Scholar Publishing Group
International Journal of Sports Technology
https://doi.org/10.38007/IJST.2022.030103
ISSN 2789-7141 Vol. 3, Issue 1: 26-38

Interaction between Sports and Protein

Nian Zhang and Yupeng Li*

Linyi No. 21 Middle School, School of Physical Education and Health, Linyi University, China

liyupengty@lyu.edu.cn

**corresponding author*

Keywords: Sports Activities, Consumption and Supplement of Protein, Interaction on Each Other, Control Experiment

Abstract: Protein is a polymer compound composed of nitrogen, carbon, hydrogen, oxygen and other elements. It is the material basis for various metabolic activities in the human body. Physical exercise is a type of exercise carried out by means of physical exercise and exercise load to enhance physical fitness, improve physical and mental health, and improve and maintain the body's ability. The purpose of this article is to explore the interaction between sports and protein. This article describes the basic structure and function of protein, and conducts experimental research through several methods such as controlled experiments, protein qualitative and quantitative analysis and literature investigation. The results of the study show that the energy provided by different nutrients is significantly different during physical exercise. Among them, sugar can provide the highest energy, reaching 34%, followed by fat, which accounts for 33%, followed by protein. , accounting for 23% of total energy consumption. As the amount of exercise continues to increase, protein consumption and demand have basically increased significantly. In addition, different types of sports have obvious differences in the consumption, demand and supplement of protein. Among the four types of sports such as race walking, running, swimming and cycling, swimming has the largest consumption and demand for protein. The protein it consumed every 1 hour is 36.3g, which is 49.6%, 44.07% and 5.5% higher than race walking, running and cycling respectively.

1. Introduction

Protein is a polymer compound composed of nitrogen, carbon, hydrogen, oxygen and other elements. Protein is one of the main components of the human body and the material basis for various metabolic activities of the human body. The basic composition of protein is amino acids. It is known that the human body needs about 20 kinds of amino acids, which can be divided into three categories. There are 12 kinds in the first category, which can be synthesized by the body itself, so

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they are called non-essential amino acids. The second category has 8 kinds. These amino acids must absorb nutrients from food and cannot be synthesized by the human body, so they are called essential amino acids. The third category is arginine and histidine, which are relatively low in human synthesis and need to be supplemented from food, so they are called semi-essential amino acids.

Sports can be defined in the following way: from the point of view of purpose, sports are a conscious activity that people take the initiative to change and improve the human body, a reflection of the positive relationship between people, and an important practical activity for human survival [1]. The purpose of physical exercise is to enhance physical health, improve physical and mental health, improve and maintain human functions, and prolong life, thereby improving the ability to work and study, and improve people's quality of life. From the perspective of sports content, sports include bodybuilding, entertainment and leisure sports, health rehabilitation sports and intellectual sports [2]. Sports are mainly measured and evaluated through physical and mental evaluation indicators [3]. In summary, physical education can be defined as a means of physical exercise and exercise load, with fitness, entertainment, health rehabilitation, and intellectual exercise as the content, to enhance physical fitness, improve physical and mental health, and improve and maintain the ability of the body.

This article discusses the interaction between sports and protein, and in the process consulted a lot of related literature. Among them, Kim studied the biological process and mechanism of muscle repair after muscle injury, aiming to propose the repair effect of heat shock protein and nitric oxide synthase on muscle injury. He believed that heat shock protein (HSP) protects cells from damage and makes it plays a vital role in surviving the new environmental challenges [4]. Binns stated in the article that the thermal effect of protein in exercise and food can help improve the body's total energy expenditure and overall health. In the study, ten active women with normal weight were randomly selected to participate in the competition. The three test phases included eating high-protein meal (total calorie content of 45%) or low-protein meal (total calorie content of 15%) or fasting, let them exercise for 30 minutes, analysis shows that high-protein food is more helpful to improve the body overall health [5]. Krivic's research shows that physical exercise covers all forms of human exercise aimed at maintaining or improving physical and mental health and establishing or improving social relationships. It can greatly improve people's mental health and promote social harmony. In sports, protein consumption should be properly planned [6]. Czech studied whether age and gender affect the selected biochemical and antioxidant blood parameters of the human body in sports, and whether there is an interaction between these factors, and analyzed the total protein, glucose, bilirubin, and urea in human plasma. Uric acid, creatinine, Zn^{+2}, Cu^{+2} and Fe^{+2}, also measured the activity of superoxide dismutase, catalase, plasma total antioxidant status (FRAP) and the concentration of malondialdehyde, the results showed that human neither age nor gender has a significant effect on blood biochemical indicators [7].

In the research on the interaction between sports and protein, this article summarizes and analyzes the research experience and results of a large number of predecessors, and also makes some innovations in research content and research methods. The specific main points are as follows: the research method of controlled experiment is to randomly select athletes with similar physical ability, and randomly group them to perform sports of different intensities, and measure the consumption and demand of protein by the human body under different exercise intensities, which ensures the integrity and rigor of the experimental data. Secondly, this study uses immunohistochemistry to determine the protein content in each process to achieve accurate data and further ensure the credibility of the experimental results. Finally, this research also uses the literature survey method to conduct related research, mainly through consulting and referencing related materials to understand the current progress and breakthroughs in this field, and at the same

time to explore the current general problems in this field. In the process of reviewing the literature, according to the research ideas provided by the predecessors, the conclusions were drawn through experiments to clarify the general misunderstanding of the role of protein in order to help people correctly understand the interaction between protein and sports.

2. The Theoretical Basis of the Interaction between Sports and Protein

2.1. The Consumption and Need of Protein in Sports

As we all know, physical activity consumes a lot of energy materials and strengthens protein metabolism. However, whether exercise will increase protein demand remains to be studied. Some scientists report through experiments on nitrogen balance that the protein requirements of athletes are higher than those of the general population [8]. Scholars in Japan and some eastern European countries have proposed that the protein requirement of athletes should be ⩾2.0g/kg. However, some reports in western Europe believe that 1.4 g/kg of protein can meet the needs of athletes, while China recommends that the protein supply of athletes be 1.2~2.0g/kg. The reason for this difference is due to the different functional levels of exercise, the different exercises engaged in, and the diet and life characteristics of different regions [9]. In addition, due to strenuous exercise, the amount of protein excreted in the urine of athletes will increase to a certain extent. However, after the human body adapts for a period of time, the nitrogen balance will be improved. Therefore, the human body should properly enhance protein nutrition supplementation in the early stage of heavy exercise and exercise intensity. Studies in Japan have reported that the initial protein intake for human exercise should be 2.0g/kg per day. In addition, in order to meet the needs of growth and development, when children and adolescents participate in sports training, a part of protein nutrition should be added. According to the results of nitrogen balance experiments, children's protein intake should be 2.0~3.0g/kg per day.

Quiet or inactive people need 0.8 g/kg of protein per day, moderately trained athletes need 12g of protein per day, heavy athletes need 14g of protein per day, and athletes who maintain the maximum amount of exercise need 15 to 17g per day [10]. For athletes, protein provides approximately 15% of energy expenditure, carbohydrates provide 60% of energy, and fats and other substances provide 25% of energy. Protein can be divided into plant protein and animal protein. Animal protein is mainly composed of various animal lean meats, fish, poultry eggs, dairy products, etc. The basic component of plant protein is the protein in soy products. It is known that long-term endurance exercise can enhance the consumption of amino acids, especially essential amino acids, thereby increasing protein requirements, which is affected to a certain extent by glycogen storage. In addition, the scientists also calculated that the energy produced by amino acid oxidation during long-term exercise (3.75 hours) accounts for 4% to 8% of the total energy consumption. Therefore, if protein requirements increase during high-intensity endurance training, it is clear that a 10% increase in protein requirements is reasonable.

2.2. Basic Function of Protein and Supplement to Sports

The main basic functions of protein are as follows. First of all, protein can form body tissues and promote human growth and development. Protein is an important part of cells, tissues and organs, and is the main raw material for the continuous formation of new cells. In addition, protein can maintain the normal function of the nervous system. Changes in protein content can significantly affect the excitement and inhibition process of the cerebral cortex. Increase or decrease in protein levels can disrupt the balance of arousal and inhibition in the brain. Protein can also control the genetic information related to the transmission of genetic information and the evaluation of the

transportation of important materials. Finally, protein can maintain the body's osmotic pressure and acid-base balance, regulate the balance of body fluids, maintain the body's plasma osmotic pressure and blood acid-base balance, and maintain the normal distribution of water in the body.

Protein supplements play a very important role in exercise and athletic ability, which is mainly reflected in the following aspects. First of all, protein can prevent exercise-induced anemia, stimulate the secretion of insulin in the body, and have a good and stable stimulating effect, so that people can maintain a stable physical and mental state. Second, protein supplementation can improve the excitability of the central nervous system. Protein can be used as a part of cell energy during long-term exercise and can provide 5-15% of energy during exercise [11]. When athletes participate in sports, due to the enhanced protein metabolism, the demand for protein also increases accordingly, providing amino acids for the body's own synthesis of protein and other tissues. However, in the process of supplementing protein, it should be noted that the intake of protein is not better. Excessive protein intake is not only not good for muscle growth and improvement of muscle movement ability, but also affects normal metabolism and health has an adverse effect. Therefore, it is necessary to correctly understand protein, pay attention to a balanced diet, understand the protein content of different foods, and take appropriate amounts of high-quality protein. Generally, people can use supplemental chain amino acids to improve athletes' ability to resist central fatigue, save muscle glycogen during exercise and reduce lactic acid production during exercise. However, when using protein and amino acid nutritional supplements, they should be under the guidance of doctors and dietitians, rather than freely supplementing them in large quantities.

2.3. The Influence of Sports on Protein Metabolism

Most protein synthesis in muscle tissue is inhibited during exercise, but there is no example of protein being broken down during exercise. On the contrary, on the one hand, exercise will accelerate the decomposition rate of non-tightening proteins in the liver and muscles, and slow down the synthesis of non-tightening proteins, thereby increasing the release of amino acids and increasing the amino acids in the metabolic pool. On the other hand, exercise will increase the amount of alanine released by the muscles, especially during this process (when the alanine release rate is 30 mol/L, moderate-intensity exercise is 70/mol/L, strenuous exercise soars to 170 mol/L when quiet). In addition, the glucose-alanine cycle can help maintain blood sugar levels. During the recovery period after exercise, the 3-methylhistidine in the muscles after exercise increases, and the urine output will also increase, increasing the 3-methylhistamine acid excretion provides evidence of muscle contraction for protein conversion. Stable isotope tracing method can be used to study protein metabolism during exercise.

As we all know, the increase in alanine concentration during exercise is mainly due to the enhancement of protein metabolism during exercise. The generated amino acids, especially branched chain amino acids, are easily converted to pyruvate under the catalysis of pyruvate to produce alanine. Therefore, during exercise, as the concentration of pyruvate increases, the release of branched chain amino acids will also increase. In the constant perfusion experiment of isotope C13-labeled leucine, it was observed that after 2 hours of exercise at 50% vo2max intensity, the oxidation rate of leucine increased by 2 times, and the absolute value of the increase of leucine was equal to 90 % Of amino acids [12]. The same conclusion was reached in a recent report: the selective uptake of branched chain amino acids by the limbs during long-term exercise shows that exercise can promote the oxidation of muscle branched chain amino acids. Whether the oxidation ability of all branched chain amino acids is enhanced remains to be further studied. It is known that muscle contraction will cause skeletal muscle to produce a large amount of glutamine, which is an amino acid whose carbon source is A-ketoglutarate (A-kg), an intermediate product of the

tricarboxylic acid cycle. In order for the tricarboxylic acid cycle to continue to play a role in energy supply, the participation of citric acid is necessary. Citric acid can only be formed in the presence of oxaloacetic acid (OAA). Without the participation of oxaloacetic acid, citric acid cannot be produced. Therefore, it is necessary to add substances to the KREB cycle to compensate for the loss of A-ketoglutarate as an amino acid (produced by deamination). Therefore, the role of amino acids in supporting the TRI carboxylic acid cycle and maintaining energy supply may actually be more important than its fuel function (the energy supply of amino acids during exercise is 5% to 10%).

3. Study on the Interaction of Sports and Protein

3.1. Purpose of the Experiment

This article studies the interaction between sports and protein. As we all know, protein is a complex biological macromolecule. The basic composition is amino acids. The elements contained include carbon, hydrogen, oxygen, nitrogen and sulfur. Some protein molecules also contain iron, iodine, phosphorus and zinc. In addition, protein is an important part of biological cells and plays a very important role in the structure and function of cells. Protein composed of 20 kinds of amino acids shows thousands of differences in different functional activities of the human body, especially its role in exercise. However, there are not many studies on the interaction between protein and exercise. Therefore, this study attempts to analyze the role and metabolism of protein in the human body to provide a reference for protein consumption, demand, metabolism and protein supplementation of the body's energy consumption during physical exercise.

This article will start from the perspective of exploring the interaction between protein and sports, and use the conclusions drawn by scientists in the past as a reference to reveal the important role of protein in various functional activities of the human body, especially in sports. This article will explore the basic functions of protein in depth, combine the body's demand for protein in sports, and explore the metabolic law of protein in the human body and the body's demand for protein. In this process, this study focused on the research method of controlled experiments, randomly selected 30 athletes with similar physical abilities, and randomly grouped them into different intensities of sports activities, and measured the body's protein concentration under different exercise intensities. Consumption and demand, so as to summarize the interaction relationship between different physical activity and protein, and summarize the metabolic law of human protein. In short, the main objectives of this study are mainly three points: first, introduce the basic situation of the current scientific research on the role of protein and sports. Secondly, understand the consumption and demand of different intensities of sports for protein , metabolism and protein supplement energy consumption of these sports. Finally, explore the basic laws of protein metabolism in sports and the laws of sports demand for protein, provide nutritional references for human health and sports, and help people more reasonably Perform exercise and supplement after exercise.

3.2. Experimental Method

In this study, experiments were mainly conducted by using several methods such as controlled experiments, qualitative and quantitative analysis of proteins, and literature surveys. The first is the control experiment, which can ensure the integrity, rigor and reliability of the experimental data, and is often used in scientific research and various analyses. This study randomly selected 30 athletes with similar physical fitness, good health and similar conditions, and randomly divided them into 3 groups, namely the natural intensity group, the medium intensity group and the high intensity group. According to the group, they were given different intensity. Then measure the

human body's consumption and demand for protein under different exercise intensities, and summarize the metabolism of human protein, so as to summarize the relationship between different physical activity and protein. Protein qualitative and quantitative analysis is a set of comprehensive analysis methods, including protein consumption determination, protein utilization determination and protein requirement evaluation. This study mainly uses immunohistochemistry to determine the protein content in each process to achieve accurate data. Furtherly, ensure the credibility of the experimental results. In addition, in order to fully explore the relationship between protein and sports, this study also used the literature survey method to conduct related research, mainly through consulting and referencing related materials to understand the current progress and breakthroughs in this field, and at the same time, the current field to explore the common problems. In the process of reviewing the literature, based on the research ideas provided by the predecessors, this article clarified the general misunderstandings of the role of protein through the conclusions drawn through experiments, so as to help people understand the nutritional value and intake requirements of protein, and correctly understand protein and sports interaction between sports.

3.3. Experimental Content

The specific content of the controlled experiment: in the experiment, 30 athletes from a certain university were randomly selected in the experiment, with a weight between 50-75kg and a height between 160cm-190cm. Among them, 14 were female athletes and 16 were male athletes. The basic physical fitness tests were performed on them first, and it was found that their scores were almost the same, indicating that their physical fitness was similar. Grouping: the 30 athletes were randomly divided into natural intensity group, medium intensity group and high intensity group. The natural intensity group walks 1km, runs 1km, swims 400m every day, and the medium intensity group walks 2km and runs 1.5km every day, swimming for 600 meters, in addition to lifting weights for 0.5 hours a day, the high-intensity group walks 2 km, runs 3 km, swims 800 meters, and lifts weights for 1 hour. The training volume of the three groups of athletes is gradually increasing. The experimental data is recorded in time every day, the athlete's diet is recorded, and the athlete's blood is subjected to immunohistochemical analysis to understand the consumption, demand and supplement of protein, so as to obtain the interaction between different exercise volume and protein. The relationship between the height, weight, and the specific data of the exercise is shown in Table 1.

Table 1. The height, weight, and projects of athletes in this study

Group	Average height	Average weight	Race walking	Running	Swimming	Weightlifting
Natural strength group	175 cm	69 kg	1 km	1 km	400 m	/
Medium intensity group	178 cm	70 kg	2 km	1.5 km	600 m	0.5 h
High intensity group	177 cm	70 kg	2 km	3 km	800 m	1 h

The specific content of the literature survey: this study first understood the basic concepts of protein's basic structure, function, role in the human body, and its relationship with sports by looking up the literature. Supplementation is related to many complicated reasons such as personal physique, exercise volume and physical condition. Therefore, protein supplementation should be carried out according to the guidance of professional doctors, and a large amount of supplementation should not be free. Secondly, by reading the literature, this study found that few

studies have studied the specific relationship between physical exercise and protein in the human body through controlled experiments, so this study will start from this aspect.

4. Results and Discussion of the Interaction of Sports and Protein

4.1. Analysis of the Relationship between Different Exercise Levels and Protein Consumption, Demand and Supplement

The results of the study show that after recording and comparative analysis of the exercises, different amounts of exercise and protein consumption, demand and supplementation of the three groups of athletes, it is found that there is an obvious interaction between sports and protein. Specifically, as the amount of exercise increases, the greater the physical energy consumption of the three groups of subjects during exercise, the more protein they consume, and the more protein they require. However, not every test subject has replenished the required protein in time. According to the experimental record, some athletes in the high-intensity group did not replenish protein in time after the experiment, which caused them to show obvious fatigue and lack of physical strength during training the next day. This shows that protein supplementation after physical energy consumption is very important and must be paid attention to. This study investigated the protein requirements of athletes per kilogram of body weight in different sports. The specific data are shown in Table 2.

Table 2. Athlete's protein requirement per kilogram of body weight in the same sport

Group	Race walking	Running	Swimming	Weightlifting	Fencing	Cycling
Natural strength group	2.0 g	2.1 g	1.8 g	2.0 g	2.0 g	3.1 g
Medium intensity group	2.3 g	2.2 g	2.2 g	2.2 g	2.1 g	3.2 g
High intensity group	2.4 g	2.4 g	2.5 g	2.5 g	2.3 g	3.5 g

Studies have found that protein is an important part of the structure of all cells and tissues. The contraction and relaxation of muscles are achieved through the activity of protein molecules in the muscles. Even the enzymes, hormones, hemoglobin, muscle fibrin and collagen that constitute the human scaffold are also it is made of protein. Therefore, protein is very important to the human body and human sports. Each person's protein requirement is specific in different periods, and the protein supply depends on many complex factors such as age, weight, exercise intensity and physiological condition. If calculated based on body weight alone, the average daily protein requirement for adults is 12 to 15 grams per kilogram of body weight, while the average athlete's daily protein requirement is 2.0 to 3.0 grams per kilogram of body weight. Athletes' demand for protein is relatively higher than the average requirement of adults, because protein synthesis and catabolism in athletes continue to strengthen with the increase in exercise volume, leading to significant changes in some factors in the body, such as enzyme activity and activity in sports organ hypertrophy. In the process of hormone regulation, increased exercise training volume, athletes' urine nitrogen excretion and sulfur increase significantly, negative nitrogen balance, hemoglobin, blood protein content and other phenomena may appear. Therefore, athletes' demand for protein increases, the dosage increases, the characteristics of the demand for different proteins are inconsistent, the demand for protein increases, and the nutritional level decreases. In addition, this study also found that after training, children's protein requirements will even be greater than that of adults. Athletes' demand for protein during the weight loss phase should be relatively increased.

During sports training, sweating is more due to the loss of nitrogen, which leads to an increase in demand for protein. In this study, the proportion of different nutrients in sports energy consumption was studied. The specific data is shown in Figure 1.

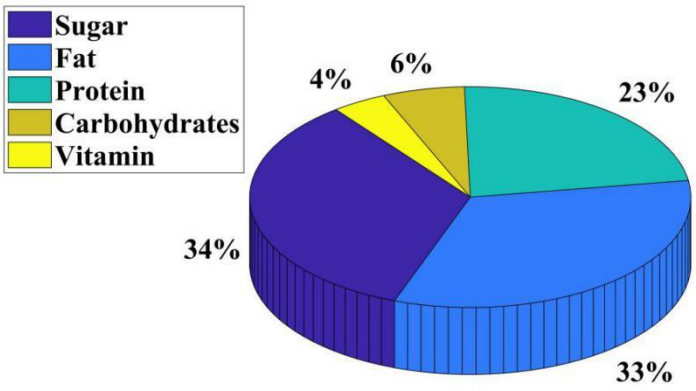

Figure 1. The proportion of different nutrients in sports energy consumption of athletes

It can be seen from the data in Figure 1 that when the human body performs sports, the energy that different nutrients can supply is significantly different. Among them, sugar can provide the highest energy, reaching 34%, followed by fat, which accounts for 33%. %, followed by protein. Protein is also converted when fat is insufficient, providing energy for the body, accounting for 23% of the total energy consumption, and finally carbohydrates and vitamins, accounting for 6% and 4% respectively.

Research results show that protein is very important for people who participate in regular physical exercise. For example, in the early stage of physical exercise, providing the human body with adequate and reasonable protein has a great help and promotion effect on the development and activity of human muscles, because protein is an important raw material for building muscles, and the metabolism and damage of human tissues repair must also rely on protein supplements to complete. In addition, exercise will accelerate the decomposition of protein in the body and increase the body's excretion. If a lot of exercise does not increase the protein content in the diet in time, not only will it not achieve the effect of strengthening the body, it will also cause body weight loss, weight loss, fatigue and other unfavorable conditions for the body. Moreover, if there is a longer-lasting and more intense exercise program, it is even more necessary to increase protein supply, because during a period of time at the beginning of exercise, under normal circumstances, the body will first use the oxidation and decomposition of sugar to provide energy. Only when muscle glycogen is depleted, the human body will need protein oxidation to participate in energy supply. For example, when an athlete's protein supply is insufficient, the body will experience obvious adverse phenomena such as reduced athletic ability and a significant decline in athletic performance. In addition, protein has a good role in promoting the excitability of the higher nervous system of the human body[13-14]. It can maintain and improve the excitability of the nervous system, enhance conditioned reflex activities, reduce fatigue, and improve athletic ability. This study recorded the protein consumption, demand and supplementation of athletes during different physical exercises. The specific data is shown in Figure 2.

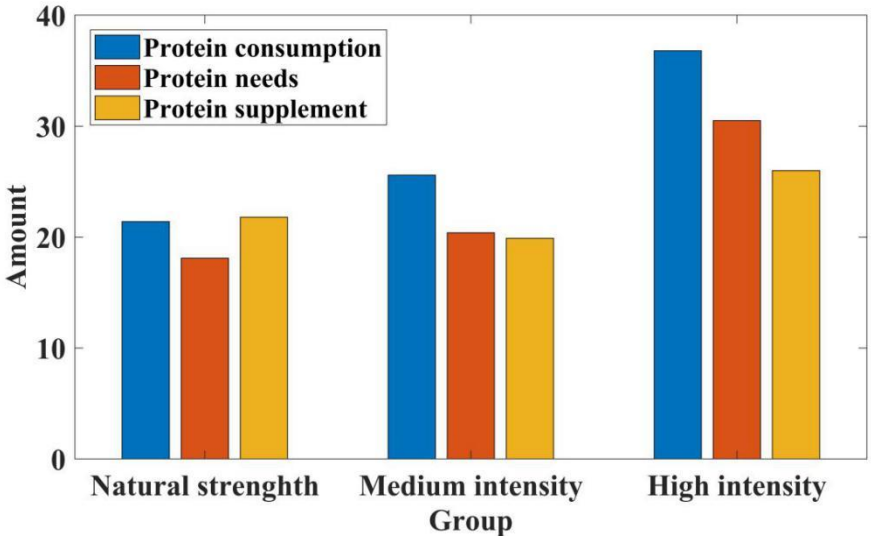

Figure 2. Protein consumption, demand and supplements during different sports

It can be seen from the data in Figure 2 that as the amount of exercise continues to increase, protein consumption and demand have basically increased significantly. The protein consumption and demand of athletes in the medium-intensity group increased by 19.0% and 11.1%, respectively. The protein consumption and demand of athletes in the high-intensity group increased by 19.0% and 11.1% respectively 44% and 51%. The protein supplementation of athletes after different exercise levels is also different, which mainly depends on the individual. Athletes in the natural intensity group supplemented with an average of 21.8 grams of protein, 16.7% more than the demand, and athletes in the medium-strength group supplemented with an average of 19.9 grams of protein. It was 7.4% less than the demand, and the athletes in the high-intensity group supplemented an average of 26.0 grams of protein, which was 13.3% less than the demand.

4.2. Discussion on the Relationship between Different Types of Sports and Protein

Different types of sports have obvious differences in protein consumption and demand. The amount of protein consumed by athletes varies with the type and intensity of exercise. Soviet scholars are most concerned about this. Some scientists have proposed the protein requirements per kilogram of body weight for athletes in various sports. It is known that protein can help anabolism and catabolism in the body, but protein is not stored in the body like sugar and fat metabolism. If the human body has fatigue accumulation during exercise, it will lead to slower synthesis of skeletal muscle protein, faster decomposition, decreased protein content, and significantly decreased muscle fibers and muscle strength. When supplementing protein, the intake of protein in the human body is first absorbed by various proteins in the digestive tract, converted into amino acids by digestive enzymes, absorbed into the blood, and transported to various tissues to form enzymes and other body structures and play corresponding roles. This study investigated the consumption, demand and supplement of protein in different types of sports. The specific results are shown in Figure 3.

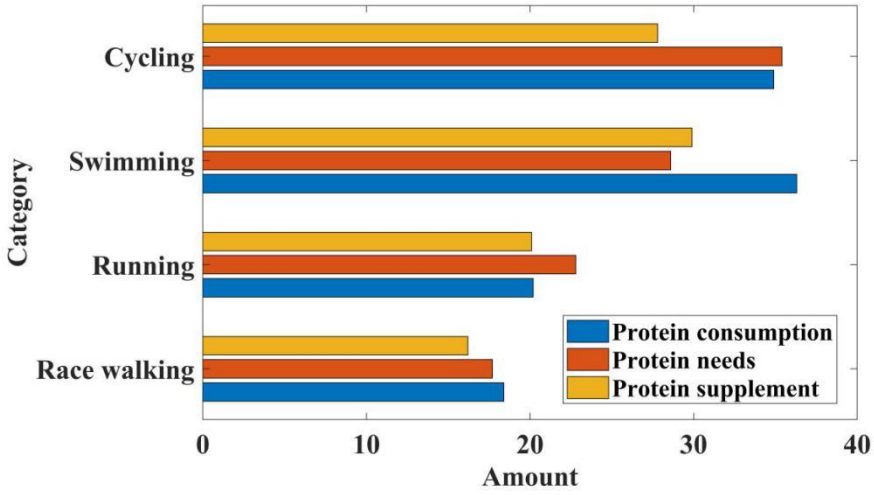

Figure 3. Different types of exercise on protein consumption, demand and supplementary graphs

From the data in Figure 3, it can be seen that different types of sports have obvious differences in the consumption, demand and supplement of protein. Among the four sports such as race walking, running, swimming and cycling, swimming has the largest consumption and demand for protein. The protein consumed per hour of swimming reaches 36.3g, which is 49.6%, 44.07% and 5.5% higher than race walking, running and cycling respectively. Among the four sports, bicycles have the largest demand for protein, which is 51.4%, 36.7% and 19.8% higher than race walking, running and swimming respectively.

Because protein with high biological value can improve the excitability of the nervous system and enhance the reflex activity of the nervous system, protein supplementation is particularly important in certain sports[15]. For example, sports such as throwing, weightlifting, and wrestling that require athletes to be highly concentrated, quick to react, and explosive, have higher requirements for the regulation of the nervous system, and athletes need relatively more protein supplements and require supplementary protein quality. better. Some scholars have shown through research that the amount of protein supplement should be 2.4-2.5g per kilogram of body weight, while research reports on Chinese athletes say that the protein requirement of Chinese gymnasts is about 1.8g per kilogram of body weight. The metabolism of children and adolescents is more vigorous. If regular training is required, it will lead to a significant increase in body protein requirements, which can even reach about 1.5 times the body weight (in kilograms), and for different age groups. There are also certain differences in the amount of protein supplementation. According to related reports, the protein requirement of gymnasts aged 9-10 is about 3.0g per kilogram of body weight (about 70-90g per day), while the protein requirement of 12-year-old basketball players is about 2.0-2.4 per kilogram of body weight. The protein requirements of children and young athletes account for about 13% of total calories. This study studied the changes in protein requirements of different types of sports at different exercise times. The specific data is shown in Figure 4.

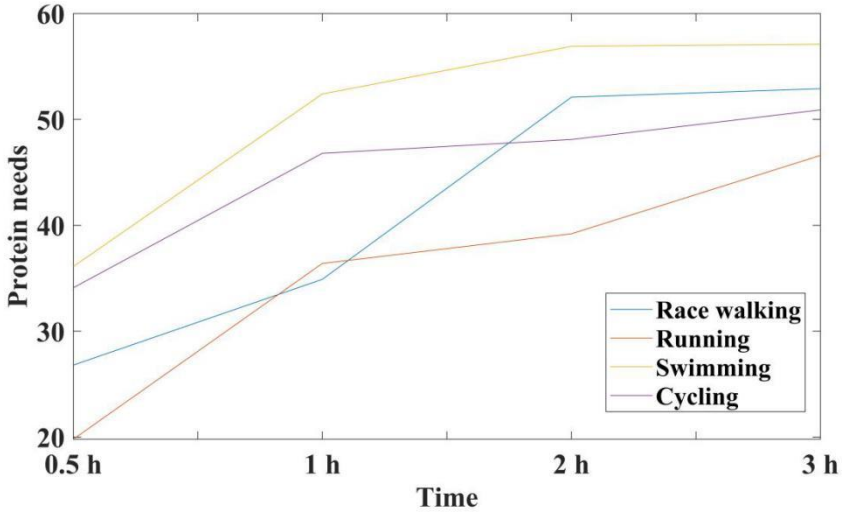

Figure 4. Different types of exercise time demand changes in protein

It can be seen from Figure 4 that the protein requirements of different types of sports have been changing at different exercise times, basically showing an upward trend. In race walking, the protein demand increased by 97.1% after 3 hours of exercise than after 0.5 hours of exercise. The protein requirement increased by 134.3% after 3 hours of exercise compared with 0.5 hours after exercise, while in swimming, the protein requirement increased by 58.2% after 3 hours of exercise compared with 0.5 hours after exercise. When riding a bicycle, after 3 hours of exercise, the protein requirement increased by 46.9% after 0.5 hours of exercise.

5. Conclusion

(1) This study first introduced the basic situation of the current scientific research on the role of protein and sports. Secondly, through controlled experiments, we learned about the protein consumption, demand, metabolism of sports of different intensities and the energy consumption of these sports by protein. Finally, this research explores the basic laws of protein metabolism in sports and the laws of sports' demand for protein, which provides a nutritional reference for human health and sports, and can more reasonably help people to exercise and exercise.

(2) The research results show that when the human body performs sports, the energy that different nutrients can provide is significantly different. Among them, sugar can provide the highest energy, reaching 34%, followed by fat, which accounts for 33%. Protein is also converted when fat is insufficient to provide energy for the body, accounting for 23% of total energy consumption. As the amount of exercise continues to increase, protein consumption and demand have basically increased significantly. The protein consumption and demand of athletes in the medium-intensity group increased by 19.0% and 11.1%, respectively. The protein consumption and demand of athletes in the high-intensity group increased 44% and 51%.

(3) The research in this paper shows that different types of sports have obvious differences in the consumption, demand and supplement of protein. Among the four types of sports such as race walking, running, swimming and cycling, swimming has the largest consumption and demand for protein. The protein consumed per hour of swimming reaches 36.3g, which is 49.6%, 44.07% and 5.5% higher than that of race walking, running and cycling respectively. The protein requirements of different types of sports are constantly changing, basically showing an upward trend. In race walking, the protein requirement after 3 hours of exercise is 97.1% higher than that after 0.5 hours of exercise. When riding a bicycle, the protein requirement increased by 46.9% after one hour

compared with 0.5 hours after exercise.

Funding

This article is not supported by any foundation.

Data Availability

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

Conflict of Interest

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

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