinder the increase in MDA content. Vitamins during exercise have antioxidant effects. The MDA levels of the quiet group (Vitamin Group D) and training + vitamin Group (F) are significantly lower than those of the control group after exercise, which effectively inhibits lipid peroxidation caused by MDA during exercise, which is harmful to the body To an important protective effect. Vitamins play an anti-lipid peroxidation role in free radical metabolism. In addition, the results of the study showed that the activity of SOD in the plasma of group F after exercise was significantly higher than that of groups D and E ($P<0.05$). Vitamins have a clear antioxidant effect, which undoubtedly improves athletes' exercise capacity. The data in the table shows that there is no significant difference in the initial weight of the players in each group, and the weight of the players in each group also maintained a steady upward trend in the experiment. Before about the 3rd day, the weight was basically stable, and there was no significant change over time. After 5 days of exercise, the weights of the players in groups E and F were significantly lower than those of the players in groups C and D ($P<0.05$), indicating that proper endurance exercise can effectively inhibit the weight gain of athletes. The weight of athletes in group D was not significantly different from that of group C ($P>0.05$). This proves that vitamin supplementation can significantly reduce body weight.

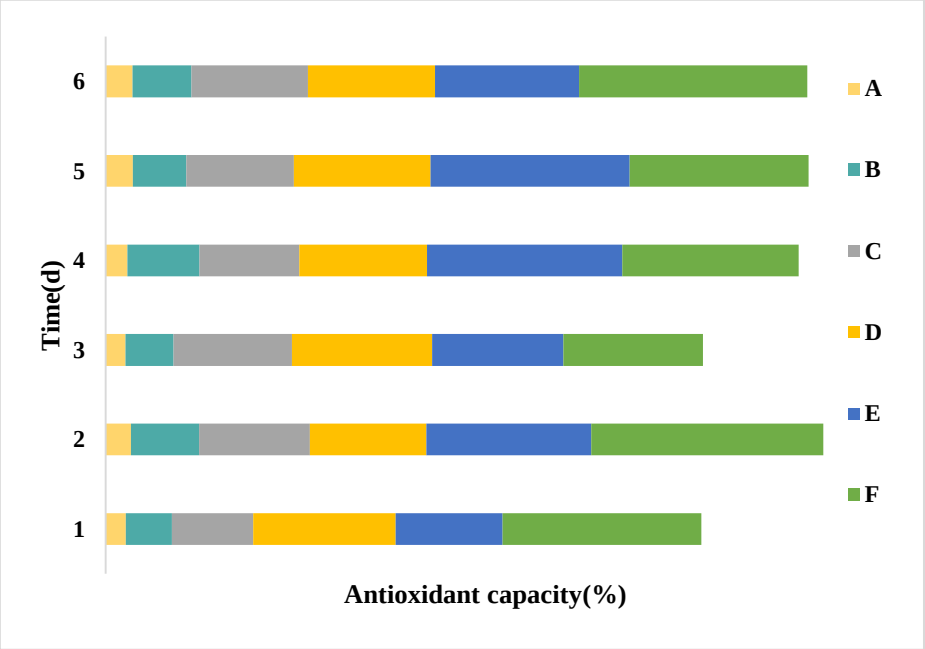

Figure 4. Antioxidant capacity of vitamins in each group

5. Conclusion

Vitamin supplementation can improve plasma protein and cholesterol levels, slow down the growth rate of body weight and body fat, increase body energy consumption, and reduce body weight and body fat. In this study, the effects of vitamin preparations on body composition and fat metabolism were observed. By measuring the physiological, biochemical and molecular biological indicators of athletes' serum, liver and other tissues and organs, as well as human morphological and biochemical indicators, this paper attempts to explore the effects and mechanisms of vitamin supplementation on the body and fat metabolism.

Vitamin supplementation can reduce body fat, improve muscle strength, and reduce skeletal muscle damage. In this study, from the perspective of morphology and enzymology, by observing the effects of skeletal muscle serum enzymes on HMB, cell membranes and muscle enzyme activities, we sought to find the protective effect of vitamins on exercise-induced skeletal muscle injury and the expected mechanism of exercise-induced skeletal muscle damage. In order to explore high-intensity exercise and long-term overload exercise training, from another angle to study the effect of skeletal muscle ultrastructure and cell membrane enzymes. By observing the protective effects of vitamin supplementation after different exercises on exercise-induced bone damage, it provides a theoretical basis for more rational use of vitamins.

This study believes that in the long-term high-load exercise training, various energy supply and energy supply paths in the body are destroyed, and the corresponding ATP-CP system is stimulated. In order to strengthen the vitality of the CK of the skeletal muscle after heavy exercise, vitamin supplements in time, in order to improve the energy supply of biological phosphorylation, and improve the exercise ability, similar to the consumption of exercise. Vitamin nutritional supplements protect cell membranes, reduce cell membrane damage, improve exercise capacity, and adapt to long-term exercise training, thereby improving membrane lipase activity, greatly improving exercise capacity, and strengthening and maintaining cell proliferation. Delay fatigue and reduce skeletal muscle damage caused by exercise.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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