Utility Analysis of the Effect of Continuous Training on Basketball Players' Physical Improvement

Dong Lifeng

1. PE School, Mianyang Normal University, Mianyang, 621000, China, jykx2006@163.com

Abstract

Basketball is a fast paced and high strength’s exercise, and its requirements for basketball players’ constitution are relatively high. An basketball athletes equipped with explosive force often help the team to achieve victory in the contest. Basketball game’s physical fitness and explosive force are closely related to the usual training, and basketball players’ constitution is mainly depended on physical strength. Strength accumulation is depended on continuous training. This paper firstly analyzes the relationship between physical fitness and basketball players’ training. Then it analyzes the leaping ability, the explosive force and endurance. Finally it investigates the NBA athletes' physical quality. The paper makes statistical analysis of survey data by using the linear regression, and it summarizes the improvements on continued training to athletes' constitution. It designs optimally the training mode by using genetic algorithm and puts forward countermeasures of athletes sustained training methods. The paper provides training reference for athlete physique enhancement and intense antagonism’s outbreak in basketball game.

Keywords: Continuous Training; Basketball Player, Physical Improvement, Power Factor, Linear Regression, Genetic Algorithm

1. Introduction

Basketball game is a intense antagonism’s sports. In the game, players have to consume a large amount of physical strength. The basketball game is different from other sports. It requires the athlete to have good bounce, incredible power, the action sensitivity, and the ability of transient response[1,2]. The basketball game’s requirements are high on the athletes' comprehensive constitution. Basketball athletes physical quality can not be trained well in a short time. Explosive power and jumping are influenced by flexible muscles ability. Continued training has great effects on muscle and body constitution[3-5]. This paper researches on continuous training to body physique improvement from three aspects. First, the paper analyzes body physique data from the NBA players, and it summarizes various factors’ the effect by using multivariate regression. The paper uses the genetic algorithm to optimize the various training methods. Ultimately, it determine the methods and countermeasures of continuous training. It provides a theoretical basis for basketball players’ physique enhancement.

At present, the fitness is put forward as one of the main goals in the international society. Along with the increasing reform of our country’s quality education, the concept of fitness is gradually integrated into the health education field in our country[6]. The events organization of the United States sports health and dance in the beginning is to help the children understand the value and significance of the sports activities, and it also can cultivate the good behavior habits. Then the continuous development makes this idea finally form the concept of fitness. The idea is slowly spread to all over the world, and it causes great repercussions in Japan, Britain, Australia, Hong Kong and other regions. This idea has good performance of guiding the children to take an active part in sports activities, forming the good life habit, improving the physical health. Then the idea is spread to the university sports, and it can reflect the new trend of sports development. The new tendency includes the lifelong sports, personalization and health[7].

Now in our country, many universities have carried out the fitness sports teaching activities. Physical fitness can be put forward to have a revolutionary influence on sports teaching of our country, but fitness sports teaching mode of many universities is in the groping stage. At the same time some teachers often do not have sufficient understanding of the fitness, and they think that it is mainly related to the physical exercise[8]. So they make the student try hard to have physical exercise, and they do not pay attention to the improvement of the overall physical fitness, finally this leads to the
poor teaching effect. So the development of the researches on the fitness training of the teaching mode in our country is very necessary.

2. Relationship between training and the body quality

Basketball athletes' constitution reinforcement is related to the usual training. Basketball players' physical fitness mainly includes the jumping ability, the explosive force and endurance. The jumping ability and endurance are concerned to muscle physiology, and it is a result of long-term continuous training. Long-term continuous training can make the muscle strength, and muscle explosive force is related to sensitivity and speed of muscle[9].

(1) Jumping ability

Basketball athletes' jumping is the most important body physical ability, and jumping ability directly affects the players' performance in the game. Jumping ability is mainly concerned to foot muscle tendon. These need to long-term continuous training, such as rope skipping, leapfrog, and these movements have good effect on the foot muscle's exercise. Long-term continuous training can train good body bounce constitution.

(2) Explosive force

The explosive force is concerned to muscle flexibility, joint sensitivity and tendon flexibility. This requires a substantial amount of training, and it need to strengthen the muscles of the thigh and the joint training. High leg exercise can strengthen the developed degree of thigh muscles. With the help of instruments, each moving organ continued swing will enhance muscle flexibility.

(3) Physical endurance

The basketball game's strength is relatively large, so it requires the athlete to have good physical endurance. Physical endurance has the very big relations with muscular endurance, and it is also relates to the produced lactic acid of movement. If the muscle can rapidly deplete the lactic acid of body, muscle has great patience. If muscles can't deplete rapidly the lactic acid of anaerobic exercise, the muscles will feel discomfort. During the game, players will feel fatigue and exits the game.

The content of basketball fitness training mainly has the following several aspects. The first aspect is to enhance the human body's cardio-pulmonary function, muscle strength, endurance, suppleness and fat content and other indexes. It is to improve health fitness of human body, and in other words it is to change the human body form and improve the body environment's adaptive capacity of basketball sports[10-12]. The second aspect is human body's sensitivity, coordinate ability, balanced capacity, speed of movement, reaction speed, explosive force and other key elements of fitness, and they are called as adaptability of physical quality. The third aspect is the special fitness, and it is mainly expressed in the basketball skills and the improvement of actual combat.

Through the appropriate training content and skills, certain load movement, regular schedule, appropriate frequency exercise, human internal environment and body form can gradually have adaptive changes. The improvement of the level of basketball and the actual combat skills' system training is the basketball fitness training. It is radically different from the athletic training that has been used in China.

3. Linear regression theory

First we introduce linear regression formula[13]:

\[ S_i = \hat{S}_i + P_i = p_0 + p_1 x_1 + \ldots + p_{nxin} + P_i \]  \hspace{1cm} (1)

\( \hat{S}_i \) is estimated value, and it changes with X. Ai is a residual error, and it is the difference between \( S_i \) and \( \hat{S}_i \). Take \( (S_i - \hat{S}_i)^2 \) to accumulate \( \sum (S_i - \hat{S}_i)^2 \), and it makes formula (2) to reach the minimum value[14]:

\[ C = \sum_{j=1}^{n} (B_i - \hat{B}_i)^2 \]  \hspace{1cm} (2)
Through the investigation of NBA basketball players' continue training, it shows that there are a lot of factors effecting basketball players' physical fitness. It need to find an main factor from these factors, and it is necessary to survey data by using linear regression analysis. Then it finds out the largest influenced factors. Through training effect investigation, 100 main players were sampled. It surveys data by using linear regression analysis. Finally it is getted that the bounce force is the most major effect factors in basketball players' physical fitness. Through the linearization of the data, it is concluded that the most main factor is bouncing. Before and after the training are shown as the table following.

<table>
<thead>
<tr>
<th>Ball-game star</th>
<th>Vertical jump before the training cm</th>
<th>High touch before the training cm</th>
<th>Vertical jump after the training cm</th>
<th>High touch after the training cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carter</td>
<td>110</td>
<td>380</td>
<td>112</td>
<td>381</td>
</tr>
<tr>
<td>Jordan</td>
<td>110</td>
<td>378</td>
<td>112</td>
<td>380</td>
</tr>
<tr>
<td>Kobe</td>
<td>104</td>
<td>372</td>
<td>107</td>
<td>375</td>
</tr>
<tr>
<td>Iverson</td>
<td>110</td>
<td>360</td>
<td>113</td>
<td>366</td>
</tr>
<tr>
<td>Davies</td>
<td>100</td>
<td>360</td>
<td>107</td>
<td>368</td>
</tr>
</tbody>
</table>

Figure 1. Comparison chart on the vertical jump and high jump before and after the training
Table 1 and Figure 1 show that through contrast diagram of training before and after, NBA players’ bouncing are very good, so they play main role in team. This is not only related to height, what's more, it is usually related to continued training. Iverson and Davies are not high, but their bouncing and touch are very high, and the bounce after training has increased. This is closely related to their peacetime training. In addition to regular training, every summer, NBA star carry out training. Training period has no holidays and the competition schedule arrangement. Basketball players can continue training on each project.

The human body system has the stability and adaptability. The stability refers to that when the outside temperature and humidity occur changes, people’s internal temperature, body fluids and other interior environments are changing in a certain range without big changes. When the human body has external stimulation for a long time, the human body form and the internal environment will be gradually changing in order to adapt to the requirements of the external stimulation. When the human body has continuous life activities, the reason of human body’s existence is the human body function’s adaptability and stability of internal and external environment. People’s adaptive capacity can be divided into short-term adaptation and long-term adaptation. When the external environment of the human body occurs changes, the human body has changes in order to adapt to the short time needs of the environment, and when the body leaves the environment and goes back to the original environment, then the human body’s function recovers the original state, this situation is called the temporarily adapt. When the human body has periodic stimulation for a long time, it can make human body form and function have substantial changes, and when there is no stimulation, the changes are not going to disappear after a long time, this change can be called the long-term adaptation.

So we can see that basketball fitness training is to achieve the purpose of making human body adapt to the basketball. It is through the long-term, regular training that has certain load, when students' basketball capabilities have improvement, it can be found that students’ cyclic system, muscle strength, breathing rate, neural response and a series of biological characteristics are getting better and better.

4. Genetic algorithm’s optimization of continuous training

Genetic algorithm can optimize the data in the strategy direction. It is different with random process, genetic algorithm can be selected to find the best solution. Binary encoding formula of genetic algorithm is as follows:

$$Z = \min + \sum_{k=1}^{i} a_k 2^{k-1} \frac{\max - \min}{2^n - 1}$$

(3)

Genetic algorithm of basketball continued training is as follows. Assuming training programme function $P(a, b)$, the training effect function $Q(a, b)$, in order to make the $Q(a, b)$ maximized, it will enable the $P$ approach infinitely to effect function of $Q$. So it need to seek out $P(a, b)$, $Q(a, b)$ and makes function:

$$Y(a,b) = \iint (P - Q) dadb$$

(4)

When the function $Y$ is close to the infinitesimal, training function $P$ will approach infinitely to the training function $Q$. It is discreted on the function:

$$Y(a,b) = \sum_{b=1}^{n} \sum_{a=1}^{v} (P - Q)^2$$

(5)

Flow diagram of genetic algorithm optimization's process is as figure 2 shown.
Through optimization of the genetic algorithm, eventually you can achieve the best training function. Then training scheme can be carried out. Different muscle training need to be trained in different ways for muscle's training scheme. Table 2 is muscle volume training programme.

**Table 2. The volume of muscles training**

<table>
<thead>
<tr>
<th>Way</th>
<th>Muscle contraction</th>
<th>Muscle relaxation</th>
<th>Muscle spreading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training intensity</td>
<td>60-70%</td>
<td>100-120%</td>
<td>70-80%</td>
</tr>
<tr>
<td>Training intermittent</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Training group's time</td>
<td>7-10</td>
<td>5-8</td>
<td>3-9</td>
</tr>
<tr>
<td>Training group's number</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2 is optimization training schedule of development of muscle volume through genetic algorithm's optimization. Such a large amount of continuous training can increase muscle physiological cross-sectional. It can improve muscle excitability, increase muscle mass and further increase the force of muscle.

**Table 3. Muscle endurance training**

<table>
<thead>
<tr>
<th>Way</th>
<th>Fast training</th>
<th>Cycle training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training intensity</td>
<td>50-60%</td>
<td>40-50%</td>
</tr>
<tr>
<td>Training intermittent</td>
<td>70-80</td>
<td>70-80</td>
</tr>
<tr>
<td>Training group's number</td>
<td>3-4</td>
<td>4-5</td>
</tr>
<tr>
<td>Repeat count</td>
<td>10-25</td>
<td>More than 25 times</td>
</tr>
</tbody>
</table>

Table 3 is training program of muscular endurance's development through genetic algorithm's optimization. Strength endurance is the comprehensive qualities of the strength and endurance, and it is exercise ability in static and dynamic work. It maintains muscle tension and doesn't reduce the working effect for a long time. Basketball athletes need to have good strength and endurance.

According to the time sequence data, and through computer technology, to observe the kinematic changes of the lower body muscle electromyography (EMG) when volleyball players carry out intense
training, to form of the motion model. Then through this exercise mode to the establishment of the
lower body muscles and muscle movement [20]. Although the formation of the amplitude activation
and jumping position are different during the intense muscle movement, the batting bending angle peak
will be up to approximately 10 DEG, causing rapid stretching and contraction of muscles. When
training, the body muscle position will increase lower body muscle exercise effect due to the strength
of bending. After body jump bending, volleyball player on the impact of the ball will reduce, and while
the lower body position generates the radial deviation on the effects of muscle that will be increased,
there are interaction with the formation of tendon. When volleyball players begin tension training, their
lower body muscle thrombosis of the ulnar deviation angle position can increase relatively. After the
batting, the lower body muscle tendon angle position will suddenly deceleration to reach 24°high peak;
when the landing, the muscles are strong impact to occur transient change direction, to cause tendon
deviation increases about 15°value as shown in Figure 3 and Figure 4.

Figure 3. Analysis of the lower body muscles’ kinematics and electromyography (EMG)

Figure 4. Tendon movement bending angle diagram and electromyography (EMG)

According to the forecast model on volleyball players intense training, the lower body muscle
electromyography indicates that the myoelectricity effects will turn out peak strength when 129ms,
however the muscle effects of volleyball players occur the peak stress after 35ms. This shows that
muscle changes can be used to predict body tendon stimulation (EMG) influence degree in the more
intense training. At the same time, it also explains the dynamics can be used to determine the lower
body muscle force and EMG changes as shown in Figure 5.

Figure 5. Lower body tendon irritation (EMG) effects of the change peak chart
when intense training
5. Basketball players' continue training's countermeasures

From Table 1, we can see that long continuous training has great influence on basketball athlete physical aspects, especially bounce. Through genetic algorithm's optimization on a training mode, muscle training table of persistent training can be concluded finally.

(1) Strengthen the bounce force and endurance's training
Jumping ability and endurance can not be trained well in a short time, and this needs to strengthen the daily training. Through a large number of daily continuous training, we can exercise the muscle tendon and muscle endurance by the rope skipping, leapfrog. Basketball game's endurance can be trained by two people's fight or maintaining a endurance training. Pay attention to training mode's optimization, it gives the optimization's daily training according to table 2 and table 3.

(2) Strengthen the training of explosive force
The explosive force is related to moving speed of body, body coordination, muscular strength and flexibility, which usually need to strengthen training on muscle and joint flexibility. Specifically it enhances the body's transfer speed by touching line rapidly, and it builds muscle and joint flexibility through the use of equipment. Training intensity and training times should be strictly in accordance with the optimized training approach and achieves the desired effect of training.

(3) Regularly organize training
For the basketball athletes' physical training, we can imitate the NBA training and have regular training for athletes. Special training can be performed during the process, and it mainly trains basketball players' physical deficiencies. It has continuous training for a particular item. According to optimization of training programs, it strengthens the endurance, the explosive force, the jumping ability and other comprehensive physical fitness.

The basketball sport is an important part of China’s university physical education curriculum, and it plays an important role in guiding students to healthily spread sports culture. This paper used the concept of fitness training in the basketball sports, and it had the experimental researches on the fitness training of basketball sports, at the same time it was through the methods of contrast test, mathematical statistics, mathematical modeling to have analysis on the results of fitness training. The results show that fitness training in the university basketball can get better training effect. Therefore the concept of fitness training can be applied in the reform of sports education in our country, and it can establish the new teaching mode. It is also known that the aspects of age and weight have significant impact on the performance of basketball sports’ fitness training.

6. Conclusion

This paper analyzes the direct relationship between basketball athletes' constitution and continuous training, and it investigates the NBA athletes' physical quality on jumping ability. The paper makes statistical analysis of data by using theory of multiple linear regression, and it obtaines the main factors that influences NBA basketball players' comprehensive constitution. It designs athletes' training mode by using the genetic algorithm, and it puts forward methods of athletes' sustained training. The paper provides suggestions and reference for the basketball athletes' physique enhancement. Basketball athletes' physique is very important for victory, and its enhancement can improve the team's comprehensive strength. While the constitution's enhancement has the big relationship with acquired training, particularly persistent training. Therefore, continued training research should be intensified for enhancing the basketball physical fitness in the future, and better training program should be determined through the research, finally it accelerates the development of basketball in china.

7. References


[2] Songzhenzhen, "Development countermeasures on university's high level sports team from the comparison of CUBA and NCAA", Journal of Shanghai Institute of Physical Education,