

# Analysis of Badminton Physical Fitness Special Training Based on Association Rule Algorithm

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**ABSTRACT:** This article introduces a badminton physical fitness specialized training analysis model based on an association rule algorithm. This model identifies the strengths and weaknesses of athletes during the training process by preprocessing their training data, mining association rules, and analyzing the results. At the same time, the model can also provide targeted training suggestions and guidance based on individual differences and training needs of athletes. Then, this article takes a badminton player as an example and uses the model to analyze their physical fitness-specific training data. By mining association rules, it was found that the athlete had some shortcomings during the training process, such as a large room for improvement in speed and endurance. In response to these issues, the model provides corresponding training suggestions and guidance, supporting the player to improve their physical fitness level further.

**Keywords:** Association Rules Algorithm, Badminton Training, Improving Physical Ability, Physical Training

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## 1. Introduction

World-class badminton has developed to a new level; competition is getting increasingly fierce. To adapt quickly to the intensity of the competition, a strong body to do the backing is necessary protection [1]. Physical fitness refers to the function of various organs and systems of the human body, including the basic physical qualities of speed, endurance, strength, sensitivity and flexibility. Badminton requires high physical quality, speed, endurance, strength, sensitivity and flexibility. Every quality cannot be weak. Therefore, badminton players must pay attention to physical fitness training on the basis of mastering basic skills and footwork [2]. Enhancing physical ability can lay a solid foundation for badminton athletes to master complex, advanced, higher levels of technology, and tactics for improving training level, which will improve the athletes' heavy load training and match adaptability [3]. Good physical fitness can extend the badminton player's exercise life; can effectively prevent sports injuries, and cultivate good psychological quality of athletes. The improvement of various functions of the body can enable the athletes to judge, think and react to the limbs in a short time so as to achieve cooperation between physical and physical quality.

## 2. The State of the Art

Badminton is very popular with young students; it belongs to the network of aggressive sports. As a mass sports program, it has become more and more eye-catching in recent years in international competitions and has also attracted a large number of young people to carry out professional learning and training [4]. Badminton teaching training is divided into skills teaching, physical training, psychological training, and technical and tactical training. A lot of literature and practice show that traditional badminton classroom teaching is based on a large number of skills to learn, and the status of physical training in the badminton classroom is relatively neglected [5]. As a reserve force of badminton talents in our country, adolescent badminton players are at a golden stage of gradually improving their competitive abilities and rapidly developing their qualities. They should also conduct physical training in a scientific and rational manner and lay a solid foundation for young athletes' athletic ability at an early age so as to cultivate their talents for the country's more outstanding athletes.

Many Chinese athletes who win medals in major international competitions such as the Olympic Games, come from all kinds of sports schools [6]. All kinds of sports schools at various levels not only transport thousands of sports specialities to all colleges and universities every year but also train a large number of medium-sized sports professionals and tens of thousands of sports cadres for the society, and play a multi-factor of promoting the all-round progress of sports effect. Youth sports schools have become the cornerstone of China's sports and an important component of solid [7].

## 3. Methodology

### 3.1. Association Rules Mining Algorithm

The association rules algorithm is the core of data mining technology. The typical algorithm is the *Apriori* algorithm. It focuses on finding out some specific events that happened together in the database to find those credible and representative rules. The basic idea of this algorithm is to mine all frequent itemsets iteratively and then use the frequent itemsets to construct rules that satisfy the user's minimum confidence. The algorithm steps are described in Table 1.

<b>Input</b>	The entire database transaction D
<b>Output</b>	The rules that satisfy the user's minimum confidence
<b>Procedure</b>	
<b>1</b>	Scan the database, perform a technique on each item, and find candidate 1 itemsets.
<b>2</b>	According to the degree of support to find a rough and frequent set.
<b>3</b>	Starting from the 2 sets of cycles, the frequent k-1 sets generate frequency k sets.
<b>4</b>	The circle ends when the current production of frequent k items only has one set of items.

Table 1. *Apriori* algorithm

The *Apriori* algorithm has two key steps: linking and pruning. The so-called connection means that in order to find  $k$  frequent itemsets  $L_k$ , the  $(k-1)$  frequent itemsets  $L_{k-1}$  are connected to obtain  $k$  candidate sets  $C_k$ . The so-called pruning mainly utilizes an important property of *Apriori*, any one  $(k-1)$  term subset in the candidate set  $C_k$  is not in the frequent item set  $L_{k-1}$ , then this candidate set can not be frequent, so that the candidate  $k$ -item set can be deleted. Following an example to illustrate the *Apriori* algorithm implementation process, assuming a minimum support of 2, the minimum confidence of 70%, the original item set as shown in Table 2.

The database is scanned, and each item is counted to obtain a candidate set of items  $C_1$ ,  $I_1: 4, I_2: 3, I_3: 4, I_4: 1, I_5: 2$ . According to the minimum support, the number of items less than two is deleted, resulting in frequent 1 item sets  $L_1$ , as shown in Table 3.

Generate  $C_2$  from  $L_1$ .  $\{I_1, I_2\}: 2, \{I_1, I_3\}: 3, \{I_1, I_5\}: 1, \{I_2, I_3\}: 2, \{I_2, I_5\}: 2, \{I_3, I_5\}: 1$ . The number of items less than two is deleted to obtain frequent 2 items  $L_2$ , as shown in Table 4.

Mark	The original item sets
1	$I1, I3$
2	$I1, I3, I4$
3	$I1, I2, I3$
4	$I2, I5$
5	$I1, I2, I3, I5$

Table 2. The Original Item Sets

Itemsets	Support
$I1$	4
$I2$	3
$I3$	4
$I5$	2

Table 3. Frequent 1 Item Sets  $L1$

Itemsets	Support
$I1, I2$	2
$I1, I3$	3
$I2, I3$	2
$I2, I5$	2

Table 4. Frequent 2-Item Sets  $L2$

The  $C3$  generated by  $L2$  includes  $\{I1, I2, I3\}$ ,  $\{I1, I2, I5\}$ ,  $\{I2, I3, I5\}$ ,  $\{I1, I3, I5\}$ , since  $\{I2, I5\}$  not belong to  $L2$ , and therefore is not a frequent item set, so that  $C3$  has only  $\{I1, I2, I3\}$  and the degree of support is 2, so  $L3 \{I1, I2, I3\}$  is obtained.

### 3.2. The Features of Badminton Sports

Badminton sport is a kind of tactic dominated by separated net events. It has fine movements and flexible techniques and tactics. Unlike other projects, badminton has an offensive and defensive round, instant attack and defence transformation, namely initiative and passivity, attack and defence. (1) The time characteristics of badminton movement. Badminton is composed of short-time sports and a long interval. The movement time is mostly between 5 and 10s, and the interval is between 10 and 20s. But after the 2008 Olympic Games, it was found that the about ratio of the badminton sports time 10s and 15s increased significantly. (2) The characteristics of the energy supply of badminton. The energy metabolism of badminton sports is supplied by three energy supply systems, namely, the phosphoric acid system, lactic acid energy system and aerobic energy supply system. Each energy supply system occupies different proportions. With the increase in the proportion of more than 10s in the modern badminton movement, the glycolytic energy supply system has more and more influence on the result of badminton competition. (3) Physical fitness is the guarantee of winning. Physical energy guarantees the normal play of technology and tactics. Without physical energy as a guarantee, there is no point in talking about technical and tactical. Due to the limitation of the badminton field, the athletes should start more than 500 times in the 30m 2 site and move more than 3000m. According to the special characteristics of badminton, from the physical aspects, the relationship between strength, speed and endurance can be summarized as follows: power is the foundation, speed is the core, and endurance is guaranteed.

## 4. Result Analysis and Discussion

### 4.1. Object of Study

This paper's research object is young badminton players at sports school. Table 5 shows that male athletes account for 61.05% of the total number of young badminton athletes, while women account for 38.95%. Male adolescent athletes are significantly more than female athletes. As seen from Table 6, only 8 of the young badminton players are very important to the role of physical fitness in badminton competitions, accounting for 8.42% of the total number of people surveyed. 13.68% and 13 people are more important, and the average number of juvenile athletes is 52.63%. In the end, 25.27% of young athletes think physical fitness is not important. After sorting out and analyzing, we know that most young badminton players cannot correctly understand that physical fitness plays an important role in the current badminton game. The contempt for physical fitness will lead to these young athletes not consciously and actively carrying out physical training and then affecting the effect of physical training, resulting in physical fitness in high-intensity competitions and training. Even cause sports injuries and end your career ahead of time. This result shows that most young badminton athletes pay less attention to physical fitness; in the future, training coaches should give young badminton athletes a wide range of knowledge about physical fitness. Make athletes fully aware of the importance of physical fitness.

Gender	Male	Female
Number of people	58	37
Percentage %	61.05%	38.95%

Table 5. Sports School Junior Badminton Athletes Gender Table

Gender	Male	Female
Number of people	58	37
Percentage %	61.05%	38.95%

Table 6. The Importance of Physical Fitness in Badminton Competition

### 4.2. Physical Training Program Arrangements

It is a long, difficult and systematic process to train outstanding young badminton players. Coaches must develop a set of physical training programs suitable for young badminton players by enriching their system knowledge, experience, and physical condition. Under the joint participation of the research team, physical fitness coaches mainly focus on the physical fitness level of youth badminton players, the competition schedule of each stage and the correlation between the proportions of various training qualities. And young badminton coaches should also amend in time according to young badminton players' physical training feedback information.

Adjustment of physical fitness training plan according to different periods. The physical fitness training scheme for young badminton athletes is more suitable for selecting the type of single-cycle training scheme. A single-cycle training program type is more appropriate for young badminton player's physical training program. This is because a one-cycle physical training program with a longer preparation period will allow the coaches more time to concentrate on training the juvenile badminton players' physical fitness to lay a solid foundation for their growth. Young badminton athletes' physical training program can be divided into quality improvement, quality maintenance, and quality decline, as shown in Table 7.

Increase the training content of poor quality according to the result of the physical Fitness Evaluation. A physical Fitness training Plan can be amended according to the physical Fitness of Young Badminton athletes. Analyzing and sorting the evaluation data shows us that the overall quality of the youth badminton players in *Haidian* schools is at the upper and middle levels. Only the young athletes with outstanding achievements account for a small amount, while the middle ones have the most players and the middle-grade young athletes also occupy a small amount. Among them, lower extremity strength, endurance quality and sensitive coordination quality have obvious advantages; superior upper limb strength quality is better, but relatively lower results in 50m, 25 × 5m turn-back run of core strength evaluation and speed quality. Analyzing adoles

Physical Training period	Physical State	Stamina Training Plan
Preparation period	Improve	Improve specific physical fitness, promote competitive ability to develop and improve
Competition period	Maintain	Maintain adequate physical reserve to achieve the best competitive state, participating to create excellent results
Period of recovery	Decline	Actively restore physical fitness

Table 7. Physical Fitness Training Scheme for Young Badminton Athletes at Different Stages

cent physical fitness scores shows that their strengths and weaknesses are good and that those with inferior qualities should focus on strengthening training. In the future, physical training programs for young badminton players should increase training content for speed quality, and the core strength training should be correspondingly increased. Scientific and reasonable arrangement of physical fitness training plan, training methods and means, and adjustment of physical fitness training load to promote the balanced development of young badminton players.

#### 4.3. Methods and Means of Physical Training

Development of physical training methods and means according to different training periods. As shown in Table 8:

Physical training period	Fitness Training Methods	Physical training means
Preparation period	Continuous training method, intermittent training method	3000m run, 3min double rocking rope, 1min sit up Sit, 50m × 8, 1min push-ups, audience pace and so on
Competition period	Repeat training method, intermittent training	800m run, 1min fast double shake, 30s fast prone position Support, 20m × 4, 1min audience pace and so on
Period of recovery	Game method, transformation method, continuous training method	Fitness games, bicycles, swimming, 3000m jogging

Table 8. Application of Physical Training Methods and Means for Young Badminton Athletes in Different Periods

Development of physical training methods and means according to the results of physical fitness evaluation. According to the result of the physical fitness evaluation, the training of relative inferior quality should be increased at the same time as the training with stronger superior quality. The training methods and methods of different quality training types are shown in Table 9.

Regulation of physical training load. As shown in table 10, the physical training load of teenager badminton players is the most flexible adjustment factor in the whole process of physical training. All diathesis exercises of young athletes need to be carried out under rhythmic and corresponding load stimulation to achieve the desired results. The juvenile badminton players' physical training load arrangements should take full account of their ability to withstand the body's ability to adapt to the young badminton players by applying a scientific and reasonable training load to promote the young badminton players to improve the quality of each ability. In a strict accordance with the principle of gradual and orderly progress, when youth physical training load is arranged, young badminton athletes will gradually improve their physique through the process of "increase load-adapt-increase load-readjust" so that young badminton athletes Ability can be improved. As young badminton players are still in a period of rapid growth and development, young badminton players have relatively poor ability to adapt to the load. If excessive load physical training severely damages the sports organs and tissues of young badminton players. And even it brings the end earlier to them. For young badminton players in basic stage, it is recommended to train 2-4 times per week for 1-1.5 hours each time. For young badminton players in special stage of improvement, arrange 1-2 times a week for 1-2 hours is more suitable. Training load is a very important factor for young badminton players to transition from basic

Quality training type	Methods and means of practice
Upper body strength training	With the main tennis racket, A small dumbbell swing, push-up, pull-up, Proper weight supine push, Dumbbell wrist force exercise, etc. Lower limb strength is the key to all badminton steps.
Lower extremity strength training	1 Various jumping exercises: vertical jump, Step jump, leap etc. 2 Squat before and after barbell, Squat bow and arrow movement, etc.
Core strength quality training	sit-ups, Fitness ball push-ups, Prone both ends, etc.
Speed quality training	1 Use all kinds of sprint exercises Run in sand, 100m sprint Up and down hill, Step run, 25m×5 etc. 2 Practice with a variety of devices, Such as traction, running, etc.
Sensitive and coordinated quality training	Double swing rope skipping, 1min full pace practice, Multi-ball training, etc.
Resistance training	Multi-ball practice, 800m, Various gait exercises, 1500m, Cat Master Dog, 3000m Variable speed running, etc.
Flexibility training	Stretching exercises for each joint. There are some static stretching movements and some dynamic stretching movements, and after warm-up or high intensity training, the wrist, foot and ankle joints, knee joint, waist abdomen joint and hip joint are stretched.

Table 9. Practice Methods and Means of Different Quality Training Types

stage to special stage of improvement. Among the factors of physical training load, the two core factors are the physical training load and the physical training load strength. Due to the growth and development of young badminton players, the intensity of physical training is relatively small, and the change of load is relatively small. In order to make young badminton athletes adapt to high intensity training and fierce badminton competition, we should increase the load intensity step by step in physical training, and increase the range of load change accordingly. In the physical training load of young badminton athletes, it is mainly in the middle quantity, the middle strength is mainly adjusted to a large number and large intensity. Through physical training, realize as soon as possible the transformation from improving special physical ability to fully improving competitive ability.

Physical training period	Physical training load
Preparation period	The intensity is relatively small, the load is large
Competition period	The amount of load is small, strong
Recovery period	Reduce the load intensity, vary from load to maintain the appropriate

Table 10. Regulation of Physical Training Load of Young Badminton Athletes in Different Periods

## 5. Conclusion

At present, there are few special researches in our country for the badminton physical training, and neither the trainers nor the athletes can correctly understand the special physical characteristics of badminton during the training process. This causes the badminton sports in our country to show some disadvantages, such as lagging behind the training idea, outmoded training methods, unreasonable physical training arrangement, and so on. All of these have greatly hindered the improvement of the level of badminton in our country. The measures and methods of strengthening physical ability in badminton training

are studied and analyzed in this paper based on association rules algorithm under the premise of maintaining a stronger state of superior quality. In order to promote the balanced development of young badminton players' competitive ability, we should focus on strengthening training for inferior quality items. Professional badminton physical coaches need to develop long-term scientific and rational physical training programs, and the daily physical training strictly enforced, and make an amendment according to young badminton player feedback on the training program. Coaches should accurately grasp the specific circumstances of each athlete, training load intensity and training to adjust the amount of time, and differentiated and stratified training to maximize the development of each athlete's potential.

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