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Article

Relationship between minerals, vitamins and sports ability of dance athletes

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Abstract: Vitamins and minerals are essential for regulating metabolism. According to the nature of sports, athletes can take multi vitamin and mineral supplements to enhance some important metabolic processes and improve sports performance. The purpose of this study is to explore the effects of minerals and vitamins on the sports ability of dance athletes. In this study, 100 professional dancers were randomly divided into the experimental group and the control group by the control variable method. The sports diet and water of the experimental group were supplemented with certain vitamins and minerals. After that, the athletes were trained and tested, including 12 min running, strength test and dance training duration test. The results showed that the 12 min running distance of the experimental group was 420 m more than that of the control group, the balance time was 16 min longer, and the strength was increased by 25 N. In the overall energy comparison, the energy and endurance of the experimental group was two hours more than that of the control group. The conclusion is that minerals and vitamins play a role in promoting and subsidizing the physical fitness of athletes, which are more prominent in endurance and strength. This study provides a certain value for the effect of nutrients on athletes' ability.

Keywords: minerals and vitamins; athletic sports; dance athletes; athletic ability

1. Introduction

In China, there is almost no research on the method of proper supplement of vitamins and minerals to athletes [1]. Most people only see what the athletes have accomplished, but they don't know the hard work, bleeding and sweating of athletes in training. Long term training and intense muscle exercise will increase the demand for energy, vitamins and minerals, leading to vitamin and mineral deficiency [2,3]. Therefore, a reasonable diet and scientific supply of vitamins and minerals are necessary. Reasonable supply of vitamins and minerals is necessary. Minerals can eliminate fatigue, improve exercise ability and prolong exercise life. In a variety of projects, it is necessary to concentrate on the reasonable supplement of vitamins and minerals.

With the continuous improvement of the competitiveness of sports athletes, excellent physical strength is the prerequisite for the development of technical ability [4,5]. The strengths and weaknesses of each athlete's physical and technical level can determine a high level of high-quality dance step demonstration [6]. If athletes want to achieve outstanding results with superb technology and perfect artistic performance, they must pay special attention to their physical strength. The level of physical strength is one of the important factors that must be taken into account in the selection of scientific talents.

The purpose of Pellicciari et al. [7] is to evaluate the incidence, location and nature of musculoskeletal injury in dance athletes, and to find out the potential risk

factors. His research was conducted at several national sports dance conferences in Italy. All 168 sports dancers who attended the conference were invited to fill in a questionnaire on the injuries they might have suffered in the previous year; other information collected included demographic data (age, gender, height, weight), dance participation (discipline, category), training (training time, number of years of training) and injuries (location, disease). Of the 102 athletes who reported injuries, 73 athletes (47.7%) reported at least one injury. The injured sites were lower limbs (n = 75, 73.5%), upper limbs (8, 7.8%) and spine (19, 18.7%). There were significant differences in the location and nature of injury ($P < 0.01$). There was no significant difference in demographic data, dance participation and training variables between injured and uninjured athletes ($P > 0.05$). His method lacks the control of nutrient supplement and is not rigorous enough [7]. Kopec et al. [8] studied the effect of repeated supplementation of sodium phosphate and caffeine on exercise performance. Among them, 11 men who participated in team sports participated in four trials: SP (50 mg/D of free fat for 6 days) and caffeine; SP and placebo (caffeine), caffeine and placebo (SP) and placebo (SP and caffeine). After that, participants took part in a simulated team game, which was composed of 2 × 30 min, and repeated 6 × 20-m sprint at the beginning, half and end of game. There was no interaction among FS, BS and TS ($P > 0.05$). However, compared with placebo, SP had the fastest time of all sprints, with medium to large effects (ES: d = 0.51–0.83) and "possible" to "very likely" benefit opportunities. Compared with caffeine, SP has a "possible" to "possible" benefit opportunity for FS, BS and TS, and compared with SP+C, SP has a "possible" benefit opportunity for BS. Compared with placebo, SP+C resulted in moderate es (d = 0.50–0.62) and "possible" to "possible" benefits, while caffeine led to moderate es (d = 0.63; FS: Set 3) and "possible" benefits with many opportunities. His method is only carried out once, and its stability is poor [8].Through biomechanical analysis, Gao et al. [9] revealed the differences in lower limb muscle strength and co-activation between forefoot landing and whole foot landing dancers in Latin dance, pointing out that the reduced standing area of FT dancers leads to decreased ankle joint stability and increased risk of injury, and the increased co-activation around the knee joint may be a compensatory mechanism for maintaining stability. Li et al. [10] compared the lower limb biomechanics differences between the side bump step and the bounce step in Jive, revealed the significant changes in joint angle, moment, speed and ground reaction force of female casual Latin dancers when performing the two steps, and emphasized the importance of strengthening lower limb muscles to prevent injuries and improve dance performance. It also points out the necessity of adjusting the heel height reasonably according to the training time, which provides a new perspective for reducing dance injury and improving dance skills [10].

This study first introduces the relationship between several major mineral elements and the ability of dancers, including potassium, calcium, magnesium and iron. After that, the effects of Vitamin A, Vitamin E and Vitamin C on the ability of dancers are explained in detail. This study also describes the factors that affect the energy metabolism of sports dancers, and sort out the sports ability of special dance. This study was divided into two groups, after the experimental group was supplemented with appropriate vitamins and minerals, the exercise ability was tested. Combined with the experimental results, the daily intake of energy analysis, the impact

of different vitamins, the impact of different minerals, the analysis of athletes' physical fitness and the overall role of analysis. Research shows that vitamins and minerals can improve the physical fitness of athletes.

2. Dancers and minerals and vitamins

2.1. Relationship between minerals and sports ability of sports dancers

Minerals are also necessary to maintain the body's acid-base balance and normal osmotic pressure. Some specific physiological substances in human body, such as hemoglobin in blood and thyroid, must synthesize iron and iodine. The activity of forming or activating enzymes is related to the metabolism of substances. Essential trace elements are essential active factors of enzymes and vitamins. They form specific hormones, participate in the role of hormones, participate in nucleic acid metabolism, and support the function of major nutrients and major nutrients. The most important minerals related to sports dance and athletes' sports skills are potassium, calcium, magnesium and iron [11–13].

(1) Potassium element

Potassium is one of the most important cations in the human body. Low potassium may slow down gastrointestinal movement, lead to intestinal paralysis, and aggravate anorexia, nausea, vomiting and abdominal distension. In normal training and competition, athletes consume a lot of energy and accelerate metabolism. In addition, the precursor of potassium fishing is often fatigue. Potassium deficiency athletes will appear fatigue and emotional depression, which will affect the normal sports ability of athletes, reduce the training effect, and affect the athletes to achieve good results [14].

(2) Calcium

The difference between normal exercise and calcium metabolism is that athletes lose a lot of calcium due to sweating in sports training and competition. Calcium plays an important role in the accessibility of nerve cells and muscle cells, the contraction of skeletal muscle and the maintenance of intracellular auxiliary information. Therefore, the nutritional balance of calcium is very important to maintain the athletes' sports skills. Calcium deficiency may lead to muscle contraction, and long-term calcium deficiency may lead to decrease of bone mineral density. The survey shows that many female athletes, especially young female athletes, have lower calcium intake than the recommended amount, which will affect bone growth and increase the risk of sports fracture.

(3) Magnesium

Magnesium is the main cation in human cells. The total magnesium content of normal adults is about 259. Magnesium can strengthen teeth and bones, relax muscles and promote muscle health. Magnesium deficiency can lead to excessive stimulation of the nerves and muscles of athletes. Muscle vibration and dyskinesia are common. In more serious cases, you may feel confused and fall into a coma [15].

(4) Iron element

Iron is an indispensable trace element in human body. According to the function of iron compounds, iron can be divided into two categories, which have specific physiological functions, such as hemoglobin. Iron containing enzymes, such as

tyrosine, caproate, etc. It participates in the oxidative respiration of tissues and catalyzes the biological oxidation reaction. The other type has no special physiological function. Preserved in the form of iron, in the form of felicity and heidelin. It exists in the liver, spleen, bone and tendon. It is a kind of iron warehouse that can be mobilized and used at any time.

Sports dancers in training can promote iron metabolism, promote the metabolism of red blood cells, increase the body's iron demand. In addition, exercise can increase muscle, increase the content of iron enzyme in muscle. Therefore, exercise promotes iron metabolism and affects iron intake. The survey shows that the iron reserve of female athletes engaged in sports is worse than that of female athletes, especially those in the growth and development stage of teenagers [16].

2.2. The relationship between vitamins and sports ability of sports dancers

Vitamins are essential nutrients and low molecular organic compounds for human body, which have an important impact on health protection, growth promotion and physiological function regulation. Many species have different chemical properties and physiological functions. They are not involved in tissue formation, but they do not provide heat. The human body needs more than 10 vitamins, which can be divided into fat soluble and water-soluble according to their solubility. These vitamins can be excreted slowly into the liver. Excessive intake can lead to poisoning. Water soluble vitamins mainly include Vitamin B1, B2, C, folic acid, pantothenic acid, etc. Vitamin A, E and C are the main factors that affect athletes' sports ability [17].

(1) Vitamin A

Vitamin A maintains normal development and protects skin tissue, especially ocular connective tissue, respiratory tract and other health needs to maintain normal vision. If it is absent, the ability of dark adaptation is reduced, which may be involved in the synthesis of glucose and polysaccharide. Stress and immunity have a certain relationship, so athletes often eat milk, fish, egg yolk and other food, in order to maintain the normal development of the body and good eyesight.

(2) Vitamin E

Vitamin E has antioxidant effect, promote capillary proliferation, maintain the function of skeletal muscle, smooth muscle and myocardium, promote metabolism, increase oxygen consumption and improve body endurance. Therefore, Vitamin E helps to improve the sports skills of sports dancers, improve the muscle nutrition and blood supply of sports dancers, improve the muscle quality of sports dancers, improve the competitiveness of athletes, and help sports dancers achieve the best results in the competition [18,19].

(3) Vitamin C

Vitamin C may be involved in the oxidation of protein, fat and sugar. There is a hydrogen transporter in the body, which participates in the redox reaction in cells. Lack of Vitamin C in sports dancers can lead to weakness and iron deficiency anemia and damage the body's ability.

2.3. Influencing factors of energy metabolism of sports dancers

Through repeated measurement and analysis of dispersion, this study confirmed the influence of dance type and gender on the whole competition of Chinese high-level sports dancers. Competition E_{PCR} is mainly affected by the different physiological muscle structure of men and women, only gender has a greater impact. ELA is mainly affected by the type of dance determined by the different intensity of dance. E_{AER} is greatly influenced by the type, gender, type and gender of dance. This shows that different types of dance intensity and gender differences have a comprehensive impact on the E_{AER} of athletes. The results of CO dispersion analysis showed that neither BMI nor body fat rate affected E_{total}, which was not different from the results of existing studies. According to the results of CO dispersion analysis, BMI and body fat ratio did not affect total energy metabolism, and there was no difference between the results of current studies and BMI [20].

After controlling the height, weight and BMI of athletes, we found that there were significant gender differences in the energy consumption of athletes in the semi-finals, but there was no reason for this result. BMI and body fat rate as a co-variable does not have much significance, which may be related to the body composition of the top Chinese Dance dancers, but on the whole, it has a certain effect, so BMI and body fat rate cannot be ignored. However, compared with BMI, body fat rate is more important. The lower the body fat rate is, the higher the muscle content of human body is, which reflects that skeletal muscle is excellent exercise energy The basis of force. Compared with the results of foreign research, the BMI level of Chinese high-level sports dancers and foreign high-level athletes is the same, but the body fat rate is very high [21].

2.4. Sports ability of special dance

Through the physical ability test of standard dancers (including movement frequency, explosive force, absolute strength, physical activity, softness and coordination, balance, rhythm coordination and endurance), we can see that they have great strength, softness and endurance. Gender differences (boys are better than girls), regression analysis shows that adjustment, exercise frequency, balance, rhythm adjustment and flexibility can significantly predict the success rate of female standard dancers; exercise frequency, explosive power, static balance, flexibility and aerobic endurance can predict the success rate of male standard dancers, which is 71%. Although the training mode of sports dance in China has changed, the training concept of "attaching importance to skills and ignoring physical strength" still remains. Sports dance is usually expressed in the form of repetition and explosive force, which introduces subtle dynamic dance performance in strength and function.

One kind of muscle movement ability has a great influence on the technical performance of dance, especially the explosive ability of muscle. According to the research, due to the lack of individual muscle strength training, sports dancers show weakness of lower limbs and propulsion to the ground. Moreover, in the specific moment of dance, the anaerobic limit value was exceeded and the critical strength limit (VO_2 max) was reached. With the increase of exercise intensity, the threshold of anaerobic metabolism is limited to the moment when energy generation and anaerobic reaction become more active. This shows that the aerobic exercise ability of athletes

is an important factor to improve high-quality sports performance [22–25].

In order to realize the physiological activity and promote the performance of dance competition, special preparatory activities must be carried out before the dance competition. However, the coordination of dance skills and techniques has complex physiological reactions that are difficult to explain [26–28]. The current sports dance project does not have the activity method before the competition completely. This may indicate that the BMI level of some subjects in the study reached its peak after the first dance due to physiological inertia. In addition, many researchers also emphasize the impact of dance choreography on energy consumption, but there is considerable controversy in the existing research, which is not only affected by the simulated competition plan, but also by other important factors. At the same time, there is no referee's on-the-spot evaluation in the simulation match of related research. Athletes' stress level, quality of exercise and labor may be different from competition. The results show that the level of energy metabolism may be lower in actual competition.

3. The ability test experiment of vitamin and mineral to dancer

3.1. Subjects

In this experiment, 100 dancers (50 females and 50 males) aged 20–25 were selected from the City Sports University. These dancers have no history of acute or chronic diseases and are in good health. Among them, 6 are athletes, 8 are 21.44 ± 1.63 years old, 7.13 ± 1.72 years old during training, height 174.45 ± 5.23 cm, weight 60.48 ± 6.89 kg. In this study, 100 people were divided into experimental group and control group, with 50 people respectively. The grouping process ensured that the two groups were comparable in terms of age, sex, years of training and health status.

A control group of 50 people was added to the experimental design, it's 50 percent male and 50 percent female. Participants in the control group will follow the same training and daily eating plan as the experimental group, but without specific vitamin and mineral supplements. By comparing the performance of the athletes in the experimental and control groups in training and tests, the impact of nutrient supplementation on the athletic ability of the dancers can be more accurately assessed.

3.2. Experimental process

Through the daily schedule of the dance team of the sports university, the professional dancers of the sports school of the sports university arrange 2 h of training in the morning and 3 h in the afternoon. There are three kinds of technical courses: physical training course and aerobic training course. Among them, the technical courses of dance studio in sport university mainly include the coach's technical description, special dance exercises, simulation competition, etc. The muscle strength class is carried out in the muscle strength room of the training foundation, mainly to balance, squat, high jump, front squat four postures to maximize muscle strength [29].

The main purpose of aerobic training class is to reduce and increase aerobic training [30,31]. During slow weight management twice a week, athletes can burn fat to reduce weight. Aerobic training class mainly includes jogging, walking in the playground, football and other medium intensity long-term sports. Through the

athletes' daily life and simple methods, every day can be accurately divided into six periods: sleep, morning, morning training, noon, afternoon training and evening.

Among them, the school will carry out lights out every night and strict traffic control measures, athletes can sleep for 8 h. Morning time includes breakfast, free activities and early training activities. The training time in the morning is fixed. During the 2-hour general training period, some athletes of the women's wrestling team of the competitive sports university may need to take cultural classes in the morning. However, due to the close competition in May 2012 and the weight management period, the athletes began to receive training. I'm focused. 100 test players worked out for two hours in the morning. During the noon period, including lunch, free activities, lunch break, etc., the training time in the afternoon is 3 h. The evening period includes dinner, cultural classes, free activities, etc.

3.3. Experimental methods

(1) Body composition test

Bioelectrical impedance (BI) is usually used in practical research in current body composition testing methods [32,33]. The composition of human body is determined according to the corresponding relationship between electrical impedance and human tissues.

(2) Exercise ability test

It is also very important for athletes to test their athletic ability to ensure normal and effective training. In sports, the metabolism of human body is bound to change. When people are in the state of quiet, exercise and recovery, the biochemical indicators in the body are also different, which can be used as the basis for evaluation. Moreover, training methods, exercise load and other factors have a variety of effects on athletes, which will bring changes to the biochemical indicators of people, which can be reflected in the exercise ability test. The basic contents of biochemical evaluation include the evaluation of athletes' physical function, the evaluation of energy metabolism and metabolic ability of substances, and the determination of blood and urine indexes [34,35].

The principle of 12 min running test: if the athlete runs for 12 min, the performance will be greatly determined according to the VO_2 max of 1 kg, and the correlation coefficient (0.897) can be obtained correctly. Therefore, using 12 min of running performance (mainly distance), the maximum oxygen intake of athletes can be calculated. Main steps: 1) Prepare and adjust the machine. 2) Test the lactic acid value of athletes' blood in a quiet state. 3) Suggest athletes run for 12 min to record the results. 4) Test the lactic acid value of athletes' blood immediately after exercise. Evaluation criteria: the aerobic ability of athletes will be stronger when the subjects run farther and the increase of lactic acid in blood is less before and after exercise. In order to evaluate the aerobic capacity, VO_2 max was calculated according to the 12-minute driving distance and VO_2 max calculation table.

The study used a bioelectrical impedance instrument for body composition testing, which determines composition by measuring the reactance of human tissue. The exercise ability test includes a 12-minute running test and a maximum strength test, which are performed according to standardized procedures to ensure data

consistency. In order to deal with data deviation or missing value, interpolation estimation, mean replacement and double-tail test using statistical test are adopted. A *P*-value of less than 0.05 was considered statistically significant. In addition, selection bias was reduced by randomly assigning participants to the experimental and control groups, and differences in mean values within and between groups were assessed by paired sample *T*-tests and independent sample *T*-tests. These methods ensure the accuracy of the data and the reliability of the analysis results.

The exercise ability test was done on a treadmill; Assess an athlete's VO_2 max and maximum strength tests, including bench presses, squats, high jumps and front squats, which are performed using standardized sports testing equipment. All measurement tools are calibrated prior to the experiment to ensure data accuracy and reliability.

3.4. Data statistical processing

Excel 2023 and IBM SPSS Statistics 28 software were used to analyze the experimental data. All data are expressed as mean ± SD and all data are kept to two places below the decimal point. Paired sample *T*-test was performed on corresponding samples from the same type group (including intervention group and control group). Different types of groups (i.e., comparison between intervention group and control group) were compared in *T*-test of independent samples. $P < 0.05$ is significant difference, $P < 0.01$ is very significant difference.

4. Analysis of the influence of vitamins and minerals on the ability of dance athletes

4.1. Analysis of daily energy intake of dancers

Table 1 shows the changes of three meals a day and total calorie intake of dancers before and after the experiment.

Table 1. Changes of three meals and total calorie intake before and after intervention (n = 150).

Energy and recommended value	Male (n = 50)		Female (n = 50)		Control group (n = 50)	Recommended value
	Before intervention	After intervention	Before intervention	After intervention		
Breakfast (%)	25.83 ± 4.57	27.90 ± 2.85	24.45 ± 5.23	27.20 ± 4.18	25.64 ± 3.46	25–30
Lunch (%)	36.24 ± 5.45	37.00 ± 4.56	36.82 ± 6.27	35.38 ± 4.73	35.68 ± 4.51	35–40
Dinner (%)	32.47 ± 4.38	29.63 ± 1.64	31.27 ± 6.81	29.15 ± 4.27	29.56 ± 3.86	25–30
Extra meal (%)	5.57 ± 4.61	5.65 ± 6.16	8.23 ± 4.33	8.35 ± 5.54	7.85 ± 4.55	0–10
Total daily energy (kcal)	4073.71 ± 549.11	4057.53 ± 581.62	2853.09 ± 577.64	3085.98 ± 303.23	3526.54 ± 464.66	100

Figure 1 shows the energy intake of dancers before and after the experiment.

In the dietary intervention study, 100 professional dancers were randomly assigned to the experimental and control groups, ensuring agreement between the two groups on key baseline characteristics. The experimental group received a customized diet with specific vitamin and mineral supplements, while the control group maintained a regular diet. The study detailed the participants' daily energy intake

before and after the intervention, focusing specifically on the proportion of meals and snacks consumed. As shown in **Figure 1**, the experimental group had a significant increase in the proportion of energy intake at breakfast ($P < 0.05$), while a decrease in lunch and snack intake indicated a more rational energy allocation. In addition, the proportion of energy intake at dinner was significantly reduced in male athletes after the intervention ($P < 0.05$), but this change was not observed in female athletes. These findings clearly distinguish differences in response between the experimental and control groups and highlight the importance of personalized nutritional supplementation for optimizing energy management in athletes.

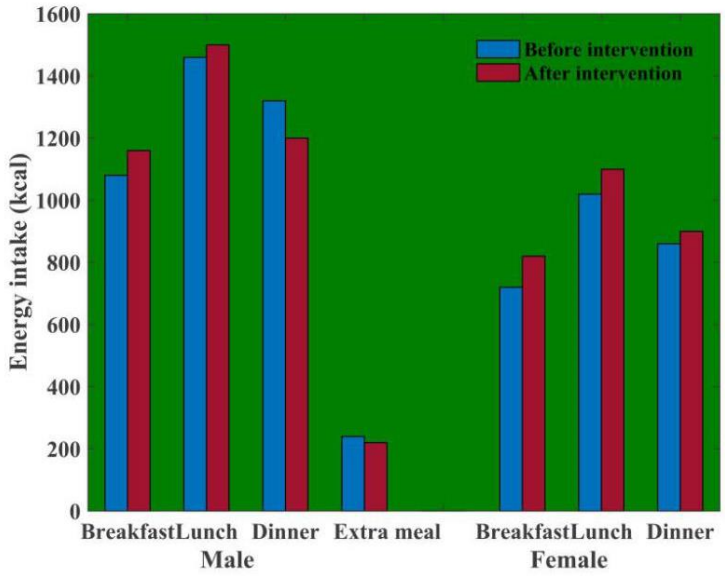

Figure 1. Energy intake of three meals a day before and after the experiment (kcal).

4.2. Analysis of different vitamin intake on the ability of dancers

Table 2 shows the changes of athletes' vitamin intake before and after the experiment.

Table 2. Changes of vitamin intake before and after the experiment ($n = 150$).

Vitamin	Male ($n = 50$)		Female ($n = 50$)		Control group ($n = 50$)	Recommended value
	Before intervention	After intervention	Before intervention	After intervention		
Retinol equivalent (μg)	824.66 ± 143.73	1237.36 ± 233.91	889.77 ± 371.25	1095.27 ± 349.23	1136 ± 264.47	1500
Vitamin B1 (mg)	1.83 ± 0.71	3.64 ± 1.42	1.59 ± 0.96	2.13 ± 0.87	2.68 ± 1.31	5
Vitamin B2 (mg)	2.47 ± 0.72	2.71 ± 0.83	1.84 ± 0.36	2.14 ± 0.37	2.56 ± 0.86	2–3
Vitamin C (mg)	70.27 ± 52.65	121.98 ± 42.36	96.48 ± 36.83	146.15 ± 39.84	112.85 ± 43.65	140
Nicotinic acid (mg)	26.27 ± 6.58	26.19 ± 4.27	22.45 ± 5.23	22.38 ± 5.58	26.54 ± 4.64	20–30
Vitamin E (mg)	25.44 ± 14.21	23.66 ± 9.26	29.68 ± 10.62	21.52 ± 12.46	24.54 ± 10.96	8–10

In the experimental group, retinol equivalent and Vitamin B1 intake increased significantly after dietary intervention, reaching the recommended value; The intake of Vitamin B2 in men was stable and close to the recommended level. Vitamin C intake increased significantly in both men and women, meeting the recommended

standards. The intake of niacin was suitable, and there was no significant change. These results suggest that the dietary intervention effectively increased the intake of key vitamins, especially those essential for exercise performance, and the comparison of the experimental group with the control group further confirmed the success of the nutritional intervention strategy.

4.3. Analysis of different mineral intake on the ability of dancers

Table 3 shows the changes of mineral intake of athletes before and after the experiment.

Table 3. Changes of mineral intake before and after intervention.

Mineral	Male (n = 50)		Female (n = 50)		Control group (n = 50)	Recommended value
	Before intervention	After intervention	Before intervention	After intervention		
Ca (mg)	1003.35 ± 172.41	1254.76 ± 231.25	1025.84 ± 217.76	1173.22 ± 240.47	1165.46 ± 198.87	1000
Fe (mg)	52.71 ± 11.28	55.93 ± 8.26	44.29 ± 14.15	52.17 ± 10.43	48.34 ± 11.54	20
Zn (mg)	24.62 ± 3.84	25.23 ± 3.17	14.68 ± 5.41	21.36 ± 5.01	26.64 ± 4.64	20
Se (mg)	140.35 ± 39.35	141.35 ± 35.72	74.52 ± 22.88	71.64 ± 20.69	90.65 ± 46	50
K (mg)	3453.13 ± 523.06	3757.2 ± 510.13	3408.62 ± 783.43	3504.62 ± 539.71	3565.64 ± 655.47	3000
Na (mg)	3285.13 ± 460.74	3077.24 ± 519.45	2458.11 ± 364.96	2025.52 ± 537.34	2647.94 ± 465.46	<5000
Mg (mg)	496.81 ± 63.79	483.72 ± 58.45	458.34 ± 50.76	421.15 ± 58.87	476.35 ± 55.64	400

Compared with the mineral intake before and after the intervention, there is a significant difference in calcium intake before and after the intervention. The iron intake of male and female athletes after food intervention was significantly higher than that before intervention ($P < 0.05$). Before and after diet therapy, the iron intake of male and female athletes reached the recommended intake, and there was no significant difference. The zinc intake of female athletes was lower than the recommended value before 4 weeks dietary therapy intervention, and the zinc intake of female athletes after dietary therapy intervention was significantly higher than that before intervention ($P < 0.01$). Before and after diet therapy, the intake of selenium, potassium, sodium and magnesium of male and female athletes were within the recommended range, and there was no significant difference between the two groups.

4.4. Analysis on physical fitness of dancers before and after the experiment

A is a significant difference compared with the intervention group before the experiment, $P < 0.05$; *aa* is a very significant difference compared with the intervention group before the experiment, $P < 0.01$; *b* is a significant difference compared with the control group before the experiment, $P < 0.05$; *bb* shows a very significant difference compared with the control group before the experiment, $P < 0.01$; *c* compared with the intervention group after the experiment, shows a significant difference, $P < 0.05$; *cc* and the intervention group show a significant difference, $P < 0.05$. There was a significant difference in the ratio of $P < 0.01$. **Figure 2** shows the difference of blood lactic acid and running distance of dancers before and after the experiment.

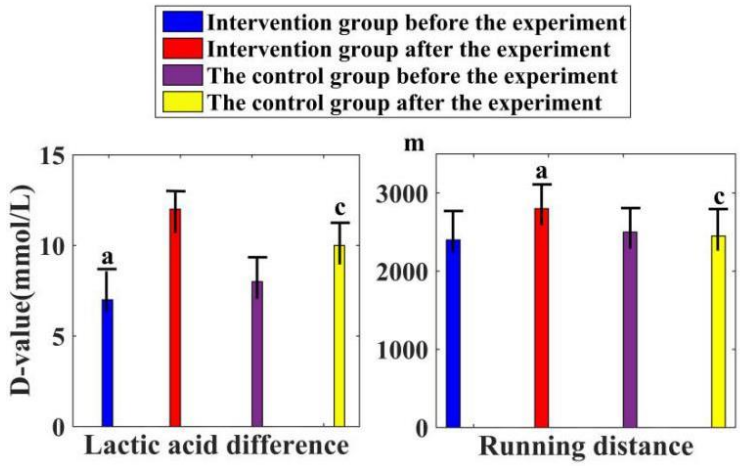

Figure 2. Blood lactate difference and running distance before and after the experiment (n = 100).

Figure 2 shows significant differences in driving distance and lactic acid values in the intervention group before and after the experiment, while no statistical changes were observed in the control group. The 12-minute running test is an effective way to assess aerobic endurance, and its low-intensity and long-duration nature helps improve cardiorespiratory function. The experimental results showed that the correlation between VO_2 max and 12-minute running performance was low (correlation coefficient was 0.187), and VO_2 max and AT could reflect aerobic capacity more comprehensively. In addition, the sustained VO_2 max level of the 12-minute run helped to indirectly measure aerobic metabolic capacity. The increasing trend of lactic acid values in the control group may be related to increased aerobic training, which helps to improve fat burning efficiency. Although dietary therapy had no significant effect on the improvement of anaerobic exercise capacity, both the intervention and control groups increased their maximum output after the experiment, showing maintenance of fatigue index, which helps to maintain the athletes' physical fitness.

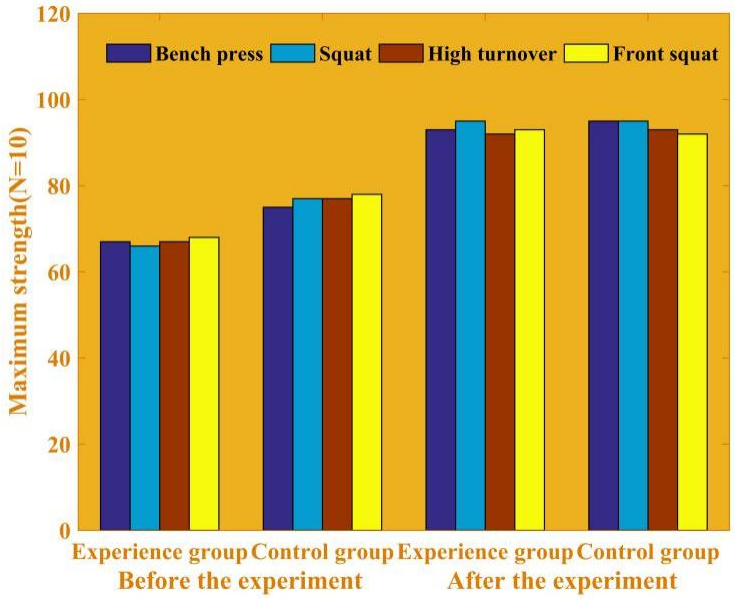

Figure 3. Maximum strength test of athletes.

According to **Figure 3**, which shows the maximum strength test of dancers, there is no significant difference between bench pressing, squat, high jump and forward squat in athletes' maximum strength test ($P > 0.05$). This shows that diet therapy during weight management almost does not affect the maximum muscle strength of athletes, and the increase of maximum muscle strength of athletes during weight management is not obvious. That is to say, there is no significant increase in muscle strength during weight management. And it's very low. As improper weight-loss methods may reduce the muscle endurance and explosive power of athletes, the dietotherapy methods in this study show that maintaining the muscle strength of athletes during the slow weight reduction period has a positive impact on sports ability.

4.5. Analysis on the overall effect of vitamins and minerals on dancers

Figure 4 shows the effect of vitamin and mineral supplementation on the physical fitness of dancers.

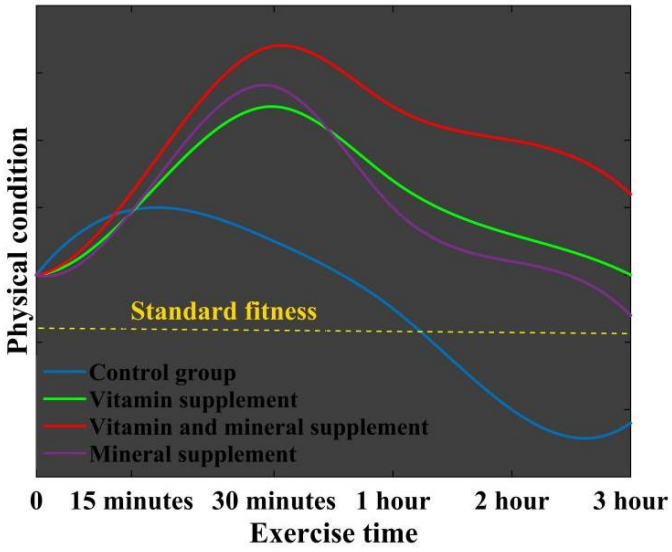

Figure 4. Effects of vitamin and mineral supplementation on athletes' physical fitness.

It can be seen from **Figure 4** that in the control group without any minerals and vitamins, the physical fitness of the athletes began to decline after one hour, while the athletes who had been supplemented with certain vitamins or minerals were still full of energy within one to two hours, and gradually weakened after more than two hours. For the athletes who supplement minerals and vitamins at the same time, they still have a certain amount of energy after nearly three hours of exercise. It can show that minerals and vitamins play a certain role in promoting the various functions of the body, including athletes' strength, endurance, balance, etc.

In this study, the regression analysis method was further used to analyze the mineral and vitamin intake of the experimental group and the control group before and after the experiment. The results of the analysis revealed correlations between specific minerals and vitamins and athletic performance. Potassium intake in the experimental group showed a significant positive correlation with performance on the 12-minute running test, which may be related to potassium's role in maintaining muscle function

and reducing fatigue. Analysis of the correlation between iron intake and strength test results indicates that iron plays an important role in promoting hemoglobin synthesis and improving oxygen transport capacity. Vitamin C intake was associated with performance on the dance training duration test, which may be related to Vitamin C's function in promoting collagen synthesis and reducing exercise-induced oxidative stress.

5. Conclusion

Sports dance is a kind of high-intensity and high-energy sports based on the aerobic energy supply system, supplemented by phosphate and sugar energy supply system. The proportion of energy supply system is greatly affected by dance type, and the proportion of sugar dissolving energy supply system increases slightly with the decrease of aerobic energy supply proportion. The role of vitamins and minerals cannot be ignored. Vitamins have immune function, antioxidant capacity, anti-fatigue, anti-anemia and metabolism of various enzymes, which cannot be separated from energy production. Minerals are more important to athletes. Immune factor active minerals are involved in nerve signal transmission, bone growth and regeneration, and muscle strength growth.

To this end, dancers should carefully plan the timing of meals, ensuring that complex carbohydrates are consumed 2 to 3 h before training, and protein and simple sugars are supplemented immediately after training to support muscle recovery and energy supplementation; at the same time, choose nutrient-dense foods such as whole grains, lean protein sources, low-fat dairy products, and rich fruits and vegetables to ensure you get the necessary vitamins and minerals; in addition, individual supplements, such as increasing protein intake to promote muscle growth or iron supplementation to prevent anemia, need to be tailored to individual training needs and health conditions to optimize energy supply and improve athletic performance.

Excessive intake of Vitamin A may cause necrosis of the femoral head, and regular intake of Vitamin A may damage the kidney. The effects of endurance, circulatory function and insufficient or excessive vitamin intake on energy metabolism have not been clearly concluded. Excess minerals can cause a series of medical symptoms. Vitamins and minerals need to be supplemented with appropriate amount as much as possible, rather than more. Nutrients need to be classified according to the characteristics of different items to get good results.

This study highlights the importance of vitamins and minerals for athlete performance. It is recommended that athletes follow a personalized nutrition plan developed by nutrition experts according to their individual physiological needs and training intensity. Athletes should follow the recommended daily intake standard provided by the nutrition society or sports organization to ensure that the intake of vitamins and minerals meets the body's needs and does not exceed the safety limit. The recommended intake of calcium is usually 1000 mg per day, while the recommended intake of iron varies according to gender, with 8 mg per day for adult men and 18 mg per day for adult women.

Although vitamins and minerals are vital to an athlete's health and performance, excessive intake can also lead to a range of health problems. Too much Vitamin A can

led to headaches, liver damage and even bone disease, while too much iron can cause iron overload, leading to organ damage, including liver and heart problems. Excessive intake of calcium may also increase the risk of kidney stones and may interfere with the absorption of other minerals. Intake should be in line with recommended levels to avoid potential health problems.

In the follow-up study, we should also pay attention to the influence of various covariates on energy metabolism of sports dancers. In the energy metabolism of dance, the spatial position of athletes, the frequency of technical skills and the difficulty of choreography should also be considered. Secondly, the level of physiological activation and stress response will affect the level of energy metabolism. Taking reasonable and scientific vitamins is good for competitive athletes. Athletes should eat fresh vegetables and fruits, reasonable diet, according to their own state, reasonable and scientific vitamin supplement, maintain the normal state of vitamin levels in the body.

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