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*Retraction*

# Retracted: Effect of Nutritional Protein Food on Metabolism and Physical Fitness of Wushu Athletes

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Y. Gao and Q. Liang, "Effect of Nutritional Protein Food on Metabolism and Physical Fitness of Wushu Athletes," *Journal of Food Quality*, vol. 2022, Article ID 8304325, 7 pages, 2022.

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*Research Article*

# Effect of Nutritional Protein Food on Metabolism and Physical Fitness of Wushu Athletes

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In order to greatly improve the physical function of martial arts athletes, this topic studies the effect of high-protein food on the physical function of martial arts athletes. Forty-five athletes in martial arts events took 5 g of high-protein food every day, 6 times a week for 4weeks, and the left and right forearm, calcaneus bone mineral density, and venous blood was drawn to detect bone metabolism and biochemical indicators related to physical function. The experimental results showed that the bone mineral density of the right calcaneus of male martial arts athletes increased significantly after taking high-protein food, and the bone mineral density of left and right forearms and calcaneus of female martial arts athletes increased significantly. After taking high-protein food, the serum calcium and phosphorus of female athletes and the serum calcium of male athletes were significantly increased. Sex decreased, female athletes significantly decreased serum creatine kinase, and male athletes significantly increased IgM. It can be seen that taking high-protein food for 4 weeks has a certain improvement effect on the bone mineral density of female athletes' forearm and calcaneus, but has little effect on the bone mineral density of male athletes' forearm and calcaneus. It can be concluded that high-protein food has no adverse effect on athletes' bone metabolism, blood biochemical indexes, and immune globulin, and can better maintain the physical function level of martial arts athletes.



## 1. Introduction

The author analyzes the impact of high-protein food on the physical mechanism of sports athletes, aiming to provide a certain reference for sports athletes' food matching [1]. Collagen is an important substance that constitutes the scaffold of the human body, and it is also composed of protein, in short, protein is the scaffold and main substance that constitutes human tissues and organs, and plays an important role in human life activities [2]. The relaxation and contraction of muscles depend on the activity of protein molecules in muscles, so protein plays an important role in sports.

Protein is a very important substance for the human body. (2) Proteins can also maintain the normal metabolism of the human body, in the normal life activities of the human body, carrier proteins need to transport various substances, such as lipoproteins, hemoglobin, receptors on cell membranes, and transport proteins, among which lipoproteins are responsible for transporting fat, hemoglobin is responsible for transporting oxygen; Protein can also provide energy for the human body, which is a very important energy-supplying substance for the human body. Protein decomposition can provide energy for the human body. When the body's energy supply is insufficient, protein will be automatically broken down [3]; Protein also participates in the regulation of the physiological functions of the human body, for example, enzymes involved in various physiological activities of the human body are composed of proteins, and the absorption, digestion, and utilization of food are inseparable from the action of enzymes. As shown in Figure 1. However, after protein metabolism, many nitrogen-containing metabolites, such as urea and uric acid, will be produced. If they accumulate too much in the body, they

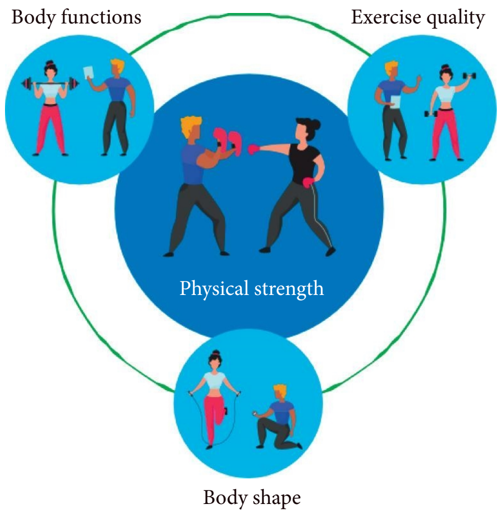


Figure 1: The influence of Wushu athlete's body function.

will have an impact on the body, especially these substances will be excreted in the urine, which will give The burden on the kidneys increases, and the kidneys will have problems in the long run. So excess protein can damage the kidneys. By consulting, retrieving, sorting out the research results of domestic nutritional supplements and protein in athletes' sports, and conducting in-depth research on the literature, this paper understands the development trend and application of protein supplement research in current athletes' sports and conducts experiments on this analyze.

## 2. Literature Review

Kodera S. found that the red blood cell count, hemoglobin content, hematocrit, reticulocyte count, and blood erythropoietin content of 5 elite swimmers increased significantly during altitude training, sending the plateau, it descended. It shows that altitude training improves the aerobic ability of swimmers. During high altitude training, the storage of iron in the body and the supplemental absorption of iron is of great significance for increasing the concentration of hemoglobin and increasing blood oxygen content. During high altitude training, in addition to the intake of iron-rich animal offal, egg yolk, beans, and fish in the diet as much as possible, an appropriate amount of iron preparations that are less reactive to gastrointestinal irritation should also be supplemented. Mainly derived from ferrous sulfate, ferrous lactate, ferrous gluconate, ferrous fumarate, ferrous dextran, ferrous succinate, and polysaccharide iron complex. In addition to iron, other minerals such as zinc, copper, calcium, potassium, etc., can be supplemented during altitude training [4]. Li, C. A survey of nutritional knowledge, attitudes, and behaviors among 102 volleyball, weightlifting, and track and field athletes at private universities. Survey results show, that athletics achieved the highest level of good nutritional knowledge, followed by volleyball players, and then weightlifters. The percentage of weightlifters with excellent nutritional knowledge was 14%, track and field athletes was 3%, and volleyball players were 0%. In terms of nutritional attitudes, athletes generally have a good understanding of protein supplementation, body hydration, and vitamins, but their understanding of iron supplementation needs to be improved. In terms of nutritional behavior, there are large individual differences among athletes, and nutritional behavior needs to be improved [5]. Pareiter A. took 26 men and 20 women, a total of 46 elite rowers as the survey objects, designed a dietary nutrition KAP questionnaire for athletes, and conducted a questionnaire survey on athletes. The results of the survey showed that the average score of the rowers' nutritional knowledge was unsatisfactory, and the shortcomings of knowledge were mainly concentrated in the three major sources of nutrients and vitamins, as well as knowledge related to sports nutrition, the average score of nutritional attitude is excellent, the overall nutritional attitude of rowers is very good, men are better than women, the average score of nutritional behavior is good, men are better than women, athletes mainly have an imbalanced intake of various nutrients, improper intake of snacks and three meals times are unreasonable [6]. Albano, K. M. Using physiological and biochemical indicators to monitor the training of 18 athletes in 4 national teams. The results showed that the measured indicators of the athletes in the quiet state were all within the normal range, and the Hb, CK, BUN, T, and C of the athletes in each group changed to varying degrees during the training period. CK is sensitive to exercise intensity, while Hb and BUN are sensitive to exercise volume [7].

Based on this, under the premise of not interfering with the athletes' diet, the changes in bone mineral density, bone metabolism, and biochemical indexes related to physical function were observed after taking a certain dose of high-protein food for 4 weeks, and the effect of high-protein food on the athletes' bone health was explored, provide a basis for scientific nutritional supplementation.

## 3. Research Methods

Due to the relatively large amount of daily exercise in sports athletes, the protein decomposition and protein synthesis and metabolism of athletes during exercise will increase, the activity of hypertrophic enzymes in sports organs will increase, and the entire process of hormone regulation will become more active. When the training volume is increased, the excretion of sulfur and nitrogen in the urine of athletes increases, at this time, the body may have a negative nitrogen balance, and the content of serum protein and hemoglobin will decrease, so protein needs to be supplemented in time. Athletes should maintain a high-protein diet, and the specific content of protein intake should be determined according to the specific exercise intensity. Protein is mainly divided into animal protein and vegetable protein [8]. The nutritional value of plant protein is relatively low, but it is more economical, and there are also some plant proteins with relatively high nutritional value, such as beans, athletes can also choose beans to match their meals reasonably. Athletes should maintain a certain amount of protein intake every day, but the amount of protein intake should not be too much. If the athlete consumes too much protein, it will

Table 1: Basic information of subjects.

| Gender | Age | Height/cm | Weight/kg | Years of training/year |
|---|---|---|---|---|
| Male | 23.4 ± 3.1 | 181.1 ± 7.6 | 74.7 ± 11.5 | 8.9 ± 3.6 |
| Female | 22.1 ± 3.8 | 175.7 ± 5.8 | 67.4 ± 6.6 | 6.7 ± 2.4 |

be converted into fat and stored in the body of the athlete, it leads to an increase in body fat rate, and may also cause hyperlipidemia, increase various diseases, and endanger the cardiovascular system of athletes. It is generally ensured that the protein-calorie supply reaches about 10% of the body's total energy requirements [9]. When choosing high-protein foods, be sure to choose ones that are easily absorbed by the human body, such as whey protein, so that athletes can better promote muscle protein synthesis after training.

Protein plays a very important role in the normal physiological function of the human body and is an important component of the human scaffold. For sports athletes, they have a higher demand for protein than ordinary people, so be sure to keep enough protein in your meals [10].

*3.1. Research Objects.* There are 45 outstanding martial arts athletes, 21 males, and 24 females, they are in good health and have no other diseases and injuries. See Table 1 for details.

*3.2. Experimental Method*

(1) High-protein food has been safety tested by the National Food Quality Supervision and Inspection Center, and meets food safety and antidoping safety standards for athletes. Take 5 g with meals, once daily, 6 times a week for 4 weeks.

(2) Diet. Athletes ate three meals a day according to their eating habits, and this study did not interfere with the diet.

(3) Bone density test. Before and after the experiment, EXA-3000 peripheral dual-energy X-ray absorptiometry was used to detect the bone mineral density of the left and right forearm and calcaneus.

(4) Biochemical indicators. Before and after taking high-protein food, venous blood was drawn on an empty stomach on Monday morning to detect white blood cells (WBC), red blood cells (RBC), hemoglobin (Hb), hematocrit (Hct), testosterone (testosterone, T), cortisol (cortisol, C), blood urea (blood urea nitrogen, BUN), serum creatine kinase (CK), bone alkaline phosphatase (BAP), calcium (calcium, Ca), phosphorus (Phosphorus, P), serum immunoglobulin A (immunoglobulin A, IgA), Immunoglobulin G (immunoglobulin G, IgG), immunoglobulin M (immunoglobulin M, IgM) and other indicators [11].

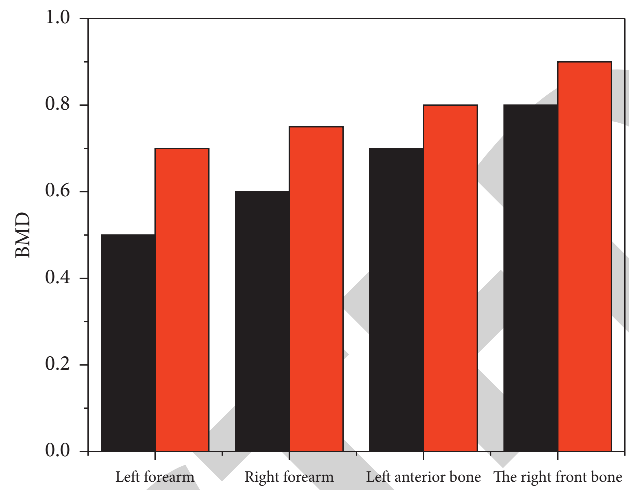


Figure 2: BMD comparison results of male athletes before and after the experiment.

*3.3. Experimental Instruments and Reagents.* Laboratory apparatus. Korean-made EXA-3000 peripheral dual-energy X-ray absorptiometry; Beckman Coulter ACCESS 2 automatic immunoassay system; Hitachi automatic biochemical analyzer; Beckman three-part blood routine analyzer. Main reagents: T, C, BAP kits were purchased from Beckman Coulter Co. Ltd.; BUN, CK, Ca, P kits were purchased from WAKO Company; IgA, IgG, IgM kits were purchased from Mike Biotechnology Co. Ltd.

*3.4. Statistics.* SPSS 22.0 statistical software was used for the experimental test data, and the "mean ± standard deviation" was calculated, descriptive statistics exploratory analysis was performed on the data before and after the experiment in each group to determine whether the data obeyed the normal distribution, and the paired sample $T$ test was used to compare the experimental indicators that obey the normal distribution before and after, nonnormal distribution of experimental indicators before and after using a nonparametric test, $P < 0.05$, $P < 0.01$ were statistically significant [12].

The basic idea of paired sample $t$-test is to set the population $X_1$ to obey the normal distribution $N(\mu_1, \sigma_{12})$, and the population $X_2$ to obey the normal distribution $N(\mu_2, \sigma_{22})$, samples $(x_{11}, x_{12}, \ldots, x_{1n})$ and $(x_{21}, x_{22}, \ldots, x_{2n})$ are drawn from these two populations, respectively, and the two samples are paired with each other. It is required to test whether $\mu_1$ and $\mu_2$ are significantly different [13]. Specific steps are as follows:

(1) Introduce Variables Introduce a new random variable $Y = X_1 - X_2$, the corresponding sample value is $(y_1, y_2, \ldots, y_n)$, where $y_i = x_{1i} - x_{2i}\ (i = 1, 2, \ldots, n)$.

(2) Establish the assumption as follows:

$$H_0\colon \mu_Y = 0. \tag{1}$$

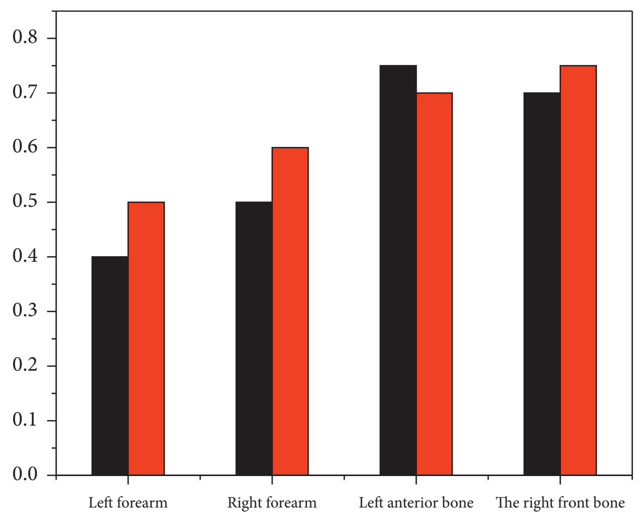


FIGURE 3: BMD comparison results of female athletes before and after the experiment.

(3) The calculation formula and its meaning are as in the formula

$$t = \frac{\overline{y}}{S_y/\sqrt{n}}, \quad (2)$$

where: $\overline{y} = \sum_{i=1}^{n} y_i/n$ is the mean of the paired sample differences; $S_y = \sqrt{\sum_{i=1}^{n} (y_i - \overline{y})^2/n-1}$ is the standard deviation of the paired sample differences; $n$ is the number of paired samples.

This statistic $t$ follows a t-distribution with $n-1$ degrees of freedom under the condition that the null hypothesis ($\mu_Y = 0$) is true.

## 4. Analysis of Results

*4.1. Bone Density.* As shown in Figure 2, the left forearm, right forearm, and left calcaneus BMD of male athletes after taking high-protein food were not statistically significant compared with those before the experiment ($P > 0.05$), but there was an increasing trend (4%, 7%, 6%). The BMD of the right calcaneus was significantly increased ($P < 0.01$) compared with that before the experiment, an increase of 12.2%.

As shown in Figure 3, the left and right forearm BMD of female athletes after taking high-protein food were significantly increased compared with those before the experiment ($P < 0.01$), which increased by 8.8% and 11.2%, respectively. The left and right calcaneus BMD were significantly increased ($P < 0.01$, $P < 0.05$) compared with those before the experiment, which increased by 10.6% and 10.1%, respectively.

*4.2. Blood Biochemical Indexes of Bone Metabolism.* Table 2 shows that, compared with before the experiment, the BAP and P of male athletes after taking high-protein food have no statistical significance ($P > 0.05$), and Ca has a significant decrease ($P < 0.05$). The BAP of female athletes after taking high-protein food was not statistically significant compared with that before the experiment ($P > 0.05$), and Ca and P were significantly reduced ($P < 0.01$, $P < 0.05$) [14].

*4.3. Blood Biochemical Indicators of Bodily Functions.* Table 3 shows that the blood biochemical indexes of WBC, RBC, Hb, Hct, T, C, BUN, CK, and other physical functions of male athletes after taking high-protein food were not statistically significant compared with those before the experiment ($P > 0.05$); The blood biochemical indexes of WBC, RBC, Hb, Hct, T, C, BUN and other physical functions of female athletes after taking high-protein food were not statistically significant compared with those before the experiment ($P > 0.05$), and CK was significantly decreased ($P < 0.01$).

*4.4. Immunity Indicators.* Table 4 shows that the blood IgG and IgA of male athletes after taking high-protein food were not statistically significant compared with those before the experiment ($P > 0.05$), and IgM was significantly increased within the normal range ($P < 0.01$). The blood IgG, IgM, and IgA of female athletes after taking high-protein food were not statistically significant compared with those before the experiment ($P > 0.05$).

*4.5. Discussion.* High-protein foods have been reported to be effective in increasing bone density. Research shows, that after the rats were fed for 12 weeks, the calcium content and bone mineral density of the femur in the high-protein food 10 and 20 times dose groups were higher than those in the low-calcium control group, and the apparent absorption rate of calcium in the 5 and 20 times dose groups was higher than that of the calcium carbonate control group at the corresponding dose, high-protein food could increase bone density and also had a higher apparent calcium absorption rate, which was considered to be the ratio of some trace elements in high-protein food [13, 15]. The above-mentioned effects of high-protein foods on bone density are based on animals. At present, no reports on the effects of high-protein foods on human bone density have been found. After female athletes took high-protein food, the bone mineral density of the forearm and calcaneus was significantly increased [16]. The results show, that 4-week high-protein food supplementation improves bone mineral density in female athletes' forearms and calcaneus, and bone mineral density of the forearm and calcaneus was less affected in male athletes.

Clinically, by detecting bone metabolites and related hormones in the blood, the state of bone metabolism can be indirectly inferred. BAP, Ca, P, etc., can reflect the bone metabolism of athletes. Bone salt is continuously dissolved, releasing calcium into the blood, and the bone continuously absorbs calcium from the blood for calcification of bone cells. This process is the renewal of bone, in the process of bone renewal, the balance of blood calcium and blood phosphorus is maintained, and the balance of bone

Table 2: Changes of blood biochemical indexes of bone metabolism in athletes.

| Index | Male | | Female | |
|---|---|---|---|---|
| | Before experiment | After the experiment | Before experiment | After the experiment |
| BAP ($\mu g \cdot L^{-1}$) | 15.34 ± 5.39 | 16.18 ± 5.78 | 14.10 ± 7.18 | 13.57 ± 6.02 |
| Ca ($mmol{\cdot}L^{-1}$) | 2.28 ± 0.22 | 2.23 ± 0.06* | 2.31 ± 0.06 | 2.22 ± 0.06** |
| P ($mmol \cdot L^{-1}$) | 1.12 ± 0.14 | 1.08 ± 0.14 | 1.21 ± 0.11 | 1.10 ± 0.21* |

*Note.* * Indicates a significant difference compared with before the experiment, $P < 0.05$; ** indicates a very significant difference compared with before the experiment, $P < 0.01$.

Table 3: Results of changes in biochemical indexes of physical function of athletes.

| Index | Male | | Female | |
|---|---|---|---|---|
| | Before experiment | After the experiment | Before experiment | After the experiment |
| WBC $10^9 L^{-1}$ | 5.48 ± 1.08 | 5.15 ± 1.29 | 5.51 ± 0.79 | 5.93 ± 1.39 |
| RBC $10^{12} L^{-1}$ | 4.77 ± 0.26 | 4.77 ± 0.26 | 4.11 ± 0.27 | 4.14 ± 0.22 |
| Hb ($g{\cdot}dL^{-1}$) | 14.59 ± 0.50 | 14.71 ± 0.66 | 12.18 ± 1.09 | 12.40 ± 0.73 |
| Hct% | 43.12 ± 1.49 | 43.56 ± 1.83 | 36.23 ± 3.15 | 37.18 ± 1.93 |
| T ($ng{\cdot}dL^{-1}$) | 440.44 ± 83.64 | 452.31 ± 107.95 | 54.14 ± 16.86 | 57.11 ± 16.29 |
| C ($\mu{\cdot}g{\cdot}dL^{-1}$) | 15.50 ± 3.75 | 14.40 ± 3.01 | 18.00 ± 6.11 | 15.34 ± 3.77 |
| BUN ($mmol{\cdot}L^{-1}$) | 5.48 ± 1.01 | 5.50 ± 1.04 | 5.06 ± 1.33 | 4.75 ± 1.27 |
| CK ($u{\cdot}l^{-1}$) | 287.53 ± 193.24 | 231.32 ± 117.22 | 213.39 ± 105.53 | 148.35 ± 57.96** |

Table 4: The results of changes in the immune indexes of athletes.

| Index | Male | | Female | |
|---|---|---|---|---|
| | Before experiment | After the experiment | Before experiment | After the experiment |
| IgG ($g \cdot L^{-1}$) | 7.91 ± 1.17 | 8.31 ± 1.02 | 9.31 ± 1.30 | 9.35 ± 1.38 |
| IgM ($g \cdot L^{-1}$) | 0.85 ± 0.32 | 0.92 ± 0.33** | 1.09 ± 0.34 | 1.08 ± 0.28 |
| IgA ($g \cdot L^{-1}$) | 2.44 ± 1.10 | 2.44 ± 1.09 | 1.95 ± 0.72 | 1.93 ± 0.76 |

*Note.* ** Indicates that compared with before the experiment, the difference is very significant, $P < 0.01$.

metabolism can be understood by measuring the content of blood Ca and P [5]. When bone mineralization is blocked, osteoblasts synthesize a large amount of BAP, which significantly increases serum BAP. BAP is a marker of osteoblast maturation and activity. The study observed that male athletes had no significant changes in serum BAP and P after taking high-protein food, but Ca significantly decreased, while female athletes had no significant changes in serum BAP but Ca and P decreased significantly. The significant decrease of serum Ca and P in female athletes indicated that the release of calcium and phosphorus was slow, which may be related to the menstrual effects of female athletes. There was no significant change in serum BAP, but serum Ca and P were within the normal range, this indicated that the female athletes had no adverse changes in the blood biochemical indexes of bone metabolism [3]. Hint, taking high-protein food had no adverse effect on the blood biochemical indexes of bone metabolism in athletes.

It can be seen from the above that high-protein food has a certain promotion effect on athletes' bone density, if supplementing high-protein food leads to the poor physical function of athletes and affects training, it will lose the meaning of nutritional supplements. In the practice of competitive sports, a system and method for the evaluation of athletes' function have been established, and blood biochemical indicators such as WBC, RBC, Hb, T, C, BUN, CK, IgG, IgM, and IgA are used to evaluate the athletes' physical function level and humoral immune function status [17]. Under normal circumstances, long-term heavy-load training will cause the physical function level of athletes to decline, but the biochemical indicators of physical function of the athletes in this experiment did not change adversely, suggesting that 4 weeks of high-protein food supplementation can better maintain the physical function level of athletes [18, 19].

Prolonged high-intensity or heavy-duty exercise will lead to a decrease in serum immunoglobulin levels, and suppress the body's immune function. The main countermeasure for the decline of the immunity of athletes is to improve the nutritional status of the body, such as supplementing protein, carbohydrates, amino acids, glutamine, vitamins, trace elements, and traditional Chinese medicine preparations, etc., in order to a certain extent, reduce the body's stress response [20]. How high-protein foods affect the immune function of athletes, research shows [21, 22].

## 5. Conclusion

Athletes who carry out high-intensity exercise training for a long time and are in a state of high-intensity competition have strong energy metabolism, high-protein consumption rate, and large loss of water and electrolyte nutrients, so they need various nutritional supplements. At present, functional beverages on the market are prepared from various ingredients such as water, vitamins, amino acids, and inorganic ions. Protein foods can preserve protein, water, electrolytes, and other nutrients, supplement various nutrients for the body, help to strengthen muscles, relieve exercise fatigue, improve immunity, etc., which are of great significance to athletes. Sports nutrition food has developed rapidly in recent years, and research has gradually shifted from a single nutritional supplement to a variety of nutritionally balanced supplements, from simple processing to more and more emphasis on product quality, taste, and safety. Protein nutrition food can promote athletes' muscle synthesis, promote muscle damage repair, relieve exercise-induced fatigue, and improve immunity. In addition, because excessive protein intake will also affect the fat metabolism of sports athletes, which is not conducive to their physical mechanism and exercise ability, therefore, protein should also be supplemented scientifically and reasonably, and personalized scientific research should be formulated according to the different types of athletes. A dietary protein nutrition program that maximizes the benefits of athletes.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## Acknowledgments

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