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Research Article

Application of Improved K-Means Clustering Algorithm in Targeted Practice of College Volleyball Fitness Training Classification

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The high-level men's volleyball team in ordinary colleges and universities is an important place for the country to cultivate outstanding volleyball reserve talents. Especially under the background of "integration of sports and education," the status of high-level men's volleyball teams in ordinary colleges and universities in my country's volleyball career has been further improved. In affirmation and attention, routine training is an important part of the work of high-level men's volleyball teams in ordinary colleges and universities. Cultivating high-level and high-quality outstanding volleyball reserve talents is an important goal of high-level men's volleyball teams in ordinary colleges and universities. The growth of high-level men's volleyball players requires high quality. For training support, in order to improve the training quality of the men's volleyball team at the general college level, it is necessary to evaluate the training quality of the existing high-level sports teams. In order to achieve "different from person to person" and "teaching according to aptitude" college students' volleyball training behavior prediction and guidance content recommendation, and to achieve a classification promotion strategy, this research uses the K-means clustering algorithm and PCA-GS-SVM algorithm to train college students' volleyball training, adhering to behavior. The data classifier has high training efficiency, and the accuracy rate is higher than 87% in both the training set and the test set, which can meet the application requirements of college students' volleyball training adhere to the classification and promotion strategy of behavior information platform and effectively support the practical application of the model. The volleyball training adherence behaviors are divided into eight categories, and specific classification promotion strategies are formulated according to the characteristics of different categories of behaviors.

1. Introduction

Volleyball has a relatively deep history of development. In 1895, William G. Morgan, a YMCA officer in Holyoke, Massachusetts, invented a new type of tennis-volleyball game on the basis of sports games, and Morgan played volleyball. A relatively complete competition rule was formulated, and the world's first volleyball competition rule was born [1]. In the same year, with Morgan's determination of the rules of the volleyball game, Springfield Junior College played the world's earliest recorded volleyball game. Then, volleyball was introduced to Canada, Cuba, Brazil, and other countries from the United States and thus set off a "volleyball" boom in the Americas, becoming a new and fashionable sport. Around 1900, volleyball began to enter Asia, and countries led by Japan quickly joined the sport and established its leading position in Asian volleyball, which promoted the expansion and development of volleyball in Asia. With the increasing influence of volleyball around the world, after 1949, world-class volleyball competitions began to increase, attracting the participation of sports elites from all over the world [2].

The development of my country's volleyball has experienced both glory and silence. From the early days of the founding of the People's Republic of China in 1949 to the early 1980s, the national system played an important role in promoting the development of volleyball. Under the guidance of the professional training thought of the development of competitive sports, the competitive level of our volleyball has been rapidly improved in a short period of time, which is reflected in the excellent results obtained by our volleyball in world-class competitions [3]. In the 1980s and 1990s, my country's national men's and women's volleyball teams won championships in world-class competitions. For example, the Chinese women's volleyball team won five world championships [4]. However, behind the rapid progress of competitive sports in our country, with the rapid changes in the international situation and Chinese society, under the leadership of the national system, the sports department is responsible for the training of volleyball reserve talents. The problem began to become prominent, which made the development of volleyball in my country and the new situation of socialist development misaligned, resulting in many adverse social effects. The emergence of these problems has also affected the improvement of my country's volleyball competitive level to a considerable extent, and then, Chinese volleyball has been quiet for a long time [5].

2. State of the Art

2.1. Research on the Training and Reserve of High-Level Volleyball Reserve Talents. In order to deal with many problems in the training of volleyball reserve talents in our country, For example, there are great differences in the quality of coaches, which affect the training. The development of volleyball reserve talents has a great relationship with the ability level of training coaches. The ability level of coaches directly affects the training results of reserve personnel. The teaching environment is poor, which is not conducive to systematic training. Because there are still some problems in the distribution of teaching resources, there are still great differences in the teaching environment in various regions. Lack of policy support and imperfect system and low attention to psychological training of athletes will affect the exertion of potential. If the sports industry wants to have long-term development, it needs more policy support. Scholars put forward their own suggestions from various angles. For example, Poonsiri et al. [6] proposed that to change the problem of talent training for volleyball reserve personnel in my country, it is necessary to give full play to the collaborative effect of sports and education departments, give full play to the commercial value of volleyball, and develop the market potential of volleyball, so as to attract more young people to participate in volleyball. Recently, Gayman and Eys [7] and others believe that to improve the training efficiency of volleyball reserve talents, it is necessary to innovate in relevant systems, strengthen the role of the market in the development of volleyball, and, at the same time, properly improve the introduction system of volleyball reserve talents. Some scholars believe that volleyball training should improve the mode of paid training, which is an approach that adapts to the market economic system and can effectively stimulate the enthusiasm of various interest groups to participate in the training of volleyball reserve talents.

3. Research on the Selection of Athletes for High-Level Men's Volleyball Teams in Ordinary Colleges and Universities

Some scholars have conducted relevant research on the selection of men's volleyball players in ordinary colleges and universities in my country and found that most of the existing ordinary college volleyball players are recruited by sports with good physical fitness and physical shape indicators that meet the requirements of volleyball selection. However, these students did not have a lot of contact with volleyball before college. Generally speaking, the relevant knowledge and special skills of volleyball are relatively weak, especially in the volleyball game, the sports awareness is relatively insufficient. In addition, some scholars have conducted related research on the selection of players in different positions in the volleyball team [8]. For example, Brinkley et al. [9] conducted a study on the selection method of setter players in volleyball. He pointed out that volleyball setter players are the link of the entire team in volleyball, and the ability and quality of the players in this position affect the competitive level of the entire team. Performance is crucial. In addition, the selection of volleyball setter players should follow the following points: First, the overall physical characteristics and upper and lower limb characteristics of the setter players should be considered; second, the jumping and speed capabilities of the setter players should be considered; third, we must consider the physiological function level of the setter player's vital capacity; fourthly, we must consider the psychological quality of the setter player.

4. Research on the Training of High-Level Volleyball Teams in Ordinary Colleges and Universities

In view of the contradiction between learning and training in the training of high-level volleyball teams in ordinary colleges and universities, academic scholars have launched an analysis and discussion on this [10]. For example, Chen and Liang [11] believe that the contradiction between learning and training in the training of high-level volleyball teams in ordinary colleges and universities is relatively prominent, and the existence of this problem is affected by many aspects. Six factors such as will and management style have a greater impact, and it is proposed that the contradiction between training in high-level volleyball team training in ordinary colleges and universities cannot be solved fundamentally, and only relevant measures can be implemented to alleviate it. Feng Hongwei pointed out that the coaches of high-level volleyball teams in ordinary colleges and universities have a greater impact on the quality of team training, because most coaches of high-level college volleyball teams are special physical education teachers, who basically have multiple educational tasks. The arrangement of high-level volleyball team training is basically in the spare time, and special physical education teachers cannot arrange for relatively concentrated volleyball team training without special circumstances. This factor greatly affects the training quality of high-level volleyball teams in ordinary colleges and universities. Li et al. [12] also pointed out that after-school training is an important form of training for high-level volleyball teams in ordinary colleges and universities, but the amateur training of high-level volleyball teams in ordinary colleges and universities is difficult to carry out annual large-cycle training like professional volleyball teams in sports teams, not a good guarantee of volleyball training time.

5. Methodology

5.1. Clustering of Behavioral Features. Classification is the precondition and foundation of intervention. In order to achieve objective classification of fitness groups, researchers have tried many methods. At present, there are many studies on the behavior patterns and classification of users in various online communities. In the selection of classification indicators, time characteristics, frequency characteristics, proportional characteristics, etc. are all involved. Generally, quantifiable indicators are selected to judge the value of the value. The index constraints jointly determine the classification results of individual behaviors. For example, Brandtzag introduces a user classification system from the perspectives of community functions and services, user usage frequency, and content activity preferences. In the research on students' online learning behavior, Wang Gaihua selected time indicators such as the total duration of online learning and the duration of a single session, and determined the weights of different indicators to comprehensively discriminate and describe students' online learning behaviors with multi-dimensional characteristics; Welling et al. [13] extracted frequency indicators such as the amount of comment forwarding among users, and some scholars used ratios between multiple indicators, such as ratio indicators such as repeated learning rate. In general, the multi-index constraint determination of user behavior is a major trend today. Due to the large amount of data processing and the unreasonable distribution of the number of groups in multi-index classification, more and more researchers tend to use unsupervised clustering methods to determine the actual user community and reasonably describe the group characteristics, which are more commonly used on the$K$-means method.

At present, the research on the classification of user behavior patterns in online communities is the basis of user behavior analysis. There are various classification methods, and most of them rely on objective behavior data to combine qualitative and quantitative classification methods. Quantitative classification indicators are mostly temporal features, frequency features, and proportional features, and so on; it is divided according to the level of the index value, and the classification of individual behavior is jointly determined by multiple index constraints. In addition, unsupervised clustering is often used to find the natural classification method of users. User behavior indicators can be converted into quantitative data sets. Clustering them can fully respect the facts of users' objective behavior data. Sensitive indicators and their variation range, and even covariation characteristics with other indicators, find a better classification method.

K-means clustering uses distance to measure the similarity between samples and is a commonly used clustering method [14]. The K-means method is the most commonly used and efficient unsupervised clustering method and has been used in the research of many scholars [15]. For example, Allen et al. [16] used K-means clustering to cluster the user behavior data of Starbucks innovation community in his research. In the research of abnormal behavior monitoring of database users, Kerr et al. [17] used the query statements and query results of users in the historical audit log of the database and adopted the K-means clustering method to obtain the grouping of users. Wang et al. studied the learner behavior of MOOC education big data, extracted five types of learning behavior characteristics and carried out K-means cluster analysis, obtained four types of learner groups, and conducted an in-depth analysis of the characteristics of group portraits.

5.2. Behavioral Feature Classifier Based on Supervised Machine Learning

(1) Feature dimensionality reduction method: principal component analysis [18] (PCA) feature extraction is a very common data processing method in machine learning, which is to convert D features of existing samples into $d\,(<D), d\,(<D)$ new features. Generally, it appears before the actual model is built to achieve the change of the dimension of the feature space (usually a dimensionality reduction operation), because practical research and applications usually need to analyze data sets containing multiple variables and find data rules and characteristics in massive data. The large amount of multivariate data sets not only contains massive information but also increases the difficulty of analysis and calculation and increases the workload of data collection and calculation. And in many cases, the correlation between variables will multiply the complexity of the problem. However, the analysis based on a single indicator often causes too much loss of key information and ignores the important correlation information between variables, which often reduces the reliability and validity of the analysis, and even produces erroneous analysis conclusions. How to balance indicator selection and information loss has become an unavoidable problem in big data analysis. In order to maximize the purpose of comprehensively analyzing the whole picture of the data, it is necessary to filter and simplify the related variables, and it is necessary to reduce the dimensionality of the big data. In order to reduce the problem of data information redundancy, a data dimensionality reduction method is selected to reduce the dimension of the model's constructs in the application, reduce the amount of data, and remove overlapping information. The goal is to construct a small number of new variables, make these new variables no longer

relevant, and use as few comprehensive indicators as possible to describe as much data information and variable relationships as possible. Data dimensionality reduction can remove noise, make the data set easier to analyze, reduce the computational cost of the algorithm, and make the results easier to understand and generalize [19].

Among them, the most widely used method is principal component analysis [20] (PCA). The principle of the principal component analysis method PCA is to calculate a set of new features arranged in descending order of importance from a set of features. They are linear combinations of the original features, and the new features are not related [21].

$$X = \left(x_{ij}\right)_{n\times p} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{bmatrix} = \begin{pmatrix} e_1^T \\ e_1^T \\ \vdots \\ e_n^T \end{pmatrix} = \left(x_1, x_2, \cdots, x_p\right). \tag{1}$$

When the contribution of the cumulative variance of the described top k principal components is large enough (usually 80%), the original data set can be approximately replaced by applying the top k principal components.

Change p variables $x_1, x_2, \cdots, x_p$ into p new variables (integrated variables) $F_1, F_2, \cdots, F_p$, that is,

$$\begin{cases} F_1 = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1p}x_p, \\ F_2 = a_{21}x_1 + a_{22}x_2 + \cdots + a_{2p}x_p, \\ \vdots \\ F_p = a_{p1}x_1 + a_{p2}x_2 + \cdots + a_{pp}x_p, \end{cases} \tag{2}$$

can be abbreviated as

$$\begin{aligned} F_j &= \sum_{k=1}^{p} a_{jk}x_k = a_{j1}x_1 + a_{j2}x_2 + \cdots + a_{jp}x_p (j = 1, 2, \cdots, p), \\ a_j &= \left(a_{j1}, a_{j2}, \cdots, a_{jp}\right)^T \in R^p (j = 1, 2, \cdots, p). \end{aligned} \tag{3}$$

The available matrix is expressed as

$$F = AX^T,$$

$$F = \begin{pmatrix} F_1 \\ F_1 \\ \vdots \\ F_n \end{pmatrix} = \begin{bmatrix} F_{11} & F_{12} & \cdots & F_{n1} \\ F_{21} & F_{22} & \cdots & F_{n2} \\ \cdots & \cdots & \cdots & \cdots \\ F_{n1} & F_{n2} & \cdots & F_{np} \end{bmatrix} = [F(1), F(2), \cdots, F(n)],$$

$$F(i) = \left(F_{i1}, F_{i2}, \cdots, F_{ip}\right)^T \in R^n (i = 1, 2, \cdots, n),$$

$$F_{ij} = \sum_{k=1}^{p} a_{jk}x_k = a_{j1}x_{i1} + a_{j2}x_{i2} + \cdots + a_{jp}x_{ip} = e_i^T a_j (j = 1, 2, \cdots, p). \tag{4}$$

The goal of PCA is to determine the coefficient vector $a_j = (a_{j1}, a_{j2}, \cdots, a_{jp})^T$, such that the variance var (F) of F, is maximized. Var(F) represents the degree of dispersion of the transformed values of all samples relative to the mean and is calculated as follows:

$$\text{Var}\left(F_j\right) = \frac{1}{n}\sum_{i=1}^{n}\left(F_{ij} - \bar{F}_j\right)^2. \tag{5}$$

The average value of the comprehensive variable after n sample transformation, that is

$$\begin{aligned} \bar{F}_j &= \frac{1}{n}\sum_{i=1}^{n} F_{ij} = \frac{1}{n}\sum_{i=1}^{n}\left(a_{j1}x_{i1} + a_{j2}x_{i2} + \cdots + a_{jp}x_{ip}\right) \\ &= a_{j1} \bullet \frac{1}{n}\sum_{j=1}^{n} x_{ij} + a_{j1} \bullet \frac{1}{n}\sum_{i=1}^{n} x_{ij} + \cdots + a_{j1} \bullet \frac{1}{n}\sum_{j=1}^{n} x_{ij} \\ &= a_{j1} \cdot \bar{x}_1 + a_{j2} \bullet x_2 + \cdots + a_{jp} \cdot x_p, \end{aligned} \tag{6}$$

are the mean values of n samples of each variable before transformation, namely,

$$\overline{x_j} = \frac{1}{n}\sum_{i=1}^{n} x_{ij} (j = 1, 2, \cdots, p),$$

$$\begin{aligned} \text{Var}\left(F_j\right) &= \frac{1}{n}\sum_{i=1}^{n}\left[a_{j1}(x_{i1} - \overline{x_1}) + a_{j2}(x_{i2} - \overline{x_2}) + \cdots + a_{j1}\left(x_{ip} - \overline{x_p}\right)\right]^2 \\ &= \frac{1}{n}\sum_{i=1}^{n}\left[\sum_{i=1}^{p}\sum_{i=1}^{p} a_{jk}a_{jm}(x_{ik} - \overline{x_k})(x_{im} - \overline{x_m})\right] \\ &= \sum_{i=1}^{p}\sum_{i=1}^{p} a_{jk}a_{jm}\left[\frac{1}{n}(x_{ik} - \overline{x_k})(x_{im} - \overline{x_m})\right] \\ &= \sum_{i=1}^{n}\sum_{i=1}^{n} a_{jk}a_{jm}s_{km} = a_j^T V a_j, \end{aligned} \tag{7}$$

where V is the covariance matrix of the data table X, as follows:

$$V = \begin{bmatrix} s_{11} & s_{12} & \cdots & s_{1p} \\ s_{21} & s_{22} & \cdots & s_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ s_{n1} & s_{n2} & \cdots & s_{pp} \end{bmatrix},$$

$$\begin{aligned} s_{km} = \text{Cov}(x_k, x_m) &= \frac{1}{n}\sum_{i=1}^{n}(x_{ik} - \overline{x_k})(x_{im} - \overline{x_m}) \\ &\cdot (k = 1, 2, \cdots, p; m = 1, 2, \cdots, p). \end{aligned} \tag{8}$$

The first principal component F_i can summarize most of the statistical information of the original data table, but not all of it. Therefore, as a supplement to the first principal component F_1, the second principal component F_2 is to be considered, and F_2 and F_1 are independent of each other. Use the eigenvector corresponding to the second largest eigenvalue

$$F_2 = a_{21}x_1 + a_{22}x_2 + \cdots + a_{2p}x_p = Xa_2. \quad (9)$$

By analogy, the corresponding Pth principal component can be obtained. The first few principal components have a relatively large contribution to the amount of information and are usually selected in practical applications to reduce the spatial dimension, defined by this

$$P_k = \frac{\lambda_k}{\sum_{j=1}^{p} \lambda_j} \times 100\%. \quad (10)$$

The purpose of principal component analysis is to replace the original P with as few principal components as possible, RF...$F(k \leq P)$ an indicator. In actual work, the number of principal components depends on the amount of information that can reflect more than 80% of the original variable, that is, when the cumulative contribution rate is greater than or equal to 80%, the number of principal components can meet the model requirements. The common situation is 2 to 3.

6. Result Analysis and Discussion

6.1. K-Means Clustering Effect Test. Selecting different classification numbers can obtain different clustering results, that is, different teaching groupings. In order to select the best teaching group, two clustering effect evaluation indicators are used: classification coefficient and average fuzzy entropy to discriminate different clustering results. Table 1 shows the size of the effect evaluation index of the clustering results when different classification numbers are used. It can be seen that when the number of classifications is 2, the classification coefficient is closest to 1, and the average fuzzy entropy is closest to 0. Therefore, the clustering result obtained at this time, that is, the clustering effect of the teaching grouping is the best.

The evaluation criteria of the maximum membership degree are used to classify the samples, so as to clarify the membership category of the samples. Table 2 shows the situation of 100 boys divided into 2 categories, from which it can be seen that category 1 represents students with good physical fitness, and category 2 represents students with poor physical fitness. In the process of physical education, the teaching content, physiological load, and exercise intensity can be reasonably arranged according to different types of students, so as to teach students in accordance with their aptitude.

The fuzzy K-means clustering algorithm is used to realize the teaching grouping, and the fuzzy phenomenon in the grouping process can be considered.

Table 1: Evaluation indicators of clustering effect when selecting different classification numbers.

Number of categories	Classification coefficient	Average fuzzy entropy
2	0.7972	0.3348
3	0.6802	0.5638
4	0.6193	0.7147
5	0.5841	0.8200

6.2. KMO and Bartlett's Test of Sphericity for Analysis. According to statistical principles, it defines a relatively reasonable set of metrics for the KMO value. When the KMO value is in the $(0.9, 1)$ interval, it indicates that the original research data is very suitable for factor analysis; when the KMO value is in the $(0.8, 0.9)$ interval, it indicates that the original research data is very suitable for factor analysis; when the KMO value is in $(0.7, 0.8)$ interval, indicating that the original research data is suitable for factor analysis; when the KMO value is in the $(0.6, 0.7)$ interval, indicating that the research original data is barely suitable for factor analysis; when the KMO value is in the $(0.5, 0.6)$ interval, indicating that the original research data is not suitable for factor analysis; when the KMO value is in the (0, 0.5) interval, it indicates that the original research data is very unsuitable for factor analysis. It can be seen that the KMO value metric standard stipulates that the KMO value is closer to 1, indicating that the correlation between variables is stronger, which further indicates that the original research data is more suitable for factor analysis; the KMO value metric standard stipulates that the KMO value is closer to 0, indicating that the correlation between variables is weaker. The weaker the correlation between the two, indicating that the original research data is less suitable for factor analysis. In addition, the corresponding P value in the Bartlett sphericity test can also determine whether the original data of the study are suitable for factor analysis. When the corresponding P value in the Bartlett sphericity test is less than 0.05, it indicates that the original research data is suitable for factor analysis; when the corresponding P value in the Bartlett sphericity test is greater than 0.05, it indicates that the original research data is not suitable for factor analysis. Tables 3 below represent the test results of the original data of this study.

As shown in Table 3, the original data of this study were input into SPSS 20.0 statistical software, and the factor analysis calculation was run, and finally, the KMO value of the original data of this study was 0.933, and the Bartlett sphericity test showed that the P value was 0.00, which was less than 0.05. According to the requirements of the factor analysis method in the above statistics for the KMO and Bartlett sphericity test, combined with the calculated data in Table 3, it can be considered that the original data of this study meet the basic conditions of the factor analysis method in statistics, and the factor analysis method can be used to analyze relevant data.

According to the operation steps of the factor analysis method in statistics, in the process of screening out the

Table 2: Classification of students.

Category	The student number included in the class
1	2, 3, 4, 5, 7, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 33, 36, 38, 39, 45, 51, 53, 57, 59, 72, 80, 81, 82, 90, 93, 96, 97, 100
2	1, 6, 8, 9, 10, 12, 23, 28, 29, 30, 31, 32, 37, 40, 41, 42, 43, 44, 47, 48, 49, 50, 52, 54, 55, 56, 58, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 73, 74, 75, 76, 77, 78, 79, 83, 84, 85, 86, 87, 88, 89, 81, 92, 94, 95, 98, 99

Table 3: KMO and Bartlett sphericity test results for the original data of this study.

Kaiser-Meyer-Olkin test		0.933
Spherical test	Approximate chi-square value	2931.134
	Df	1233
	Sig	0.00

common factors affecting the training quality of high-level volleyball teams in colleges and universities, it is first necessary to test the common degree of independent variables of the original data of this study. The factor analysis method interprets the common degree of independent variables as the degree of influence of different factors in the whole factor group, which indicates the common degree of the factor. The larger the common factor value, the greater the influence of the factor on the common factor. Table 4 below shows the common degree of each factor in this study.

In order to make the 18 influencing factors more clearly displayed, to explore the most important common factors, the factor analysis method is used to calculate the load of each factor to extract the principal components and categorize and determine the number of common factors.

In this study, the factor analysis method in SPSS 20.0 statistical software was used to perform principal component analysis on the original data; factor analysis refers to a multivariate statistical analysis method that starts from studying the dependence within the index correlation matrix and reduces some variables with overlapping information and complex relationships to a few unrelated comprehensive factors. The basic idea is to group the variables according to the correlation, so that the correlation between the variables in the same group is high, but the variables in different groups are not correlated or have low correlation. Each group of variables represents a basic structure, i.e., common factor, and finally, the historical plot of 18 influencing factors (Figure 1) and the total variance explained by the factors (Table 5) were obtained.

The five main factors are coaches, athletes themselves, training design, university level, and social support.

Combining the results shown in Figure 1 and Table 5, it can be seen that when the factor explained the total variance in this study to the fifth factor, its cumulative contribution rate reached 72.706%. After the factor, the factor contribution rate tends to be flat. According to the principle of statistical factor analysis, when the factor contribution rate is greater than 70%, the extracted common factors can basically explain most of the information of the original variables. Combined with the above data, this study can extract 5 common factors, and these 5 common factors can explain most of the information of the original variables.

6.3. Empirical Analysis of Factors Affecting the Training Quality of Volleyball Teams. From the statistical results of Figure 2, in terms of coaching ability (factor 4), the average scores of the three schools are all greater than 4.00, of which Yanshan University has the highest score of 4.73, and Hebei Normal University has the lowest score of 4.29. From the result that the difference between the highest score and the lowest score of factor 4 is only 0.44, it is agreed that the coaching ability has a high degree of influence on the training quality of high-level men's volleyball teams in ordinary colleges and universities. Among the coaches' own quality (factor 5), the three schools with the highest average score are Hebei Agricultural University (4.33), and the lowest average score is Hebei Normal University (4.08). The degree of influence of team training quality is also agreed upon. In terms of coaches' love of work (factor 6), the three schools with the highest average score are Hebei Agricultural University (4.32), followed by Yanshan University (4.00), and the lowest average score is Hebei Normal University (3.78). It can be seen that the difference between the highest score and the lowest score of factor 6 is large, indicating that there is a slight difference in the degree of love of work between the high-level men's volleyball team coaches of Hebei Normal University and the high-level men's volleyball team coaches of Hebei Agricultural University and Yanshan University. In terms of coaches' leadership style (factor 7), Yanshan University (4.37) has the highest average score among the three schools, and Hebei Normal University (3.57) has the lowest average score. It can be seen that the difference between the highest score and the lowest score of factor 6 is relatively large, indicating that there is a certain difference in the leadership style of the coaches of the high-level men's volleyball team in Hebei Normal University and the other two schools. From the above analysis, it can be seen that the coaching ability of the coaches in this study (factor 4), the quality of the coaches (factor 5), the love of the coaches for their work (factor 6), and the coaches' leadership style (factors 7). There is a certain difference in the degree of influence of the four influencing factors. The degree of influence from high to low is the coach's coaching ability (factor 4), the coach's own quality (factor 5), the coach's leadership style (factor 7), and the coach employee's passion for work (factor 6).

From the statistics in Figure 3, we can see that the three schools surveyed have high satisfaction with their high-level

Table 4: Common degree of each factor in this study.

No.	Factor name	Initial value	Extract value
1	College athlete admission policy	1.000	0.633
2	The school's emphasis on the development of volleyball	1.000	0.678
3	Investing in school grounds	1.000	0.612
4	Coach's coaching ability	1.000	0.703
5	Coach's own quality	1.000	0.584
6	The coach's passion for the job	1.000	0.554
7	Coach's leadership style	1.000	0.575
8	Athlete's own volleyball skill level	1.000	0.648
9	Athletes' liking for volleyball	1.000	0.672
10	The extent of the athlete's injury	1.000	0.578
11	Athletes' requirements for self-skills	1.000	0.529
12	Reasonableness of physical training content	1.000	0.611
13	Reasonable content of tactical training	1.000	0.589
14	Reasonable content of mental training	1.000	0.703
15	Reasonable training schedule	1.000	0.753
16	Athlete family support level	1.000	0.610
17	The social recognition of high-level volleyball talents	1.000	0.699
18	The degree of social demand for high-level volleyball talents	1.000	0.756

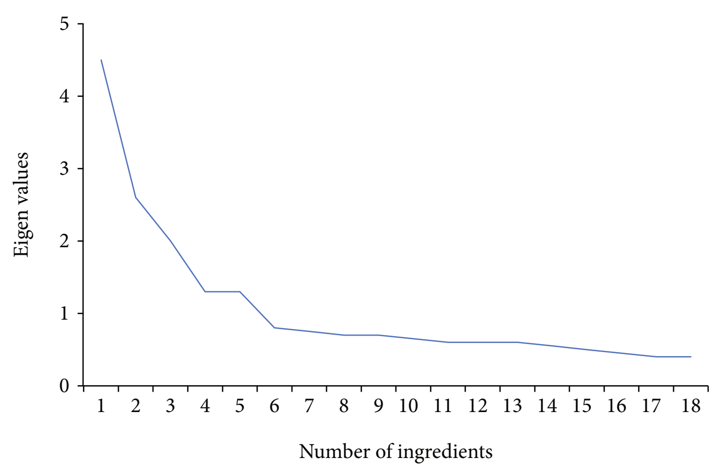

Figure 1: Gravel diagram of each factor in this study.

Table 5: Total variance explained by the factors in this study.

	Initial eigenvalues			Extract the square and load the product (%)			Rotate square and load		
Element	Total	% of variance	Grand total (%)	Total	% of variance	Grand total (%)	Total	% of variance	Cumulative contribution rate (%)
1	6.359	31.800	31.800	6.36	31.800	31.800	4.300	21.501	21.501
2	2.762	13.808	45.608	2.762	13.808	45.608	3.317	16.586	38.087
3	2.591	12.955	58.562	2.591	12.955	58.562	3.139	15.696	53.783
4	1.608	8.040	66.602	1.608	8.040	66.602	2.332	11.658	65.441
5	1.221	6.103	72.706	1.221	6.103	72.706	1.453	7.265	72.706

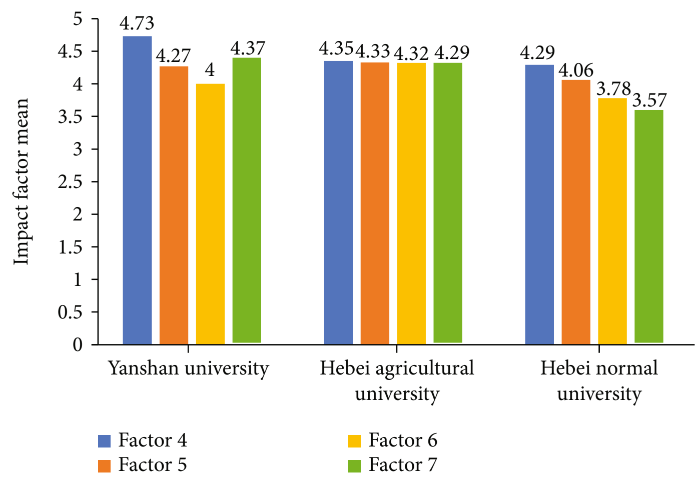

Figure 2: The average score of the high-level men's volleyball team in ordinary colleges and universities about the coach factor.

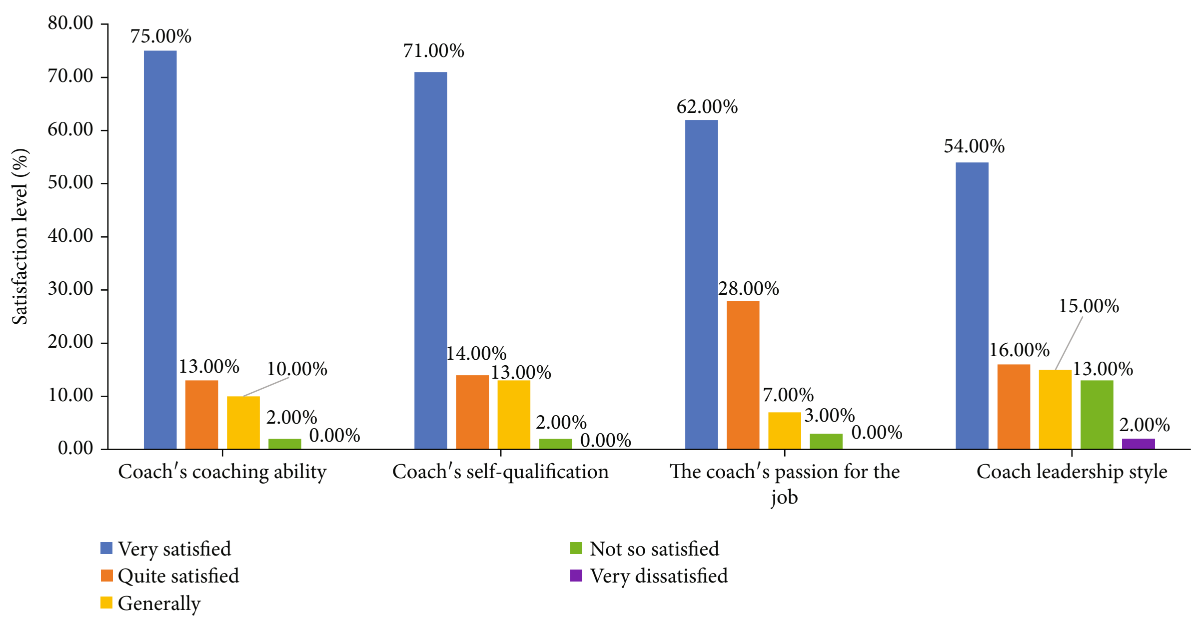

Figure 3: Satisfaction level of high-level men's volleyball teams in general colleges and universities with regard to the coach factor.

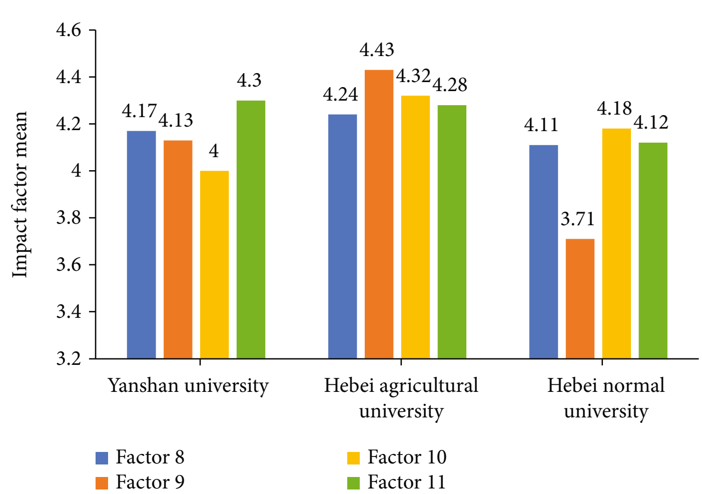

Figure 4: The average score of the high-level volleyball team in ordinary colleges and universities about the player's own factor.

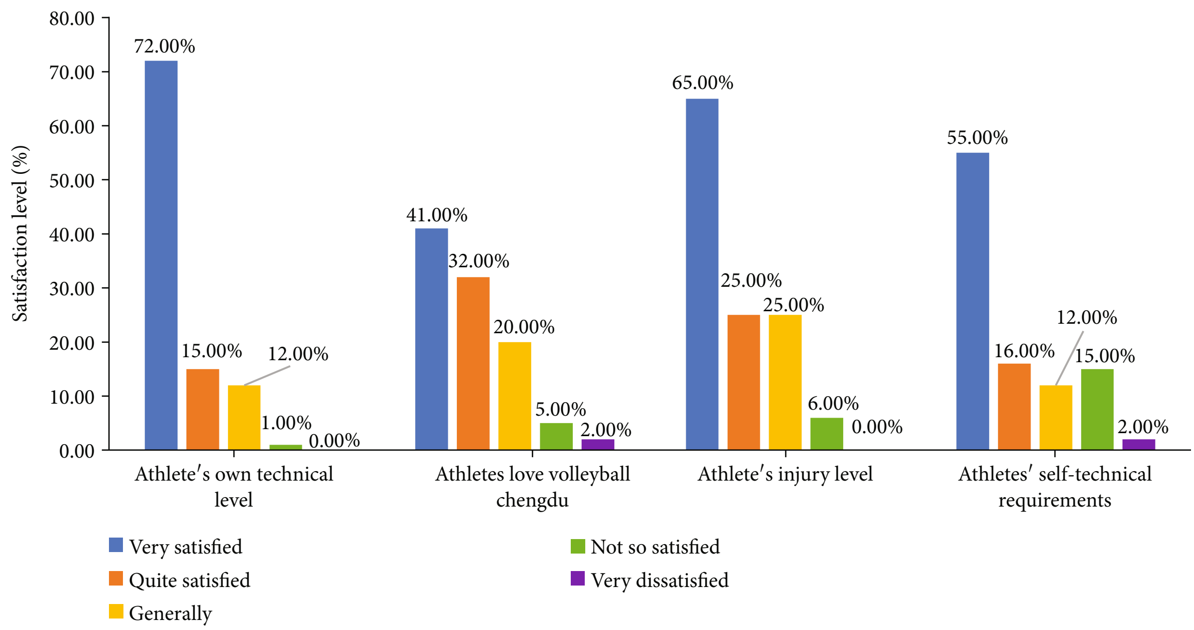

Figure 5: Satisfaction level of high-level men's volleyball teams in ordinary colleges and universities with regard to their own factors.

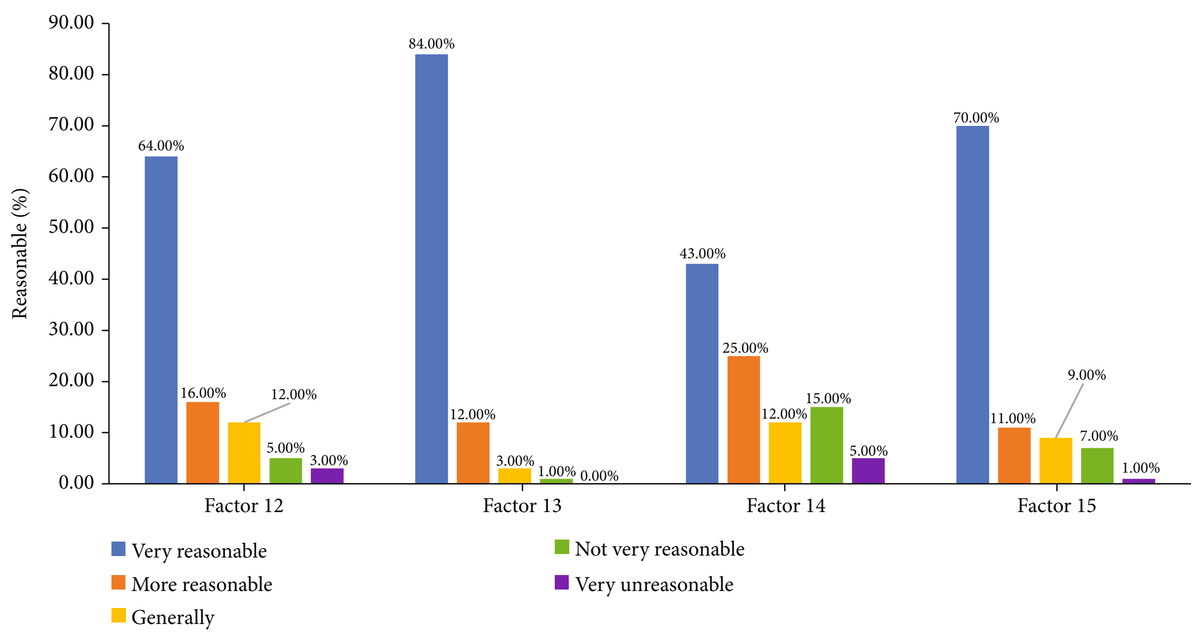

Figure 6: The reasonableness of training design for high-level men's volleyball teams in ordinary colleges and universities.

men's volleyball team coaches and coaching ability and the quality of the coaches themselves, with 75% and 71% being very satisfied, respectively. Among them, coaches' satisfaction with their work and love and coaches' leadership style is relatively low, with 62% and 54% being very satisfied, respectively.

From the statistical results in Figure 4, in terms of the players' own volleyball skill level (factor 8), the average scores of the three schools are all greater than 4.00, among which Hebei Agricultural University has the highest score of 4.24, and Hebei Normal University has the lowest score of 4.11.

As can be seen from the statistics in Figure 5, the three schools surveyed have high satisfaction with their high-level men's volleyball team players' own volleyball skills and the degree of injury of the players, with 72% and 65% being very satisfied, respectively. Among them, the players' satisfaction with volleyball and their own technical requirements is relatively low, with 41% and 55% being very satisfied, respectively.

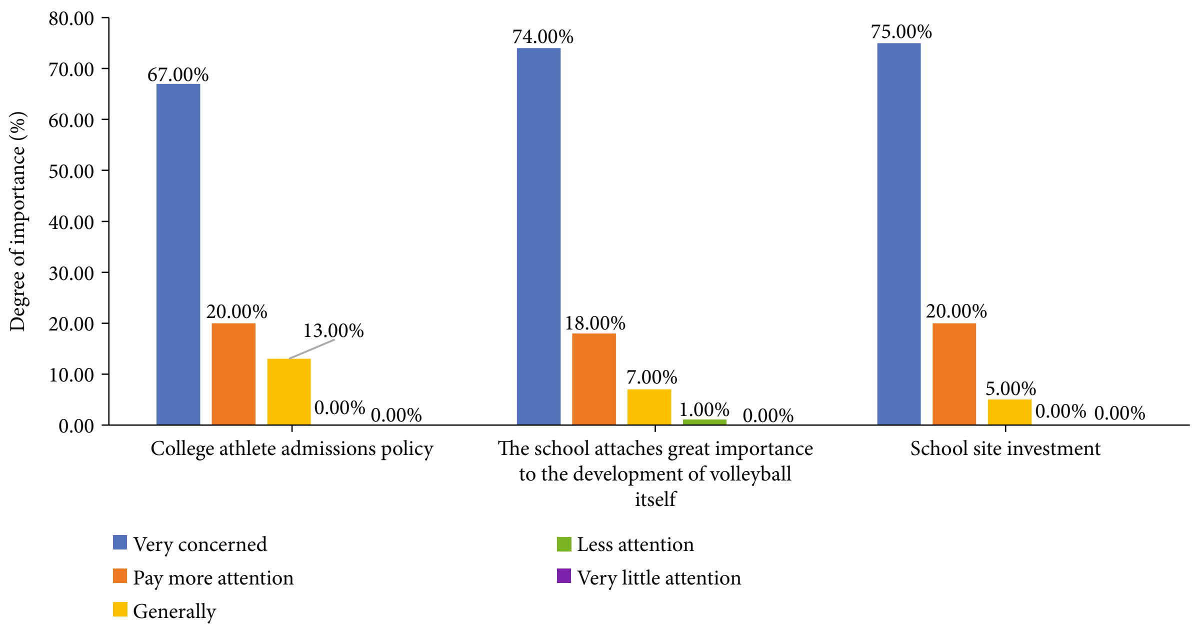

Figure 7: The importance of high-level men's volleyball teams in ordinary colleges and universities on college-level factors.

From the statistics in Figure 6, we can see that the three schools surveyed are reasonable in the content and method of physical training for their high-level volleyball team (factor 12) and the rationality of the content and method of technical and tactical training (factor 13), the rationality of training time and load arrangement (factor 15) has a high evaluation, and the proportions that are considered very reasonable are 64%, 84% and 70%, respectively, but the rationality of the content of psychological training and preventive arrangements (factor 14) There are certain deficiencies, which is also one of the problems in the training arrangement.

From the statistics in Figure 7, it can be seen that the three schools surveyed attach great importance to the high-level men's volleyball team's college-level factors, which are 67% of the college's athlete enrollment policy, and 74% of the school's emphasis on the development of volleyball and 75% of the investment in school venues, equipment, and funds. We can see that the overall impact of colleges and universities on the quality of sports team training is not too great, but the school's emphasis on the development of volleyball and its investment in venues, equipment, and funds affect sports team players' enthusiasm for training. The impact is still relatively large. In the training of high-level men's volleyball team, if the school does not have good support, and the investment in hardware and software is not guaranteed; then, the incentive effect on the training of coaches and athletes will have a greater impact. There may be a phenomenon of passive sabotage, which will greatly reduce the quality of training for high-level volleyball teams.

7. Conclusion

There are 18 factors affecting the training quality of high-level men's volleyball teams in ordinary colleges and universities. The factor analysis method is used to obtain 5 influencing factor groups, which are the coach factor, the athlete's own factor, the training design factor, the college-level factor, and the social support factor. Among them, the coach factor group includes four influencing factors: the coach's coaching ability, the coach's own quality, the coach's love for work, and the coach's leadership style; the player's own factor group includes the player's own volleyball skill level, and the player's love for volleyball. There are four influencing factors: the degree of athlete's injury and the athlete's requirements for self-skills; the training design factor group includes the rationality of physical training content and method arrangement, the rationality of technical and tactical training content and method arrangement, and the rationality of psychological training content and preventive arrangement. Reasonability, training time, and load arrangement are three influencing factors; the college-level factor group includes three influencing factors: college athlete enrollment policy; school's emphasis on the development of volleyball, school venue, equipment, and funding investment; and social support The factor group includes three influencing factors: the degree of family support of athletes, the degree of social recognition of high-level volleyball talents, and the degree of social demand for high-level volleyball talents.

The three schools surveyed were highly satisfied with their high-level men's volleyball coaches and their coaching ability and quality, with 75% and 71% of the schools, respectively, very satisfied. Among them, coaches' satisfaction with their work, love, and leadership style is relatively low, with 62% and 54% satisfied, respectively. Its high-level men's volleyball players are satisfied with their volleyball skills and the degree of injury, which are 72% and 65%, respectively. Among them, the satisfaction of athletes with volleyball and their own technical requirements is low, with 41% and 55%, respectively, very satisfied.

Based on the research results of this paper, the following suggestions are put forward: (1) We can train high-level men's volleyball coaches to improve the quality and ability of coaches; (2) stimulate the enthusiasm of high-level men's volleyball players in colleges and universities and guide them to establish correct concepts; (3) do a good job in the training design of the high-level men's volleyball team in colleges and universities and improve the scientific and reasonable training mechanism; (4) strengthen the attention of the high-level men's volleyball team in ordinary colleges and universities and improve the logistics support level of the team; and (5) increase the high-level men's volleyball team in colleges and universities. The promotion of the team and the increase of social support for college men's volleyball players have been carried out.

Data Availability

The figures and tables used to support the findings of this study are included in the article.

Conflicts of Interest

The author declares that he/she has no conflicts of interest.

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