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# *Qualitative Evidence-based Evaluation of Systematic Nutrition Combined with Rhythmic Exercise in Regulating Fat Loss in Sports Athletes*

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***Abstract:*** With the increasingly intense sports competition, more and more athletes start to pay attention to their own physical condition. In order to win the competition and reduce their own fat content, athletes are prone to adopt unreasonable fat reduction methods to reduce their own fat content, which can easily cause adverse effects on the health of athletes. This paper proposed to use systematic nutrition combined with rhythmic exercise to reduce fat in sports athletes, and reduce fat content without harming the health of athletes. Through testing different athletes, it was found that the system nutrition combined with rhythmic exercise can maximize the fat reduction effect, can effectively reduce the weight of sports athletes, reduce the body fat content of sports athletes, and improve the physical health index of sports athletes. Athletes who used systematic nutrition combined with rhythmic exercise experienced a 7.3% improvement in satisfaction scores.

## 1. Introduction

With the current improvement of people's living standards, people's basic physical conditions have been improved to a certain extent. However, in retrospect, people's physical health problems have been greatly affected by the lack of healthy eating habits, especially athletes. Although there are many ways to lose fat, in general, the best way to lose fat is through rhythmic exercise. In order to achieve the best fat loss effect, all fat loss activities must be systematically combined with physical exercise to achieve ideal effect.

Athletes need to pay attention to their fat at all times and adjust when the fat is too high. Witard O C explored the nutritional improvement effect of protein powder on the fat control of athletes participating in weight-limited sports, aiming to solve their nutritional deficiencies in the process of fat control [1]. Olak A studied the effect of the frequency and intensity of anaerobic exercise training on the fat and body mass index of male martial arts athletes. Through anaerobic exercise tests on different martial arts athletes, it was found that the fat and weight of obese athletes decreased, and the weight of thin athletes increased [2]. Finlayson G found that athletes often take long-term weight control and rapid weight loss before competitions. The long-term weight control method of scientific diet combined with exercise load has less impact on the physical function and performance of athletes. Rapid weight loss through dehydration before competition negatively impacts athlete's physical function and performance [3]. Ikari A used the methods of literature and training practice to discuss how to control body weight reasonably. For athletes, the daily weight control goal is based on the principle of a moderate negative energy balance, maintaining a safe limit for reducing fat and body fluids, limiting dietary caloric intake, reasonably controlling body weight and fat, and controlling changes in biochemical indicators at different stages [4]. Zepetnek J D conducted a comparative study on the rapid weight loss and slow weight loss of male judo athletes through experimental methods, and introduced the scientific theory of weight loss into training practice [5]. The above research shows that athletes should take a reasonable approach when trying to lose fat.

Systematic nutrition combined with rhythmic exercise can well mediate people's health. Miller's systemic nutrition research changed from a high-carbohydrate and low-fat diet to a high-sugar and low-fat diet. The expression and regulation of 12 nutrient-related receptors in monocytes isolated from peripheral blood monocytes and monocyte-derived macrophages help people reduce body weight and fat [6]. By reading a large number of literatures, Francois M E summarized and discussed the influence of aerobic exercise on fat, discussed the biological mechanism of aerobic rhythmic exercise and the precautions for fat loss methods, and provided theoretical guidance for ideal body weight [7]. By reviewing relevant literature, Wang L summarized the relevant factors affecting the initiation of puberty, and discussed when exercise to lose weight would release adverse symptoms, in order to provide a theoretical basis for the study of exercise weight loss, and to use systematic nutrition to prevent the adverse sexual development of obese boys [8]. Zhang H constantly explored scientific ways to lose weight, and found that rhythmic exercise has become an effective way to help people lose fat. Based on the literature, he analyzed the methods of fat loss and the mechanism of exercise to reduce fat, and proposed effective methods [9]. Jang J studied the development of people's fat and a series of diseases caused by excessive fat, and proposed that rhythmic exercise is the simple and most effective weight loss method [10]. The above studies have shown that systematic nutrition or rhythmic exercise can effectively help people lose fat.

Excessive fat in sports athletes is not conducive to physical health, and it is even more unfavorable for athletes to participate in sports competitions. In this paper, the qualitative evidence-based research on the fat loss of sports athletes through the use of systematic nutrition combined with rhythmic exercise was carried out to help sports athletes lose fat in a healthier and more effective way. Through experiments on athletes, it was found that system nutrition combined with rhythmic exercise can effectively reduce the fat of athletes and ensure the physical health of athletes.

## 2. Qualitative Evidence-based Evaluation on Fat Loss Regulation in Sports Athletes

(1) Sports athlete health testing system

Athlete information and data are constantly changing. Big data technology is the most popular and useful technology today. If big data technology is used in the storage and analysis of athletes' body data resources, the changes in fat of athletes can be observed in real time. However, although the combination of athletes' physical health detection and big data is very important, the use of health data is still in the research stage due to the problems of complex information structure, inconsistent format, and large amount of information. This article has repeatedly mentioned health data detection, which is an exploration of the combination of athlete fat detection and big data technology. The realization of the sports athlete health detection system can be divided into five parts, as shown in Figure 1.

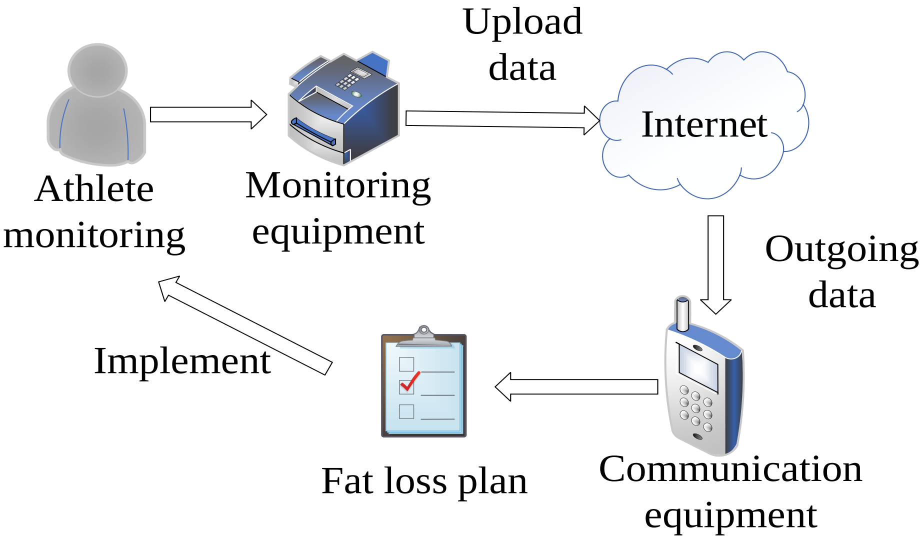


*Figure 1. Sports athlete health detection system*

1) Communication

Monitoring data from mobile devices, such as health monitoring, is sent to a big data center through a specific network for health monitoring.

2) Monitoring equipment

Health monitoring devices with different functions and backgrounds upload health search data to the data center according to a unified data entry process.

3) Transmission

The data entry process transfers fat data from different athletes into a large health database.

4) Fat monitoring

The health monitoring data center collects the health monitoring data of sports athletes, understands the fat situation of athletes, collects real-time data storage and organization forms, and centrally stores them according to different perspectives such as the age and gender of the athletes, and conducts data analysis and management, mines health monitoring data, and discovers the regularity of athletes' personal fat status.

(2) Health detection big data architecture

In the big data health detection platform, in order to be compatible with data from different sources, a unified access process is adopted, and a third-party application is released to obtain the results for selection and analysis. The health detection big data architecture has considered many data ecosystem issues in the design, but personal privacy and data security are the most important issues. Therefore, to create a real health data architecture, it is necessary to ensure that health data and exercise records are not leaked. The health search big data system is large in scale and complex in structure, and has many technical details in its implementation, as shown in Figure 2.

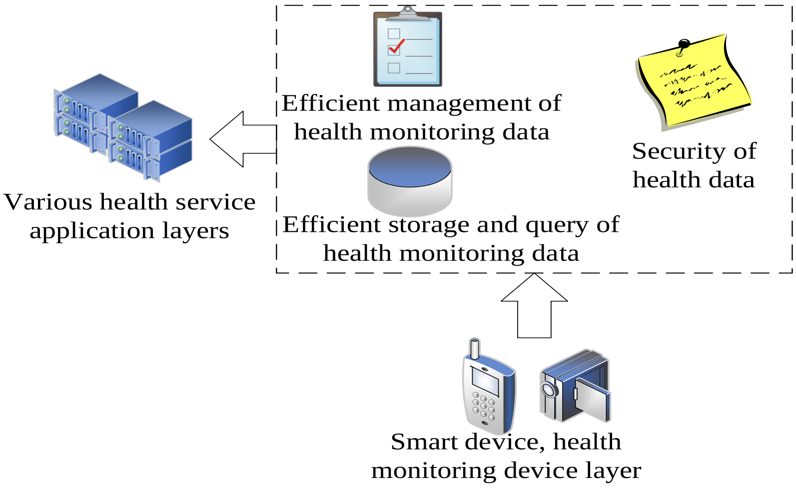


*Figure 2. Health detection big data architecture*

(3) Athlete fat detection module

The athlete information data has six classes in the fat detection module: activity class, entity object class, role class, role association class, participation class and activity association class. The activity class and the entity object class are the two most basic main classes. The entity object class refers to the people, scenes, equipment, etc. involved in fat reduction, and they are the main body. Participation class and role class are the link between entity object class and activity class. Participation class refers to who participates in this activity and who performs this work. Roles refer to the roles played by entities in this activity, such as athletes, monitors, nutritionists, etc. in fat-reducing activities, as shown in Figure 3.

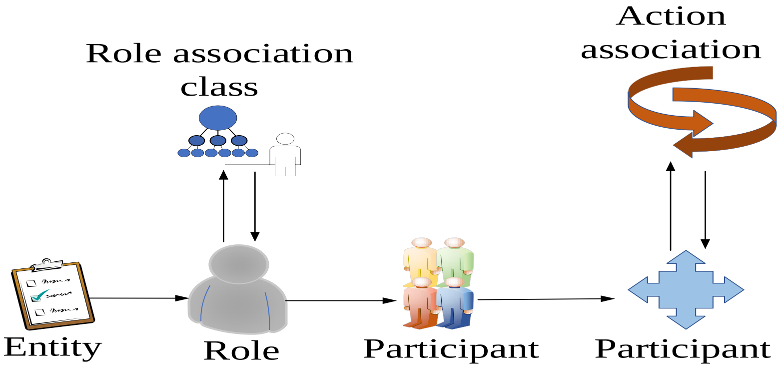


*Figure 3. Athlete body fat detection module*

(4) Systematic nutrition regulates fat loss for athletes

1) System nutrition characteristics

Systematic nutrition is based on traditional health care, modern nutrition and modern nutrition, including new research results such as modern molecular nutrition and cellular nutrition [11-12]. The scientific viewpoint of the relationship between food and human health is explained, and the systemic nutrition of human body, the systemic nutrition of human organs and tissues, the systemic nutrition for promoting the normal production of the human body, nutritional maintenance, nutritional support and nutritional optimization, and the indirect regulation of metabolism are introduced systematically and comprehensively. Using the method of system thinking, the production and demand of nutrients are analyzed from the three levels of system regulation to promote the healthy development of human beings.

2) Systematic nutrition mediates fat loss for athletes

To understand the relationship between scientific nutrition management and weight management, on the premise of not harming the health of athletes, the nutritional program is adjusted scientifically, following a low-calorie high-protein diet, eating less staple food and more fresh fruits and vegetables, maintaining good eating habits, increasing muscle strength, appropriately reducing fat rate, and maintaining the stability and intensity of exercise power.

3) Precautions for athletes to lose fat

During exercise, athletes who need to lose weight should pay attention to muscle recovery and body shape control, reduce carbohydrates and fatty foods, and eat more high-quality protein while appropriately reducing food calorie intake. Under normal circumstances, the proportion of protein, fat and carbohydrate foods is 14%, 30% and 56% respectively, and the protein intake is controlled at 1.5 to 2 grams to ensure the supply of essential amino acids and avoid negative nitrogen balance. The intake process allows for more hemoglobin and achieves an effective increase in muscle mass and explosive power with exercise.

## 3. Athlete Body Detection Algorithm Model

(1) Overview of logistic regression analysis

Logistic regression is a data analysis method, and logistic regression analysis is often used in classification prediction and analysis research. When using logistic regression for classification, the computational cost is low, the speed is fast, and the storage resources are low [13].

Logistic regression model is an analytical method used to study the relationship between two classification results y and factors affecting $(m_1, m_2, ..., m_y)$. The dependent variable in the logistic regression process can be a binary variable or a multivariate variable. However, binary classification is easier to interpret the results than multiple classifications, so it is often used [14].

The logistic regression algorithm is as follows:

$$P(n=1|m)=\frac{1}{1+e^{-Z}} \tag{1}$$

$$z=\alpha+\sum_{k=1}^{k}\beta_k m_k \tag{2}$$

Among them, $\alpha$ represents the intercept, $\beta_1, \beta_2, ..., \beta_k$ is the weight corresponding to the independent variable $x_1, x_2, .., x_k$, and $x_1, x_2, .., x_k$ is the feature present in each sample.

The logistic regression model is a log-linear model. The relationship between the categorical variables included in the model is discussed according to the established regression model analysis. Maximum likelihood parameters are often used to estimate the probability of multiple observed variables and obtain better estimates of independent parameters [15].

If $P(n=1|m)=\pi(m)$, the probability that n does not occur under condition m is:

$$P(n=0|m)=1-\pi(m)=1-\frac{1}{1+e^{-z}}=\frac{1}{1+e^{z}} \tag{3}$$

$$\frac{P(n=1|m)}{P(n=0|m)}=e^{z} \tag{4}$$

Odds are taken logarithmically, which gives:

$$\ln e^{m} = z = \alpha + \sum_{k=1}^{k} \beta_k m_k \tag{5}$$

Assuming there are x samples in the overall data, it can be expressed as:

$$z_1 = \alpha + \beta_1 m_{11} + \beta_2 m_{21} + \cdots \beta_k m_{k1} \tag{6}$$

$$z_2 = \alpha + \beta_1 m_{12} + \beta_2 m_{22} + \cdots \beta_k m_{k2} \tag{7}$$

$$z_y = \alpha + \beta_1 m_{1y} + \beta_2 m_{2y} + \cdots \beta_k m_{ky} \tag{8}$$

It is represented by a matrix as:

$$\begin{bmatrix} z_1 \\ z_2 \\ \cdots \\ z_y \end{bmatrix} = \begin{bmatrix} 1 & m_{11} & \ldots & m_{k1} \\ 1 & m_{12} & \ldots & m_{k1} \\ \ldots & \cdots & \ldots & \ldots \\ 1 & m_{1y} & \ldots & m_{kn} \end{bmatrix} \begin{bmatrix} \alpha \\ \beta_1 \\ \cdots \\ \beta_k \end{bmatrix} \tag{9}$$

The visible constant term $\alpha$ is:

$$\alpha = \bar{z} - \beta_1 \overline{m_1} - \beta_2 \overline{m_2} - \cdots - \beta_k \overline{m_k} \tag{10}$$

Since each sample is independent of itself, the likelihood function is the joint distribution of each sample, that is, the product of the marginal distributions of each sample:

$$L(w) = \prod_{i=1}^{Y} [\pi(m_i)]^{n_i} [1 - \pi(m_i)]^{1-n_i} \tag{11}$$

In order to maximize the value of the likelihood function, a parameter estimation is performed, that is, the corresponding $\alpha, \beta_1, \beta_2, ..., \beta_k$ is found. The natural function L(w) takes its maximum value, and takes the logarithm of the function L(w), as shown in Formula 12, and solves it in reverse:

$$l(w) = \log L(w) = \sum_{i=1}^{Y} [n_i \log \pi(m_i) + (1 - n_i) \log(1 - \pi(m_i))] \tag{12}$$

It simplifies to:

$$l(w) = \sum_{i=1}^{Y} [n_i \log \frac{\pi(m_i)}{1 - \pi(m_i)} + \log(1 - \pi(m_i))] \tag{13}$$

(2) Overview of decision tree model

Decision tree algorithm is an important technology in data mining, which can be used for classification analysis and regression analysis of data, and can also predict unknown variables based on existing data. Decision tree algorithms are relatively easy to understand and explain, with simple data preparation and fast processing [16]. It is considered as a white-box model, as shown in Figure 4.

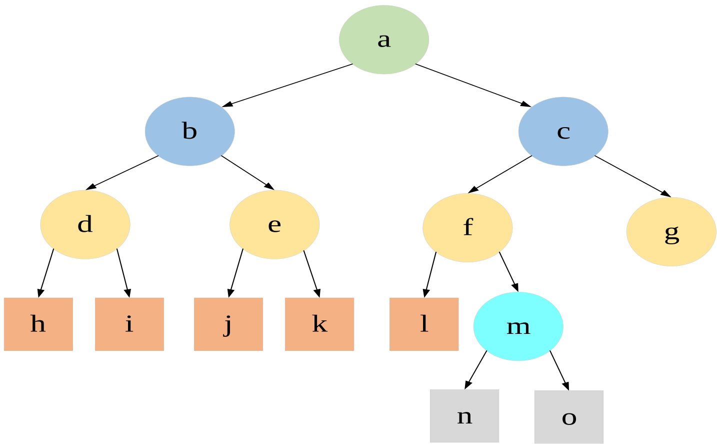


*Figure 4. Overview of the decision tree model*

A decision tree model is a tree structure, similar to the sort notation generated by flowcharts, with the root node at the top. Decision tree analysis starts from a specific test line and splits the root node data into intermediate nodes, and continues to perform data division processing for each intermediate node according to the test conditions. Its essence is a recursive function. The termination condition of this renewal is that all data in the node belong to the same class. For all data in the node, there is no redundant attribute to separate the data, and the element with the highest number can be used as the node identifier [17-18].

(3) Establishment and analysis of CART (Classification and Regression Tree) model

The specific steps of the CART algorithm to construct a classification tree are:

The sample set is divided according to the possible subset a of the value of set A (excluding the complete set and the empty set). If attribute A has three values of {m,n,z}, the grouping position is {{m,n },z}, {{m,z},n}, and {{n,z},m}. If an attribute has value x, then there are $2^m - 2$ valid subsets. The Gini index of each element of the feature set is calculated, the group with the lowest Gini index is selected as the distribution property of the feature, and the distribution point corresponding to the minimum value of the Gini index is selected as the minimum value [19].

When the corresponding recursive stopping condition is satisfied, the final CART decision tree model is obtained. Among them, the Gini index is the most important part of the decision tree model, which determines the alignment of the decision tree model. At the same time, the Gini index is also the hardest part of the decision tree model [20].

In the CART tree classification problem, the Gini index is calculated as follows:

Assuming that there are y classes in the sample set, and the probability that the sample belongs to the i-th class is $p_i$, the Gini index of the probability distribution is defined as:

$$Gini(p) = \sum_{i=1}^{y} p_i(1-p_i) = (p_1 + p_2 + ... + p_y) - \sum_{i=1}^{y} p_i^2 = 1 - \sum_{i=1}^{y} p_i^2 \tag{14}$$

Assuming that item $C_i$ belongs to the ith category in dataset D, the Gini index of dataset D is:

$$Gini(D) = 1 - \sum_{i=1}^{y} \left( \frac{|C_i|}{|D|} \right)^2 \tag{15}$$

Since the CART tree is a binary tree, each classification is a binary classification. If data D is divided according to a value of attribute A to obtain two subsets $D_1$ and $D_2$, then the Gini index of set D under attribute A is:

$$Gini(D,A) = \frac{|D_1|}{|D|} Gini(D_1) + \frac{|D_2|}{|D|} Gini(D_2) \tag{16}$$

$$D_1 = \{\{m,n\} \in D \mid A(m) = a\}, D_2 = D - D_1 \tag{17}$$

The lower the Gini index, the higher the purity of $D_1$ and $D_2$ in this region.

## 4. Effect of System Nutrition Combined with Rhythmic Exercise on Fat Loss in Athletes

The main job of sports athletes is to perform physical exercises to help athletes win in competitions. If a sports athlete's fat is too high, it is easy to have an adverse effect on their physical health and affect the athlete's competition performance. It is very necessary for athletes with high fat to reduce fat. 20 sports athletes with excessive fat were randomly selected for this experimental test, and the 20 athletes were divided into 4 groups, namely group A, group B, group C and group D. Among them, the athletes in group A used traditional methods to reduce fat, the athletes in group B used systematic nutrition to reduce fat, the athletes in group C used rhythmic exercise to reduce fat, and the athletes in group D used systematic nutrition combined with rhythmic exercise to lose fat. The fat loss process of the four groups of athletes was 12 weeks, and the results were recorded every two weeks. The four groups of athletes were tested for weight test, fat content test, body health index test, and athlete satisfaction test. The experimental results were recorded and analyzed, and the fat-reducing effect of systematic nutrition and rhythmic exercise was observed. The specific data of the 20 sports athletes are shown in Table 1.

*Table 1. Athlete specific data*

| Group | Athlete | Age | Height | Weight |
|---|---|---|---|---|
| Group A | 1 | 22 | 182cm | 85kg |
| | 2 | 21 | 181cm | 85kg |
| | 3 | 20 | 190cm | 95kg |
| | 4 | 19 | 182cm | 86kg |
| | 5 | 22 | 179cm | 83kg |
| Group B | 1 | 23 | 178cm | 82kg |
| | 2 | 21 | 181cm | 86kg |
| | 3 | 20 | 182cm | 88kg |
| | 4 | 24 | 179cm | 84kg |
| | 5 | 19 | 178cm | 83kg |
| Group C | 1 | 21 | 180cm | 85kg |
| | 2 | 20 | 179cm | 84kg |
| | 3 | 20 | 176cm | 82kg |
| | 4 | 23 | 182cm | 87kg |
| | 5 | 21 | 184cm | 88kg |
| Group D | 1 | 20 | 186cm | 92kg |
| | 2 | 22 | 181cm | 86kg |
| | 3 | 23 | 179cm | 82kg |
| | 4 | 24 | 178cm | 82kg |
| | 5 | 21 | 180cm | 86kg |

(1) Weight test

Weight is an important criterion for detecting obesity in long-distance athletes. Athletes with too much fat tend to have a higher body mass index. The four groups of athletes were tested for weight, and the weight changes of each athlete were recorded during the experiment, and the differences in the weight changes of the four groups of athletes were analyzed. The results are shown in Figure 5.

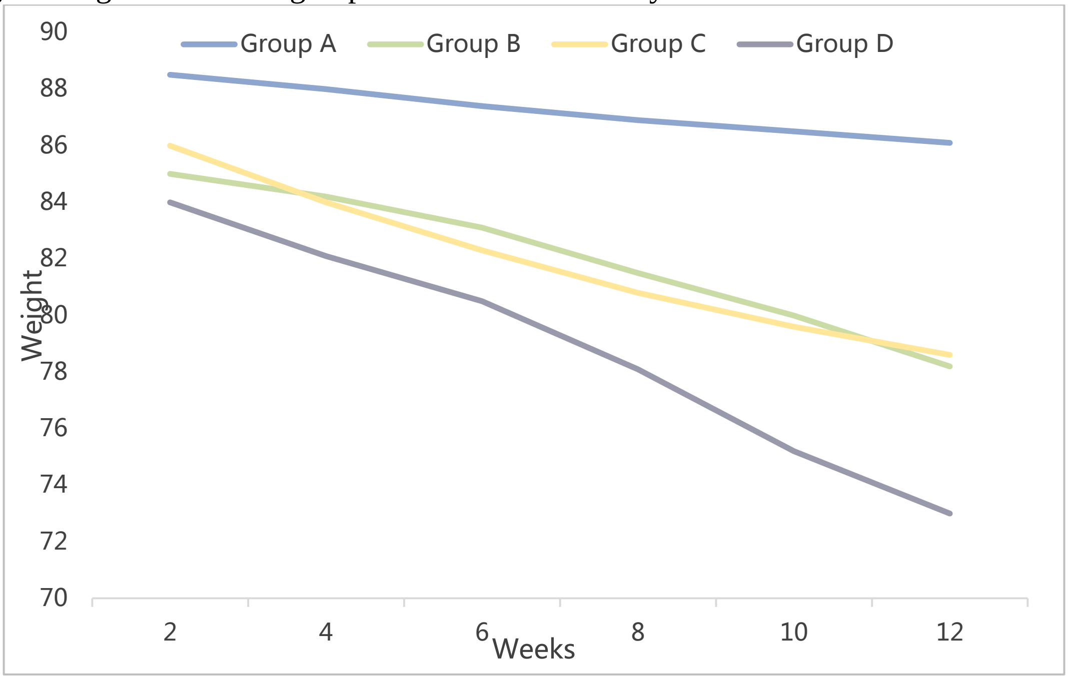


*Figure 5. Athlete weight test results*

It can be seen from Figure 5 that no matter which training method is used, the weight of sports athletes shows a downward trend. Among them, the weight of sports athletes in group A who used the traditional fat reduction method decreased from 88.5 to 86.1, and the rate of decline was slower. The weight of the athletes in group B who used systematic nutrition to lose fat decreased from 85 to 78.2, and the rate of decrease was slower at first and then faster, and the rate of decrease was faster than that in group A. The weight of the athletes in group C who used rhythmic exercise to reduce fat decreased from 86 to 79.5, and the rate of decrease was fast at first and then slow. The weight of group D athletes who used systematic nutrition combined with rhythmic exercise for fat loss decreased from 84 to 73, and the rate of decrease was faster than that of group A, group B and group C. To sum up, the traditional fat reduction method is very slow in reducing fat, and both system nutrition and rhythmic exercise have an effect on athletes to reduce fat, but the effect is not obvious. System nutrition combined with rhythmic exercise can maximize the fat reduction effect and can effectively of reducing the weight of a sports athlete.

(2) Fat content test

The 4 groups of athletes were tested for fat content to observe the difference in the fat content of the athletes after different methods of fat-reduction training, and to observe which group of athletes had the best fat-reduction effect. The results were recorded and analyzed, and the results are shown in Figure 6.

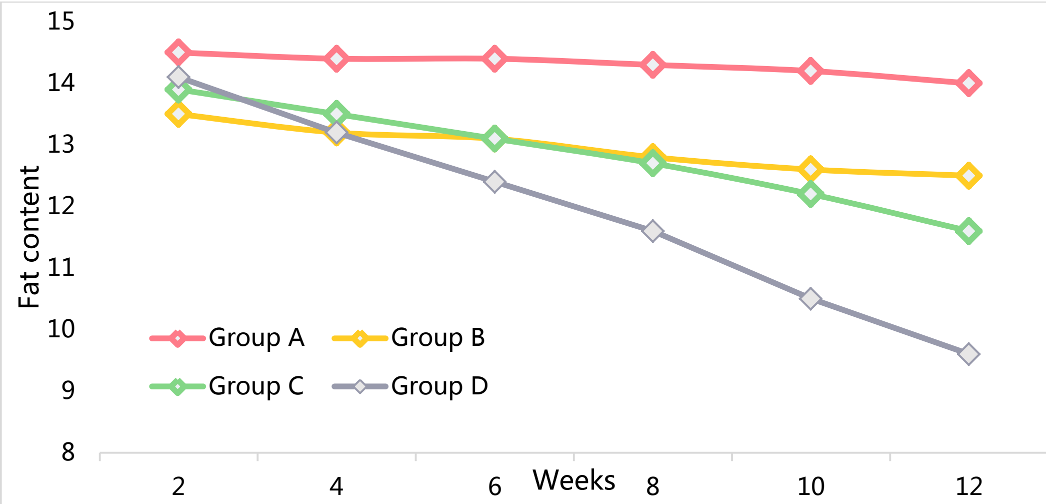


*Figure 6. Athlete fat content test*

As can be seen from Figure 6, the athletes in group D had the fastest decline in fat content, and the athletes in group A had the slowest decline in fat content. Among them, the fat content of athletes in group A decreased from 14.5 to 14, and the decline rate was too slow, and there was no significant change in the athletes' fat content from the 4th to the 6th week. The fat content of athletes in group B decreased from 13.5 to 12.5, which was faster than that in group A. The fat content of athletes in group C decreased from 13.9 to 11.6, which was faster than that in groups A and B. The fat content of athletes in group D decreased from 14.1 to 9.6, and the rate of decrease was faster, which was higher than that of group A, group B and group C. To sum up, the traditional fat reduction method is the worst, and the fat reduction method of systematic nutrition is not as good as the fat reduction method of rhythmic exercise. The combination of systematic nutrition and rhythmic exercise can effectively reduce the body fat content of sports athletes.

(3) Physical health index test

The physical health status of athletes is related to their future sports careers. The 4 groups of athletes were tested on the body health index, and the differences in the physical health of the athletes who were trained with different training methods were observed, and the experimental results were recorded and analyzed. The specific experimental results are shown in Figure 7.

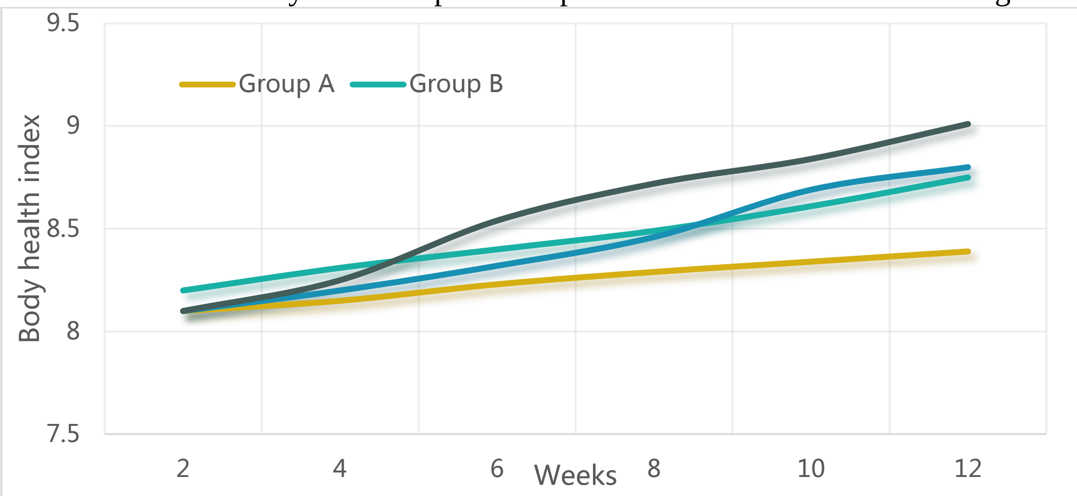


*Figure 7. Physical fitness index test*

In Figure 7, the physical fitness index of the athletes in group D increased the fastest, and the physical fitness index of the athletes in group A increased the slowest. Among them, the physical health index of group A athletes rose from 8.1 to 8.39, and the physical health index rose relatively smoothly. The physical fitness index of group B athletes increased from 8.2 to 8.75, which was faster than that of group A. The physical fitness index of group C athletes increased from 8.1 to 8.8, and the rate of increase was faster than that of groups A and B. The physical health index of group C athletes increased from 8.1 to 9.01, and the physical health index rose faster than that of group A, group B and group C.

(4) Athlete satisfaction test

After the experimental test, the athletes in each group were asked to rate the satisfaction of the test process, with a full score of 10 points. The scores of each athlete were recorded and analyzed to observe the differences in the satisfaction scores of athletes who used different methods of fat loss training, as shown in Figure 8.

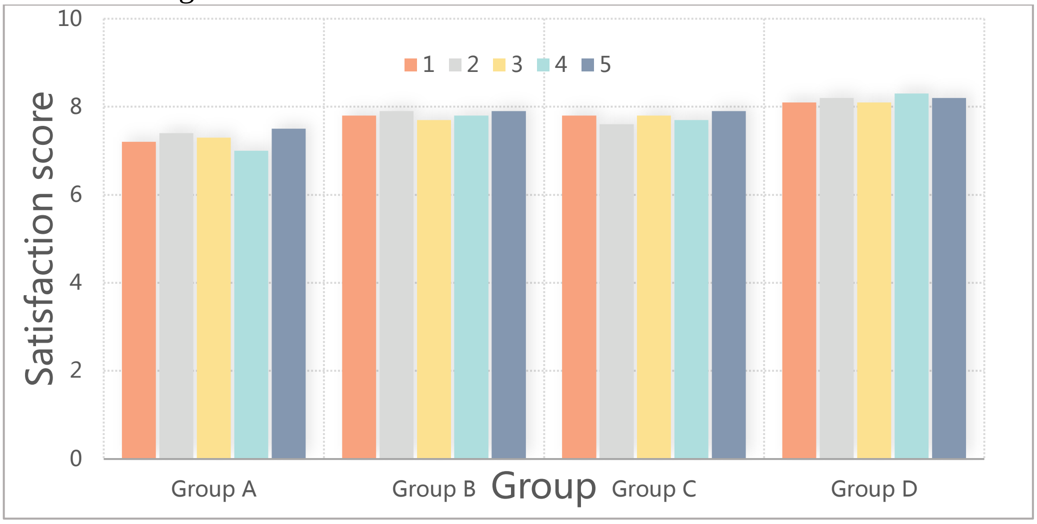


*Figure 8. Athlete satisfaction test*

In Figure 8, it can be seen that the satisfaction scores of the athletes in group D are higher than those in groups A, B and C. Among them, the average satisfaction score of group A athletes was 7.28, the average satisfaction score of group B athletes was 7.82, the average satisfaction score of group C athletes was 7.76, and the average satisfaction score of group D athletes was 8.18. The average satisfaction score of group A, group B and group C was 7.62, and the satisfaction score of athletes who used systematic nutrition combined with rhythm exercise increased by 7.3%. To sum up, the average satisfaction of athletes in group D is the highest, and the average satisfaction of athletes in group A is the lowest.

## 5. Conclusion

Athletes need to control their weight and body fat in real time. When body fat is too high, they should reduce fat in time to keep their body in a good state. In this paper, the method of systematic nutrition combined with rhythmic exercise was used to carry out reasonable and effective fat reduction training for sports athletes, so as to reduce the excess body fat content while ensuring the health of athletes. Through experimental tests on different sports athletes, it was found that system nutrition combined with rhythmic exercise can effectively reduce the weight and fat content of athletes, ensure the physical health of athletes, and make athletes more satisfied with fat-reducing training.

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## Data Availability

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

## Conflict of Interest

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

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