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Research Article

Nanoselenium on Aerobic Endurance Exercise Adaptation

Guiping He[1] and Long Liu[2]

[1]*Anyang Vocational and Technical College, Anyang, 455000 Henan, China*
[2]*Collage of Physical Education, Beibu Gulf University, Qinzhou 535011, Guangxi, China*

Correspondence should be addressed to Long Liu; liulong@aynu.edu.cn

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If the load exercise exceeds a certain degree, it will lead to sports injury. The main reason for this phenomenon is that the human body produces a lot of free radicals after sports training. Free radicals can attack human cells and cause lipid peroxidation to damage cell membrane. The human body can improve the antioxidant capacity of the body by supplementing some trace elements. Selenium, iodine, zinc, iron, and calcium are all trace elements that contribute to antioxidants in the body. Nanoselenium is of great interest among many immune modulators because of its high antioxidant properties and remarkable immune protective function. In this paper, grey rabbits were used as the research object to carry out aerobic endurance training. Nanoselenium and placebo were supplemented in each group. The evaluation model of nanoselenium on aerobic endurance exercise was established by system control method, exhaustion compensation method, and analytic hierarchy process. The adaptive changes of nanoselenium on aerobic endurance exercise of grey rabbits were studied in detail, and the effects of exercise and antioxidant on the body were observed. Compared with the previous research methods, the difference is that the decentralized control theory is introduced as the guiding ideology of the research. According to the experimental results, the accuracy of the overall experimental results is improved by about 20%, and the accuracy is higher, which has certain practical value.

1. Introduction

Selenium is one of the essential trace elements for human body, which is crucial for human survival and development. As an emerging bionanotechnology, research on the preparation of selenium nanoparticles is gaining more and more attention and has a broad application prospect. After exercise training, the human body will produce a lot of free radicals, such as oxygen free radicals and hydroxyl radicals, which have high oxidation activity. They are very unstable and highly active. They attack cell membrane and mitochondrial membrane and react with unsaturated fatty acids in membrane, resulting in enhanced lipid peroxidation and changes in membrane fluidity and permeability. This destroys the integrity of cell membrane structure. Lipid peroxidation injury of cell membrane is an important mechanism of exercise-induced fatigue and injury. In order to eliminate sports fatigue and quickly reduce sports injury and improve the body's sports ability, we must try to reduce the production of excessive free radicals in the body or increase the body's ability to remove free radicals.

The production of reactive oxygen species (ROS) can cause serious oxidative damage to proteins, lipids, and genomic structures. Shirvani et al.'s study showed that the production of reactive oxygen species increased during high-intensity exercise training. The purpose of Shirvani et al.'s study was to investigate the effects of high-intensity intermittent training on the levels of 8-oxoguanidine DNA glycosidase (OGG1) and 8-hydroxy-2′-deoxyguanosine (8-OHdG) in brain and liver tissues [1]. In Shubhangi et al.'s study, Shubhangi et al. reported (a) the biosynthesis of selenium nanoparticles (SE NPs) and (b) the protective effect of selenium nanoparticles on broilers [2]. An effective bacterial strain isolated from farmland soil has been identified as pantoea aggregate (GenBank: KU500622). It can tolerate high concentration of selenium dioxide (9 mm) and produce selenium nanoparticles under aerobic conditions. The results show that the selenium nanoparticles are amorphous and

spherical, and the particle size is less than 100 nm. Shubhangi et al. studied that selenium NP supplementation could significantly restore these values in the control group, even higher than that in the control group. Efruxifermin (EFX) is an Fc-FGF21 fusion protein. The adverse effects of EFX were prevented by simultaneous exposure to selenium nanoparticles (0.6 mg per kg feed) in poultry feed. Maynar et al. studied the changes of serum copper, chromium, manganese, nickel, and selenium contents of high-level athletes [3]. Before the training, 80 professional athletes with different metabolic patterns were recruited. The control group consisted of 31 sedentary participants from the same geographical area. Copper, chromium, manganese, nickel, and selenium were analyzed by inductively coupled plasma mass spectrometry (ICP-MS). Selenium ecotoxicology is one of the most famous examples of the effects of biotransformation and food chain transfer of toxic elements on the environment. However, it has been gradually recognized that biotransformation of selenium by microorganisms and plants may also be the key to in situ bioremediation of selenium pollution in large-scale situations (such as agricultural drainage systems). A kind of euryhaline algae (Chlorella vulgaris) was isolated from the wastewater containing selenium. The aerobic biotransformation activity of Chlorella vulgaris to seleno anion was studied by GCMS and multinuclear magnetic resonance (NMR). Fan et al. found that the algae were active in the volatilization of alkyl selenides, the production of hypothetical selenide precursors of alkyl selenides, and the precipitation of selenium, while exhibiting a very low accumulation of toxic selenomethionine in free form. Therefore, this kind of microalgae is of great significance for in situ bioremediation and biogeochemical cycle of selenium in contaminated saline alkali soil [4].

So far, different bacteria have linked selenite resistance with the production of metal selenium nanoparticles (senps). Although senps have many biotechnological applications in different fields, the molecular mechanism of their microbial genesis has not been fully understood. Alpaca is a physiologically multifunctional β-protein associated bacterial group [5]. Here, Tan et al. reveal another physiological characteristic of CIB strain, which is related to its resistance to seleno anion and the formation of senps. Selenium oxygen anion reduction is an effective detoxification or assimilation process in organisms, but its mechanism is poorly understood [6]. Se (VI)/SE (IV) was reduced to selenium nanoparticles (senps) with less toxicity. For se (VI) reduction, sulfate reduction and Se (VI) reduction showed a competitive relationship. When the required sulfate-reducing genes were destroyed, Se (VI) did not reduce to red senps. Therefore, the reduction of Se (VI) is catalyzed by enzymes in the sulfate reduction pathway. In the aspect of Se (IV) reduction, SERT, a potential molybdenum oxidoreductase, was screened and further applied to the analysis of Se (IV) reduction. Selenite is the main form of selenium in aerobic soil, but different from selenite, the mechanism of plant absorbing selenite is not clear. Ming et al. studied the effects of different concentrations of selenite and selenite on the absorption, transport, and selenium forms of wheat through hydroponic experiment. Nanoselenium (100-500 nm) has high bioavailability and relatively low toxicity [7]. Gulyás et al. studied the effects of selenium-free control diet and nanoselenium diet supplemented with 4.25 mg/kg DM on liver proteome of broilers. Two-dimensional gel electrophoresis (2D-PAGE) and trypsin digestion (LC-MS) were used for differential proteomic analysis. A total of 788 protein spots were detected in the two groups, and the intensity of 18 protein spots was significantly different ($P < 0.05$). Compared with the control group, the expression of 8 kinds of proteins was increased, and the expression of 5 kinds of proteins was decreased. The function of the differentially expressed proteins indicated that dietary stress was caused by high-dose selenium supplementation. Selenium supplementation can affect the metabolism and antioxidant system of fatty acids and carbohydrates and increase the content of actin in cytoskeleton and the expression of actin regulatory protein [8]. Nanoselenium avoids the side effects of selenium, but little research has been done on the adaptation of aerobic endurance exercise.

In this paper, the effects of different selenium sources and selenium supplement time on growth performance, plasma antioxidant capacity, and tissue selenium deposition of gray rabbits were studied.

2. Research Methods

2.1. Decentralized System Control Method. In this paper, in the evaluation model of the effect of nanoselenium on aerobic endurance exercise, the transfer function of the controlled object is $g(s) = y(s) - U(s) = n(s) - D(s)$, and the control system is $K(s) = P(s) - Q(s)$. Where $n(s)$ and $D(s)$ are the zero polynomials and pole polynomials of $G(s)$, and the degree of $D(s)$ is not less than the degree of $n(s)$, where $p(s)$ and $Q(s)$ are the zero and pole polynomials of $K(s)$, and the degree of $Q(s)$ is not less than that of $P(s)$. The expression is as follows:

$$y_{re}^{-1}\int = \frac{1}{A_{re}\int(s)} y_{re}\int(0), \omega(s) = \frac{1}{A_{\omega}(s)}\omega(0). \tag{1}$$

Let the zeros of $A(s)$ and $A(J)$ lie in the right semiclosed plane of the complex plane. The least common multiple of these two polynomials is $A(s)$, as shown in Figure 1.

The connections in Figure 1 are as follows:

$$\begin{aligned} e &= \frac{D(s)Q(s)}{N(s)P(s) + D(s)Q(s)} y_{re}\int - \frac{Q(s)}{N(s)P(s) + D(s)Q(s)}\omega \\ &= \frac{D(s)Q(s)}{N(s)P(s) + D(s)Q(s)} \cdot \frac{1}{A_{re}\int(s)} y_{re}\int(0) \\ &\quad - \frac{Q(s)}{N(s)P(s) = D(s)Q(s)} \cdot \frac{1}{A_{\omega}(s)}\omega(0). \end{aligned} \tag{2}$$

In the evaluation model of the effect of nanoselenium on aerobic endurance exercise, the objective is to make the system composed of data of each group form a closed loop, and the internal stability makes the steady value of output value y

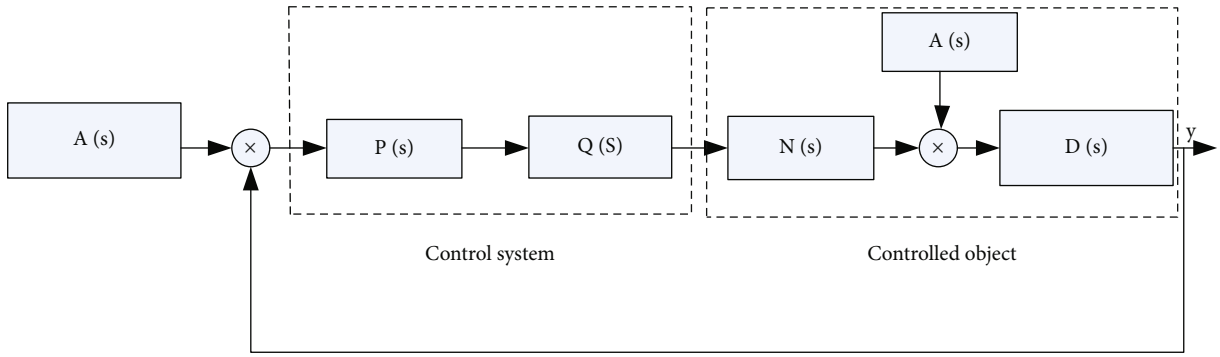

Figure 1: Relationship diagram of experimental coefficients.

independent of the interference factor ω, and track the reference output value y, which is expressed as follows:

$$\lim e(t) = \lim s \cdot e = 0, \forall \overline{y_{re}} \int (0), \bar{\omega}(0). \quad (3)$$

The condition for the establishment of formula (3) is that $Q(s)$ is divided by both sums. This means that the control system contains a model of external instability. This calculation method can make the experimental data more accurate [9, 10].

2.2. Preparation Method of Nanoselenium. Nanoselenium has higher biological activity than selenium and is the safest of known selenium products.

Selenium is an essential trace element with a small gap between effective and toxic doses. Red monomeric selenium has the same antioxidant, immunomodulatory, and antiaging functions of selenium, but its toxicity is lower than that of general inorganic and organic selenium. In order to ensure the stability and reliability of the prepared cross immunochromatographic strip, the qualified nanomarker must be stable, economical, and sensitive.

The preparation of nanoselenium requires the purity and grade of water and reagents. In the process of experiment, it was found that the size of nanoselenium particles prepared by ordinary deionized water was not uniform, and the suspension stability was poor. Only by using ultrapure water of 18.2 mΩ can the selenium nanoparticles with uniform size and dispersion be prepared. In addition, the beaker and centrifuge tube used in the experiment must be clean and free of strong ions. Otherwise, the prepared nanoselenium solution will become turbid and cannot be used in subsequent experiments. In addition, all reagents must be analytically pure, and the purity must be greater than 99.7%. The results show that the nanoselenium prepared by low-grade chemical reagent has irregular morphology and uneven size, the color development effect of the test paper is poor, and the sensitivity is low [11].

Nanoselenium has many stabilizers. In this study, BSA, glucose, gelatin, gum Arabic powder, SDS, PEG, and PVP were used as stabilizers to prepare nanoselenium. Only glucose, Arabian gum powder, SDS, and SDS + peg can be used as markers for cross immunochromatography. However, the performance of the test strips prepared from glucose and SDS was not stable, and the difference between batches was large. The preparation of LFICS with Arabic gum powder as stabilizer requires high protein labeling concentration and high preparation cost of test paper. When SDS and peg are used as templates, they are considered to be the chemical reagents commonly used in the preparation of LFICS. SDS is an anionic surfactant, which can reduce the background interference of LFICS and reduce the false-positive results. Nail is a kind of polymer compound, which can increase the stability of sol [12, 13].

2.3. Exhaustion Compensation Method. In order to evaluate the relative biological efficiency of nutrients, depletion compensation method is usually used. The model of nutrient deficiency was established. Usually, animals are fed on a nutrient-deficient diet for a period of time and then supplemented with different forms of nutrition. According to the influence of nutrients on the relevant indicators of animals, determine whether the nutrients are deficient and the effects of supplements on experimental animals [2, 14].

At present, there are several methods to study the biological potency of selenium: (1) isotope tracer method is used to evaluate the absorption, retention, and excretion of selenium, but the test cycle is relatively short, but the cost is high. (2) Slope ratio method is a commonly used method to evaluate the relative biological potency of nutrients, that is, to select a nutrient form, define its biological potency as 100% and establish a regression curve with nutrients as reference. According to the reference index, the slope of nutrient of 20000 m^3 was calculated, and the relative bioavailability of nutrient to be tested was obtained. At present, the slope ratio method is the main method to evaluate the relative biological potency of selenium, that is, taking sodium selenite as the standard reference material, the biological potency of sodium selenite is defined as 100%. The loss compensation method is used to feed animals with selenium deficiency diet to achieve the effect of selenium deficiency and then add different selenium sources at different levels or at the same time and at different times Source. By comparing the relative indexes of selenium, such as the deposition of selenium in tissues and the activity of GPX in tissues and plasma, the regression equations of these indexes with selenium level or selenium supplement time

were established, and then the slope of sodium selenite and selenium source was compared to determine the relative value [15, 16]. In this study, we established a model of selenium deficiency in grey rabbits and then added three selenium sources: sodium selenite, yeast selenium, and biological nanoelement selenium. The effects of three selenium sources on growth performance, antioxidant capacity, and tissue selenium deposition of grey rabbits were analyzed to evaluate the relative biological efficacy of biological nanoelement selenium.

2.4. Analytic Hierarchy Process. Analytic hierarchy process (AHP) is a multicriteria decision-making method. This method can combine qualitative analysis with quantitative analysis. Its basic idea is to decompose complex decision-making problems in order to obtain an ordered hierarchical structure. Then, the relative importance of each index is compared in the hierarchical model, and several judgment matrices are constructed. Then, the relative importance weight of each level element is calculated; finally, according to the total ranking of each level, the relative weight of all indicators in the whole hierarchical model is calculated, and the research problems are comprehensively evaluated. In China, AHP has been successfully used to solve many problems. To study the data asset evaluation model, AHP method can be used to determine the index weight and calculate the complete evaluation model. The local variables of a function are independent and do not affect each other, and recursion must be approximated to the condition of exit from recursion, otherwise, it is infinite recursion. On the basis of strict mathematical theory, AHP can not only carry out qualitative analysis but also ensure the effectiveness of quantitative analysis, so the evaluation results are more convincing [17]. Hierarchical analysis is not only suitable for situations where there is uncertainty and subjective information but also allows the use of experience, insight, and intuition in a logical manner.

According to the related theory of AHP, the basic idea of AHP depends on the nature of the problem and the overall objective to be achieved, to decompose complex decision-making problems and get several lower-level indicators. Then, the hierarchical structure model is established, and then, the judgment matrix is constructed according to the structure model. Finally, the weight coefficient of each index is calculated to sort the total hierarchy.

(1) *Establish Hierarchical Model.* In the process of analyzing the hierarchical structure, the most important step is to establish the hierarchical structure model of indicators and construct the judgment matrix according to the structure model. Only after the judgment matrix has passed the consistency test can it be analyzed and calculated. The structural model can be divided into three levels. The highest level is the target level, which is the purpose and problem of decision-making. The middle layer is the factor to be considered in decision-making, which is the standard of decision-making, and the lowest level is the alternative scheme of decision-making. In this paper, the hierarchical model refers to the hierarchical model constructed by the factors that affect the value of data assets. In the construction process, we need to consider the value factors. Experts, references, and other methods can be consulted to consider [18]. Hierarchical model is the basis of data asset evaluation model

(2) *Establish Judgment Matrix.* After the construction of the hierarchy model, the judgment matrix is established according to the indicators in the hierarchy model. The judgment matrix represents the relative importance of all factors in this layer to a certain factor in the upper layer [19]. Judgment matrix has an important impact on the follow-up results and is also the embodiment of the quantitative nature of AHP. The construction of judgment matrix can refer to the opinions of experts, and the elements of judgment matrix can be assigned by relevant professionals. When assigning values to the elements of the judgment matrix, the nine level scaling method can be used (i.e., the relative importance between indicators is represented by the number 1 to 9 and its reciprocal), which is also the most commonly used method in AHP. The specific scaling method is shown in the table

Hierarchical analysis treats the research object as a system and makes decisions according to the way of thinking of decomposition, comparative judgment, and synthesis, which has become an important tool of system analysis developed after mechanistic analysis and statistical analysis. Based on the number of specific experimental data, the accuracy of the data was qualitatively analyzed to verify the validity of the analysis model. The specific analysis model is shown in Figure 2.

3. Experimental Design

There were 80 adult male grey rabbits, all of them were in normal condition. According to the different sampling time, they were divided into a nonexercise selenium supplement group, B exercise supplement selenium group, C exercise group, and D no exercise no selenium supplement group. According to the time, the test cycle of each exercise group was controlled. Each exercise group was divided into control group and Nan Kuang se group, as shown in Table 1.

After adaptive training, the training lasted for 30 minutes, and the running speed was 25 meters per minute. Exercise six days a week. The temperature is controlled at 20-25 °C. The humidity is 60-80%.

In addition to normal feeding, the rats in the supplement group were given intragastric administration of 200 UG/kg body weight from 6 : 00 to 8 : 00 every night. The control group was given placebo at the same time and dose.

According to different sampling requirements, the specific sampling procedures are as follows: after the grey rabbits were killed, the stomach of quadriceps femoris was taken, the liver was washed with normal saline ~ dried and weighed with filter paper, homogenized with 0.2 mol/

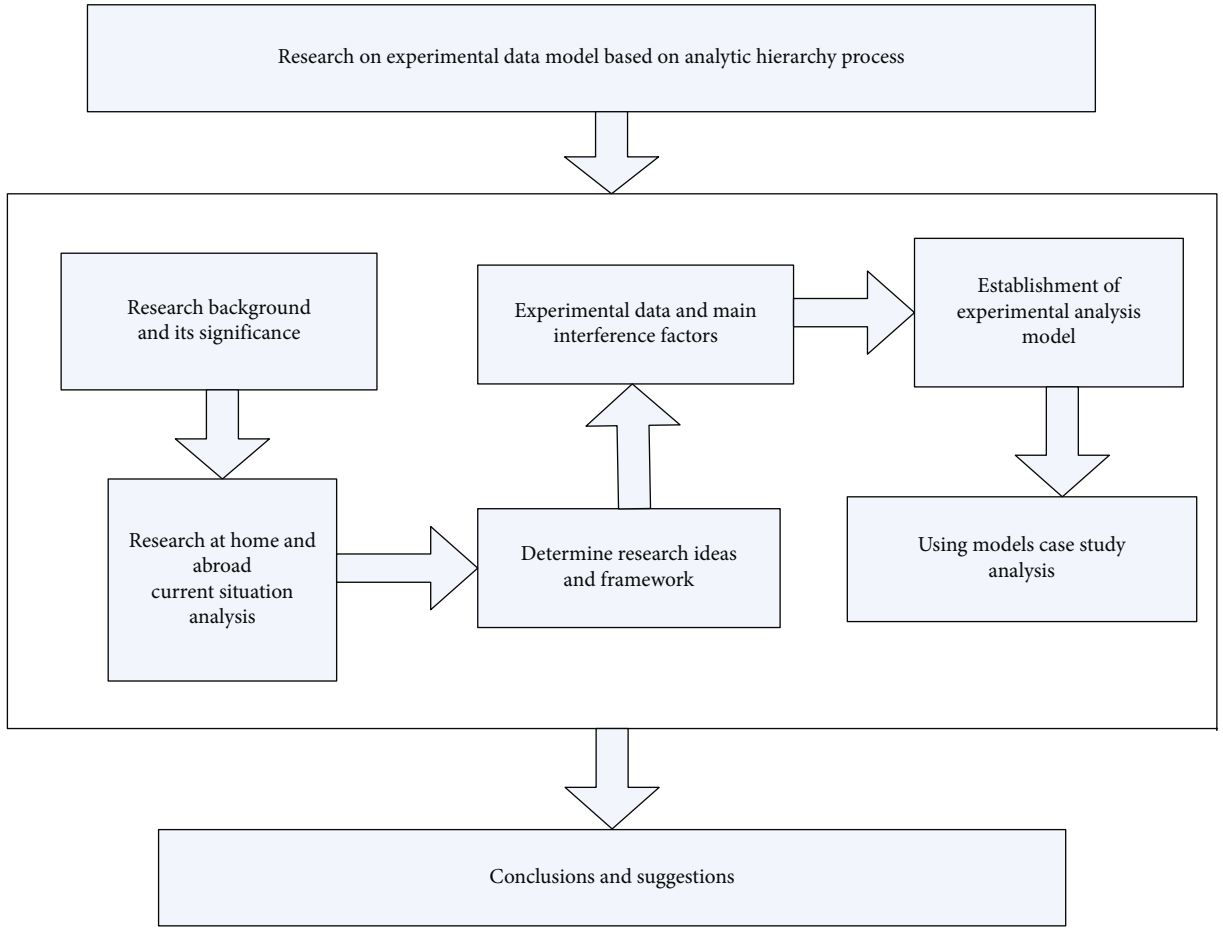

Figure 2: Analysis model establishment diagram.

Table 1: Experimental control group.

Grouping	Group 1	Group 2	Group 3	Group 4
No movement (A)	5	5	5	5
It is moving (B)	5	5	5	5
Selenium supplement before exercise (C)	5	5	5	5
Supplement selenium after exercise (D)	5	5	5	5

1 sucrose (pH = 7.5), and centrifuged with (0.005 mol/1 trishcl, 0.0001 mol/1 EDTA) at 2000 rpm for 20 minutes, and the concentrations of SOD, MDA, and GSH PX in the supernatant were measured.

Preparation of 10% liver homogenate: take about 0.1 g liver, put it into 2mlep tube with steel ball, add 1 ml PBS ice, put it into homogenizer, and homogenize the prepared homogenate at 4°C. The determination methods of selenium content in liver homogenate were as follows:

(1) *Standard Curve*. Take the enzyme plate, add protein standard solution o, turn 1 and 8 wells into 2, 4, 6, 8, 12, 16, and 20 UL in turn, and add deionized water in each well to make up the total volume of each well is $20''$L, and the corresponding protein content is 0, 0.5, 1. 0, 2.0, 4.0, 6.0, 8.0, and 10. The BCA working solution was prepared according to the standard curve and sample quantitative preparation method, in which the ratio of reagent A to reagent B was 50 : 1 and fully mixed

(2) Add 200 ml BCA working solution to each well

(3) Shake the enzyme plate for 30s, place it at 37°C for 30 min, measure the absorbance at 562 nm, add 20 μl sample, and then add 200 plbca working solution. After addition, the mixture was fully mixed, diluted at 37°C for 30 min, and the absorbance was determined at 562 nm

(4) After moderately diluting the sample, add 20 L sample, then add 200 plbca working solution, fully mix, incubate at 37°C for 30 min, and measure the

Table 2: Indexes of grey rabbits.

Grouping	SOD	GSH-PX	MDA
A	133.311 ± 16.251	125.311 ± 15.452	133.271 ± 17.223
B	135.311 ± 16.752	113.311 ± 167.163	112.321 ± 17.184
C	140.311 ± 17.833	125.331 ± 17.854	125.361 ± 17.455
D	151.261 ± 17.644	132.211 ± 13.355	121.671 ± 17.366

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D	151.261 ± 17.644	132.211 ± 13.355	121.671 ± 17.366

absorbance at 562 nm; according to the absorbance value of the sample, calculate the selenium content in the sample through the standard curve

4. The Effect of Nanoselenium on Aerobic Endurance Exercise of Grey Rabbits

As shown in Table 2, SOD of quadriceps femoris in group C was higher at rest before exercise, decreased immediately after exercise, and slightly increased at 2 hours after exercise, while GSH PX decreased immediately after exercise and significantly decreased at 2 hours after exercise, with significant difference compared with that before exercise; MDA increased immediately after exercise. 2 hours after exercise, the value decreased slightly, but still higher than that at rest.

After a week of training, the sod value of preexercise group was significantly higher than that of quiet group ($P < 0.05$), and there were significant differences between the two groups immediately after exercise and 3 hours after exercise ($P < 0.05$); the value of GSH-Px decreased immediately after exercise, but did not recover 3 hours after exercise, which was still lower than that before exercise; MDA value before exercise was higher than that before quiet, immediately after exercise was higher than that before exercise, and decreased at 2 hours after exercise.

As shown in Table 3, the content of selenium in liver of grey rabbits after selenium supplement was higher than that in normal control group ($1.32 \pm 0.065\,\mu$g/g) ($P < 0.05$). The content of selenium in liver of group C ($1.8 \pm 16.251\,\mu$g/g) and group D ($1.6 \pm 16.752\,\mu$g/g) was significantly higher than that in group A ($1.67 \pm 0.31\,\mu$g/g) ($P < 0.05$).

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Selenium content in liver cells of grey rabbits was detected in vitro. 926 cells were treated with H2O2 as an inducer of oxidative stress. The effects of low concentration (0.5 and $1\,\mu$m) of nanoselenium on endothelial cell oxidative damage were studied by detecting the related markers of cell viability and oxidative stress. The results of MTT assay and LDH activity assay showed that H2O2 induced vascular endothelial cell viability decreased and LDH leakage increased, while nanoselenium pretreatment for 24 hours could significantly inhibit H2O2 induced vascular endothelial cell injury. It was found that hydrogen peroxide could increase the content of malondialdehyde, decrease the activities of SOD and GPX, and decrease the content of glutathione, which indicated that hydrogen peroxide-induced oxidative stress, and nanoselenium pretreatment could significantly reduce the oxidative stress induced by hydrogen peroxide. These results indicate that low concentration of nanoselenium can protect vascular endothelial cells from H2O2-induced injury through antioxidant effect.

As shown in Figures 4 and 5, before exercise, SOD index decreased (1 week), increased (2-4 weeks), and exceeded. The results show that the GSH PX index is relatively unstable, with an increase in volatility (1.3 weeks) and a decrease in volatility (2.4 weeks), but there is no significant difference between them. MDA increased (1 week) and decreased (2-4 weeks), close to the level of 0 weeks, and decreased with continuous exercise.

At 3 hours after liver exercise, SOD index increased with continuous exercise, and there was significant difference between 2-4 weeks and 0 weeks. On the one hand, free radicals have a great influence on the activity of SOD in the liver during 0-week transportation; on the other hand, it also

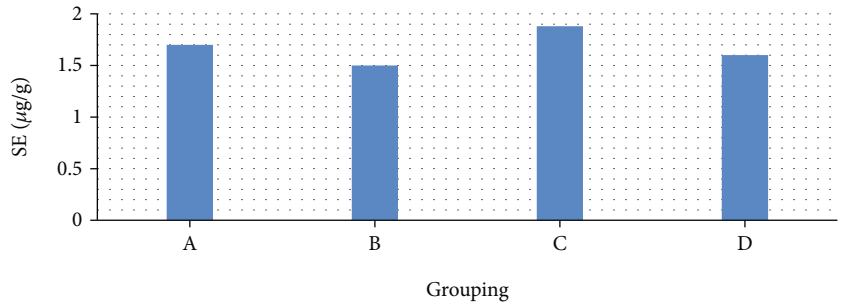

Figure 3: Selenium concentration in animal liver cells.

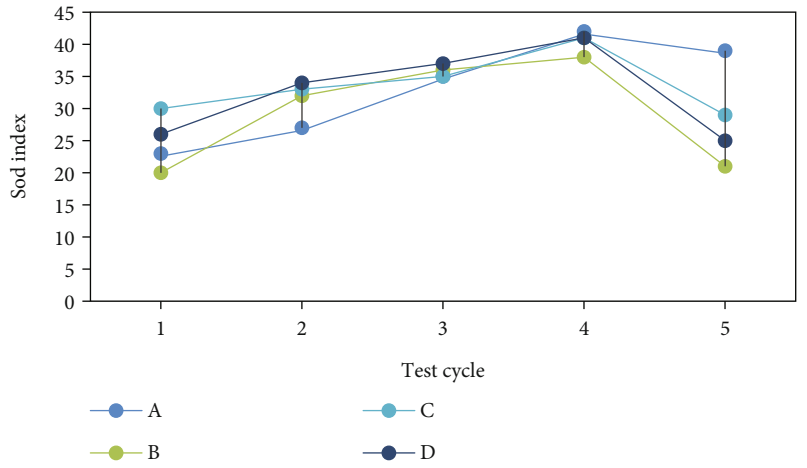

Figure 4: Sod index chart.

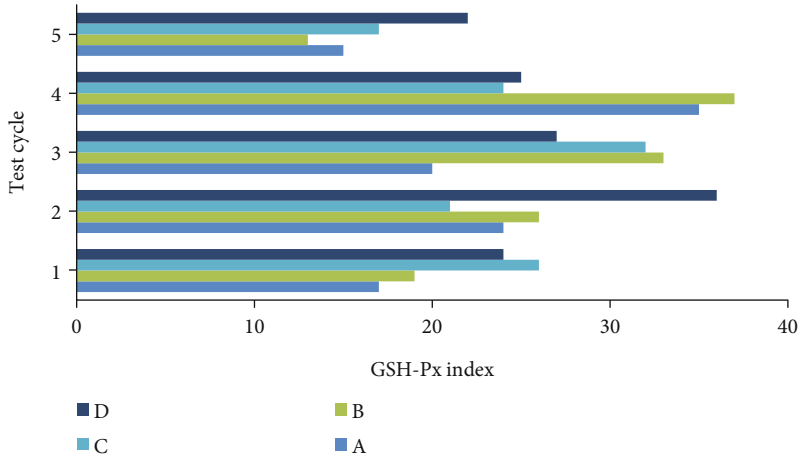

Figure 5: GSH PX index chart.

reflects the strong adaptability and recovery ability of visceral organ liver to exercise. As the exercise continued, GSH PX index also showed an overall upward trend, and there were significant differences between the values at week 1 and week 4 and those at week 0. Combined with the activity levels of GSH PX in the second and third weeks of exercise and before exercise, the difference may be due to the lower operating value in the first week, rather than caused by exercise factors; MDA first increased and then decreased in the first week, and the value of the third and fourth week was close to the level of 0 week. The preexercise value is the recovery value 24 hours after the last training of each week. The results showed that the activities of SOD and GSH PX did not fully recover after 0 week of training, but the values of 3 hours in the first week after exercise were very close to those before exercise, while the results of 2-4 weeks showed that the recovery of antioxidant enzyme activity was basically completed 3 hours after exercise. Compared with the

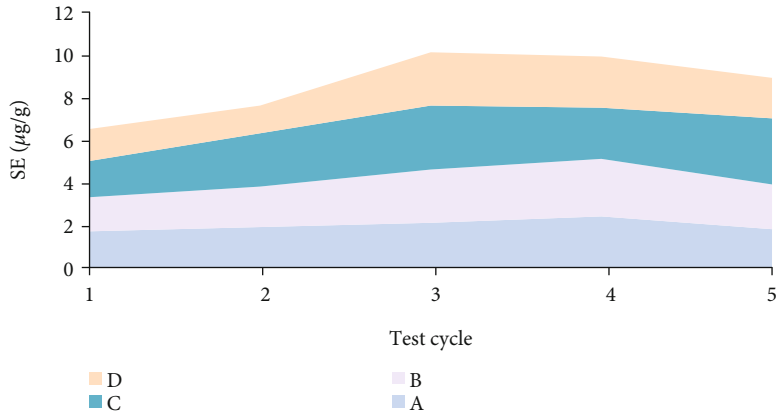

Figure 6: Selenium content cycle chart.

changes of antioxidant enzymes in quadriceps femoris, it was found that the recovery efficiency of liver was higher 3 hours after the first week of exercise, and the enzyme activity was close to the level before exercise.

There was no significant difference in SOD and GSH PX at 4 weeks after liver exercise, but increased continuously from 0 to 4 weeks. MDA first increased (week 1), then decreased (week 2-4), close to the level of week 0. The mobile trend is downward. The increase of antioxidant enzyme activity indicated that the stress ability of liver to stimulation was enhanced on the basis of adaptive exercise.

As shown in Figure 6, after a week of intensive training, the accumulation of free radicals in quadriceps femoris increased, and the consumption of SOD and GSH PX increased, resulting in the decrease of SOD and GSH PX activity after exercise, and the change of SOD was significant, which still affected the recovery period. 3 hours after exercise, the changes of antioxidant enzymes in liver were different from those in quadriceps femoris. The recovery rate of SOD was higher than that of resting state. The level of GSH PX also changed significantly. Although nanoselenium products were supplemented at the same time, the emergency capacity of antioxidant enzymes was still very poor in the first week. However, the changes of liver and quadriceps femoris were different 3 hours after exercise. We think it may be related to liver function. However, due to the lack of comparison between the selenium supplement group and the control group, the effect of nanoselenium in the first week needs further analysis. After the second week of exercise, the activities of SOD and GSH PX increased immediately, and the body under the pressure of exercise increased.

GSH PX is an important enzyme that catalyzes the decomposition of hydrogen peroxide. Its active center is selenocysteine, and selenium is an important component of GSH px. After two weeks of supplementation of nanoselenium, we believe that the activity of GSH PX is increased, the ability of scavenging tian0 is enhanced, and the stress capacity is increased due to the increase of selenium content in vivo. However, H0 is not only an inhibitor of SOD but also an inhibitor of superoxide anion.

The activity of SOD will also destroy the structure of SOD and make it lose its activity irreversibly. After adding nanoselenium, the ability of GSH PX and the activity of SOD were improved. Based on hydroxyl radical quenching, rhodamine B fluorescence method can be used to detect the free radical scavenging effect and antioxidant effect of antioxidants. The free radical scavenging effects of selenium nanoparticles (senp), ascorbic acid (VC), and sodium selenite (Na2SeO3) were determined by fluorescence method. With the increase of antioxidant concentration, their ability to scavenge hydroxyl radicals also increased. When the concentration reached a certain level, the scavenging rate decreased. Within a certain concentration range, there was a linear relationship between antioxidant concentration and elimination rate.

These results indicate that selenium nanoparticles are not only stronger than ascorbic acid but also stronger than inorganic salts of selenium, especially in the dose. It is an antioxidant with strong antioxidant activity, which may be the reason why the biological activity of selenium nanoparticles is higher than that of traditional inorganic salts.

5. Discussion

In order to eliminate sports fatigue and reduce sports injury, it is necessary to reduce excessive free radicals in the body. The body relies on certain enzymes and antioxidants to remove free radicals. Proper selenium supplementation can improve the activity of glutathione peroxidase (GSH PX) and enhance the antioxidant capacity of human body. In this study, selenium nanoparticles were prepared, and their scavenging effects on free radicals were studied.

In this paper, through the establishment of nanoselenium on aerobic endurance exercise evaluation model, the effect of nanoselenium on biological aerobic exercise was studied by detecting the related markers of cell viability and oxidative stress. The results of MTT assay and LDH activity assay showed that H2O2 induced vascular endothelial cell viability decreased and LDH leakage increased, while nanoselenium pretreatment for 24 hours could significantly inhibit H2O2 induced vascular endothelial cell injury. It was found that hydrogen peroxide could increase the content of malondialdehyde, decrease the activities of SOD and GPX, and decrease the content of glutathione, which

indicated that hydrogen peroxide-induced oxidative stress, and nanoselenium pretreatment could significantly reduce the oxidative stress induced by hydrogen peroxide. These results indicate that low concentration of nanoselenium can protect vascular endothelial cells from H2O2-induced injury through antioxidant effect.

Due to the limited experience of the author, the research scope is small, but nanoselenium has many functions, such as antibacterial, anticancer, anti-inflammatory, and antioxidant. However, there are still many problems when nanoselenium is used as a disease treatment drug, antibacterial material, or nutritional supplement. Therefore, it is necessary to develop some analytical and detection methods, especially fluorescent labeling technology, to trace nanoselenium in vivo. In order to further expand the application and product development of nanoselenium in biomedical field, it is necessary to continue to explore and research.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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