

Research on Control Method of Athletes' Physical Fitness Training Based on Clustering Algorithms

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Objectives: Modern sports training attaches more and more importance to the combination of its own characteristics and the use of multi-disciplinary knowledge and methods to improve the athletes' abilities most needed in the competition. Scientific physical training is an important training section to improve the body's sports quality, and is an indispensable part of following athletes' career. **Methods:** Athletes with outstanding physical fitness can maintain a good state of competition and self-confidence, good physical fitness can also make up for technical deficiencies. Training methods and means are highly targeted. Athletes' nutrition and recovery are regarded as an important part of physical training. **Results:** In the usual technical and tactical training, the coaches should pay attention to the normative nature of the basic technical movements of the athletes. Based on the clustering algorithm, this paper analyzes the concept of football physical training. Establish a comprehensive assessment system for athlete training. **Conclusion:** Combined with physical training practice, the coaches athletes will be given a theoretical lecture on physical training, which will enable the coaches to have a more profound subjective understanding of physical training.

Key words: physical training; football; technical action; clustering algorithms

Tob Regul Sci.[™] 2021;7(5-1): 2863-2873

DOI: doi.org/10.18001/TRS.7.5.154

From the point of view of training, physical training is an important part of sports training. Any sport needs physical support, and physical training is indispensable to any training¹. Modern sports training attaches more and more importance to the combination of its own characteristics and the use of multi-disciplinary knowledge and methods to improve the abilities most needed by athletes in competitions². The main manifestations of physical fitness and skills are divided into two sub-categories: speed, strength and endurance³. Without efficient physical training, it is difficult to guarantee the improvement of sports competitiveness. An important feature of modern competitive sports is that athletes are required to constantly master the most advanced techniques and tactics⁴. Physical training is an important metho

d and means to improve athletic ability, improve athletic performance, and avoid sports injuries. Scientific physical training is an important training section to improve the physical fitness of the body and is an indispensable part of the athlete's career⁵. Physical fitness as an important part of athletes' athletic ability, its development level largely determines the athlete's competitive performance. The traditional football training method is based on improving the skill level of athletes⁶. However, with the increasingly fierce competition in the level of contemporary international competition, the performance of sports does not depend entirely on the skill level of athletes.

Physical fitness training has promoted the progress of China's competitive sports, and has been accepted by various national sports programs and achieved good results⁷. As the level of exercise continues to increase, the number of sports

injuries increases significantly during the competition or training of athletes. Athletes have outstanding physical strength in order to maintain a good state of play and self-confidence, and good physical fitness can also make up for technical deficiencies⁸. Physical training in skills training sports is limited to endurance training. The high intensity of modern competitive sports has increased physical and mental fatigue and even injuries⁹. If there is good physical fitness, athletes can effectively reduce sports injuries and prolong their sports career. The pursuit of athletes' body shape, function and physical quality in modern football has almost reached the extreme¹⁰. The arrangement and content of physical training in flying football can not be satisfied with the deepening of professional and technical training. To improve the level of endurance quality, it is necessary to arrange long-distance running training and test¹¹. We do not pay enough attention to the training and improvement of strength, speed, flexibility and other sports qualities. With the development of modern sports, physical training is playing an increasingly prominent role in competitive sports training¹². Attaching importance to physical training will be the most economical and effective way to improve the level of sports.

In training, if some aspects of the load exceeds the physiological limit of human beings, there will be various sports injuries. Physical fitness is the power source of sports, the foundation of sports, and also needs a good physical reserves as a guarantee¹³. The design of training program pays great attention to individual and special characteristics. Physical fitness diagnosis and load monitoring run through the whole process of physical fitness training. This will inevitably affect the effectiveness of physical training to varying degrees, and affect the improvement of competitive ability and sports performance¹⁴. Football events are characterized by skill-oriented and highly demanding accuracy, so athletes are required to have good stability and accuracy¹⁵. The training methods and methods are highly targeted, and the nutrition and recovery of athletes are regarded as an important part of physical training. It is even harder to consider the training and improvement of body shape structure

and functional ability, and there are fewer plans and indicators to arrange and implement¹⁶. With the increasingly fierce competition in the level of contemporary international competition, sports performance does not depend entirely on the skill level of athletes. Based on the clustering algorithm, this paper attempts to analyze the concept, components and content of football physical training. Combined with the characteristics of the football project, a high-level athlete's physical function file and comprehensive evaluation system are established.

In this article, we propose a research method based on clustering algorithm, which is aimed at the research of athletes' physical training control methods.

In summary, our contributions are as follow:

1. Cluster analysis is based on similarity, with more similarities between patterns in one cluster than patterns that are not in the same cluster.

2. Based on the clustering algorithm, this paper proposes a new model for the study of athletes' physical training control methods.

3. This technology has achieved a good visualization effect in the study of athletes' physical training control methods, and established a high level athletes' physical function file and comprehensive evaluation system.

Chtara M stated that physical fitness is a comprehensive physical exercise ability that improves the professional and tactical levels required by athletes¹⁷. Akenhead R proposes that a competitive athlete must have both athletic skills and his own excellent basic motor function, which is indispensable¹⁸. Professor Mueller A S believes that physical fitness is a comprehensive manifestation of subjectivity and objectivity, and in objective reality is the most basic norm for evaluating physical strength¹⁹. The core of Jouke R C et al. suggests that the core is a whole formed by the waist, pelvis, and ankle joints²⁰. The muscles contained include the back, the abdomen, and all muscle groups that make up the pelvis. Curran T et al believe that the contraction of muscles in the core of athletes can create a fulcrum for upper and lower limb movements. And coordinate the force of the upper and lower limbs to optimize the generation, transmission and control of power²¹. Heim D's personal

viewpoint in the article holds that physical fitness is the related function acquired by human body through physical training and the embodiment of physical function in activities²². It includes the adaptability of the body as well as speed, sensitivity and flexibility, endurance and strength in quality. Glazier P. S. believes that the body has the ability to adapt to human daily life. That is, to participate in work, study and other activities should have and will consume a variety of physical fitness. This kind of physical fitness can be generally divided into healthy physical fitness and exercise physical fitness²³.

METHODS

Today, the level of competitive sports is getting higher and higher, and competition is getting more and more intense. Football players must not only have a strong level of skill, but also have ample physical fitness. The characteristics of football are the rhythmic bounce control technology based on the control technique of body posture. Good psychological quality is extremely important for football players. Balance ability can determine the stability of the body in the activity, mainly depends on the shift of the

body's center of gravity. Modern sports training is increasingly emphasizing the law of the project, focusing on the use of multidisciplinary knowledge and methods to improve the various abilities that athletes need most in the game. The training content of aerobics physical training is mainly to solve the problem of what to practice²⁴. In modern aerobics, the content system of physical training is an important guarantee to achieve the goal of physical training. Physical fitness training is an organic whole. The formulation and implementation of training plan must have a scientific basis, that is, the physiological basis of athletes and the requirements of football. The goal of physical training is clear, and the training effect will be remarkable.

In sports training, besides the requirement for athletes to learn the skills of competition, the more important thing is to strengthen the ability of athletes to withstand the heavy training load. Professional men's football players in domestic professional football leagues are selected as the research object. The basic information of athletes is shown in Table 1.

Table 1
Basic Information of Athletes

Number of cases	Age	Weight (kg)	Height (cm)	Training years
20	24.5±2.9	74.2±4.8	179.3±3.5	6.5±0.8

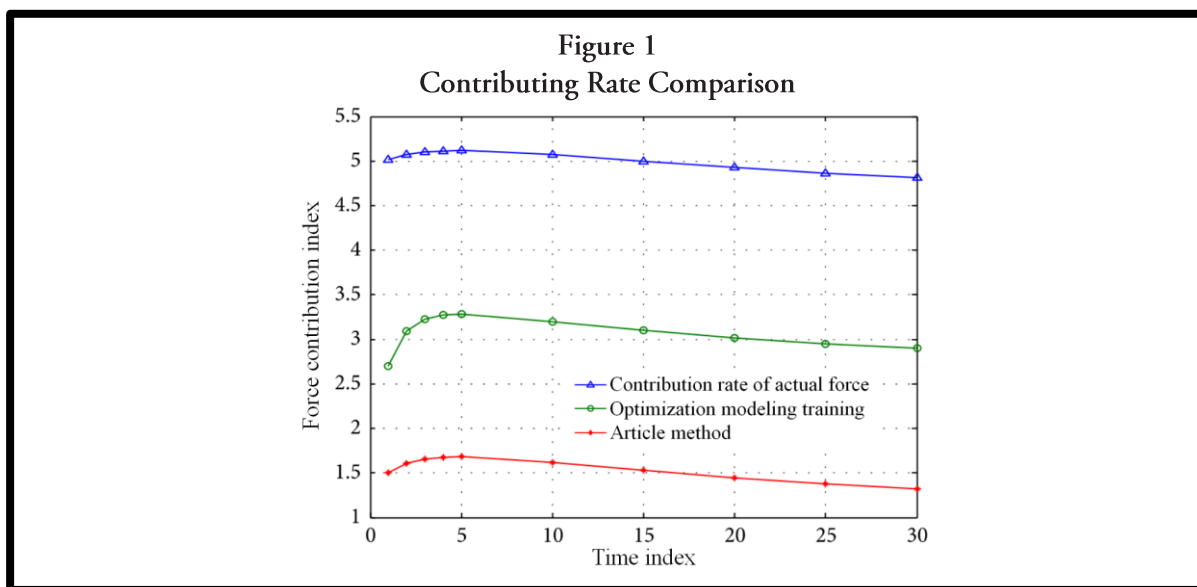
In today's increasingly high level of competitive sports and fierce competition, it is particularly important to use physiological and biochemical indicators to detect and evaluate the physical function of athletes. According to the characteristics of football events, the main factors that have an important impact on the performance level of athletes, which are interrelated and mutually restrictive, form a whole. Before every physical training, athletes will be tested for their basic abilities. And in the future training process, the use of multiple dynamic monitoring, in order to fully grasp the development of athletes' different qualities and abilities. It mainly uses physiological and biochemical methods and corresponding

indicators to diagnose athletes' ability to bear the load of sports training, physical function status, scientific and effective training. Competitive expression ability refers to the individual athletic ability and complete set of action ability that has been obtained in football sports. Interference is an important factor affecting the display of competitive ability in the game. In the whole process of training, coaches and athletes pay attention to the basic problem of nutrition. There are many recovery methods after training to meet the energy needs of athletes during training and competition. It helps to improve the body's immunity and keep athletes in a good competitive state.

Since the development of football, the physical

factors of athletes have become more and more important. From the coaches of various teams to the athletes, physical training is placed in the first place. Athletes must maintain a specific range of motion or quality of action throughout the competition. Technical movements that violate the principles of biomechanics may increase the

damage of muscles, ligaments and soft tissues. The test of the sports strength of the lower extremity knee extension and knee flexion of the football player can be used as one of the indicators for the special strength evaluation. The muscle contribution rate of different methods is compared as shown in Figure 1.



Sports injuries are generally closely related to sports events and technical and tactical movement characteristics, and are often related to sports training levels and conditions. When the

body is injured, it will change the body's shape, function and metabolism. Investigate the sports injuries of 50 football players, as shown in Table 2. The injury rate is 100%. It can be seen that the sports injury of football players is very serious.

Table 2
Sports Injuries of 50 Football Players

	Number of injured	Number of uninjured	Total
Number	46	4	50
Proportion (%)	92	8	100

In football, athletes have more physical contact with each other, strong confrontation and fierce competition in the air, which makes athletes vulnerable to various sports injuries during training and competition. A modeling method based on clustering algorithm for athletes'

biomechanical influence under football training is proposed. Table 3 shows the power and fatigue index during the repetitive anaerobic sprint run. Table 4 shows the relevant physiological indicators during the repetitive anaerobic sprint run.

Table 3
Power and Fatigue Index During Repeated Anaerobic Sprints

Peak power (W)	Average power (W)	Minimum power (W)	Fatigue index
798.2	621.5	519.8	409.5

Table 4
Relevant Physiological Indicators During the Process of Repetitive Anaerobic Sprint

Blood lactate (mmol/L)	Heart rate (b/min)	RPE
11.2	171.5	14.8

In the process of optimizing the joint damage of football players, the soccer player overtrains the joint damage vector set. It is assumed that P represents a variance vector of the football player overtraining the joint damage vector set. Then you can get the following formula:

$$C_n^P = \frac{\sum N_s^P n_c^P}{N_s^P} \quad (1)$$

When the muscle starts to move, the first increase is the discharge frequency of the motor unit potential, which is manifested by the high shift of the spectrum. In the process of optimizing the joint damage of football players, the following formula can be drawn:

$$F_{ij}^t = \frac{1}{N_c} \sum_{c \in N_c} \frac{f^t t_i n_j}{1 + a_{kl}^c n_k n_l} \quad (2)$$

In the process of optimizing the joint damage of the football player overtraining, V represents the orthogonal transformation matrix of the football player overtraining the joint damage. And use the following formula to define the transform code gain of V:

$$\sigma_{ij} = \frac{1}{V} \sum_{c \in N_c} f_i^c d_j^c \quad (3)$$

If athletes have strong physical support, they can rely more effectively on the strength of the lumbar hip muscles during rapid start-up. Some actions are direct force, such as jumping the head and the steering after an emergency stop. Some actions

are indirect force, such as the control of shooting and passing. In the practice of football, the various organ systems and sports parts of the athletes work together in a certain time and space. Reasonable and effective ability to complete all kinds of ball and ball-free technical movements and tactical activities²⁵. It is necessary to strengthen the practice of standardized shooting action so as to achieve the finalization of the strength of the action. With the gradual increase of strength, the number of recruited motor units is further increased, which shows that the EMG spectrum continues to move higher. If the sports team can pay full attention to the usual physical training, to ensure that each player has a higher level of physical training. The tactics of the whole team will undoubtedly be better implemented, and the possibility of winning is mentioned.

RESULTS

Football is a competing sport. It has the characteristics of large amount of exercise, fast rhythm, frequent physical contact and strong confrontation. Common rehabilitation exercises are about strengthening muscles. Generally there are isometric and isotonic motions. The so-called isometric exercise is to tighten the muscles but not to move or tighten the joints. Modern football is characterized by high speed, strong confrontation, fast rhythm and rapid changes on the field. This increases the load on the joints and increases the number of injuries on the playground. To study

the influence of physical fitness training on football training skills and physical fitness of middle school students. If the sports team can pay full attention to the usual physical training, to ensure that each player has a higher level of physical training. Training should be in line with the game, which means that the purpose of training is to meet the needs of the game. Developing endurance quality and improving anti-fatigue ability The physical training level of football players is the basis for completing the technical actions of various football sports.

In the recovery of skeletal muscle injury in football, the constant velocity motion technique is also one of the new sports rehabilitation methods that have emerged in recent years. In tissue repair, cell proliferation relies on the regulation of growth factors to increase or inhibit the proliferation and proliferation of certain cells,

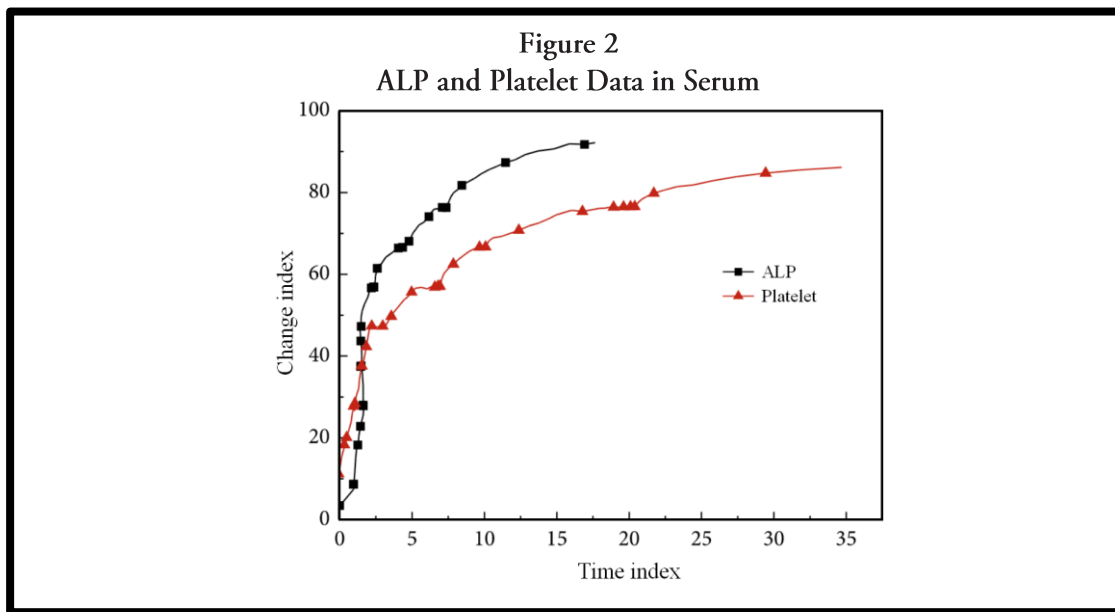
and achieve the purpose of repair. The use of different styles gives the characteristics of muscle changes in the training state:

$$R = \frac{E_p I_p}{E_s r i^3} \tag{4}$$

Calculate the average value of muscle work and muscle torque at different training stages:

$$w_j = \frac{I_j}{K_i^j \sum_{i=1}^N (I_j / K_i^j)} \tag{5}$$

After the training of the treadmill and the electromagnetic field of joint damage, two conventional indicators were tested to reflect the metabolic changes during the joint damage repair process. As shown in Figure 2, there was no significant change in the values of total ALP and platelets in the serum.



Through the investigation of the time of sports injury to the male players. The injury of athletes is mainly caused by sports training, and the incidence rate during training is 78%. The incidence of injury during the game was 16%.

Injury caused by other reasons accounted for 6%. Therefore, the prevention and treatment of sports injuries is mainly during exercise training, as shown in Table 5.

Table 5
Football Athletes' Sports Injury Type Data

Number	Injury stage	Number of injured
50	Train	39
50	Match	8
50	Amateur	3

Due to the fierce competition in today's football, in order to achieve good results, high-quality training is required for football players, mainly in terms of long training time and high intensity. Incorporating the statistical analysis theory to extract the relationship between football players' overtraining and sports injury factors, it can be expressed by the following formula:

$$\Delta M = \left[\frac{\sum n_i (\Delta M_i)^m}{\sum n_i} \right]^{1/m} \quad (6)$$

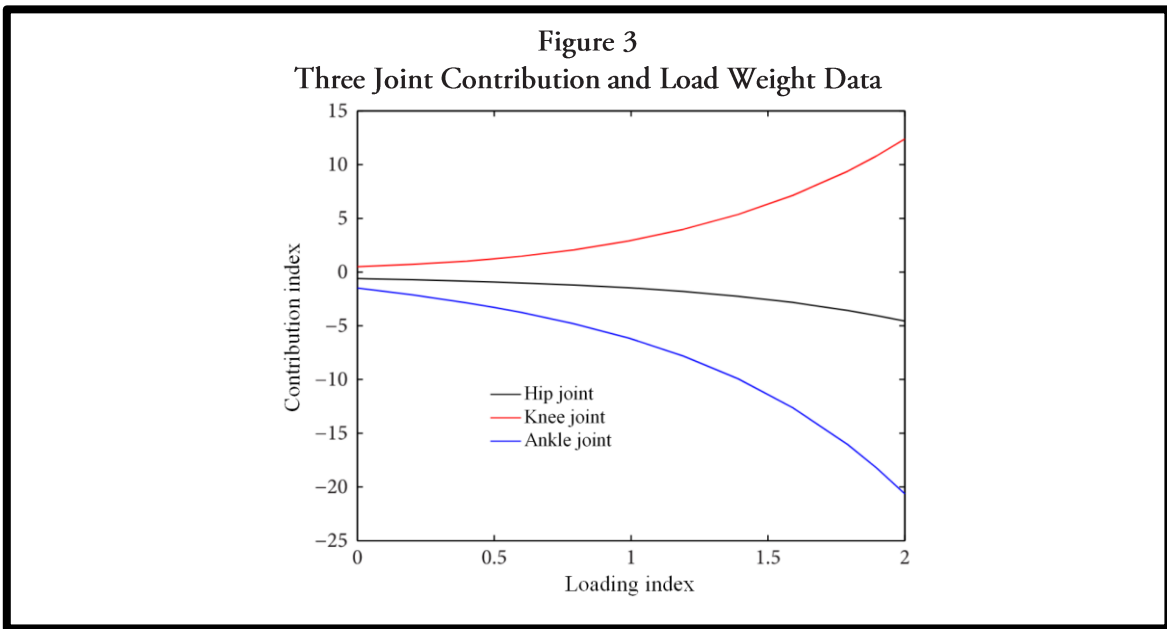
$$\tau_b = \frac{\rho g n^2 Q^2}{A^2 R^{1/3}} \quad (7)$$

The second moment of football player's

overtraining sports injury is expressed by the following formula:

$$\sigma_v = \frac{\gamma D}{2fk} \left[e^{2fkH/D} - 1 \right] \quad (8)$$

The contribution of each joint work to the work of the lower limbs increases with the added weight. The contribution of the hip joint is gradually increased, and the contribution of the knee joint is gradually reduced. There was no significant difference in ankle joint contribution under various load-bearing conditions. There is no linear relationship between the contribution of the three joints and the load, and the contribution does not increase or decrease linearly with the increase of the load. As shown in Figure 3.



The modern football player's body shape is developing in a diversified direction, and athletes of different body shapes can find their own position on the football field. By comparison, the calculation

values of the diaphragm, triceps and elbow muscles are within the range of anatomical results, while the value of the biceps muscle is significantly larger than the anatomical results. The results of the calculation of the physiological

lateral area are shown in Table 6.

Muscle name	Calculated
Long head of biceps brachii	4.65
Short head of biceps brachii muscle	5.22
Long head of triceps brachii	4.59
Lateral triceps brachii muscle	3.74
Medial triceps brachii muscle	4.61

A series of physiological and biochemical changes in the human body during exercise are the objective reflection of the body's exercise load, that is, the body's stress ability to exercise training. The complete set of endurance in physical training mainly refers to the physical reserve to complete the complete set of endurance. In the usual technical and tactical training, coaches should emphasize the standardization of the basic technical movements of football players and the rationality of the actions in the implementation of tactics, and standardize the basic football techniques in the training. Through the design of movement mode, the athletes' competitive ability can be improved by erecting a bridge between physical fitness and technology. Accurate and skilled technical movements are one of the necessary conditions to avoid athletes' injury risk in training competitions. The mastery of any football technical action can not exist

independently without coordination ability. The speed and quality of football technical movements, and the extent of their consolidation and improvement depend to a large extent on the development and improvement of coordination capabilities.

Although physical training has a unique effect on improving the body's ability to exercise and preventing sports injuries, it cannot deny the value of traditional strength training. In a cycle, after a certain closed value is extracted, a data point is extracted, and in many cases, the recognition speed of the EMG signal is required. Two channels of model coefficients corresponding to each level calculated previously are used as input feature vectors of the respective classifiers. The influence of the classifier recognition rate and the model order on the recognition rate is shown in Table 7.

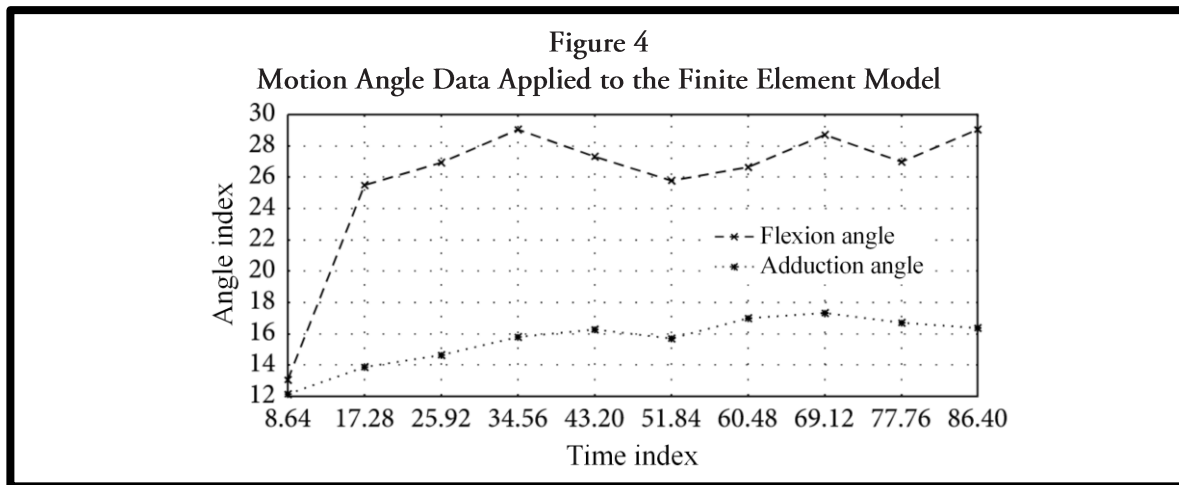
Order of model	20kg	25kg	35kg
3	74.64	85.68	86.68
6	81.53	81.36	87.57
9	75.47	87.52	90.16

When kicking a ball vigorously, the action of kicking the ball with the leg will lead to the shift of the body's center of gravity. If the function of stabilizing the body at the core is not enough and the

body loses its balance, it is likely to damage the lumbar and dorsal muscles. Most football technical movements are accomplished mainly by lower limbs. According to the change trend of the buckling angle and the muscle force of the

football player, the change of the three-dimensional motion angle and the muscle force of the knee joint in each analysis step is applied

as a boundary condition to the finite element model. The motion angle parameters applied to the finite element model are shown in Figure 4.



In terms of function, many of the core muscle groups are not directly involved in exercise. Randomly select input and output data and submit it to the network. Calculate the output of each neuron in the hidden layer:

$$F_{Adh} = F - \frac{4}{3} E^r \sqrt{R(d-d_0)^3} \quad (9)$$

Calculate the response of the output layer neurons:

$$E_{cr} = \frac{C_p}{E} \int_0^r \sigma^2 dt \quad (10)$$

Calculate the error of the output layer neurons using the given output data:

$$V_j = \frac{2PL_b}{H_b - t_b} - V_c = \frac{2PL_b}{H_b - t_b} - \frac{PL}{H} \quad (11)$$

Calculate the generalization error of each neuron in the hidden layer:

$$w_{0i} = \frac{1}{n} \sum_{k=1}^n r_{0i} \quad (12)$$

With the rapid advancement of science and technology and competitive sports, the scientificization of sports training has received more and more attention. Football completes a variety of complex and varied movements in a fast-paced, high-intensity game. The high degree of coordination of athletes greatly affects the quality of the movement and the improvement of the technical level. The failure of old sports

injuries is the most important factor in causing football injuries. Sprains and contusions are typical of the old injuries and unhealed sports injuries. The ball is transmitted with reasonable force when picking up low-level balls of various characteristics or passing through various distances and arcs. Physical fitness training needs to integrate skills and tactics, mental and psychological training. Physical fitness training is the basis for athletes to maintain good mental state and improve their competitive performance. Physical fitness training is all done by coaches or assistant coaches. In the absence of physical training related professional knowledge and skills, physical training process will inevitably have some problems.

DISCUSSION

The physical fitness of Chinese football players has become a bottleneck restricting their development. The most urgent task is to ask our football managers and coaches to pay attention to the physical fitness of athletes. Common rehabilitation exercises are about strengthening muscles. Generally there are isometric and isotonic motions. The so-called isometric exercise is to tighten the muscles but not to move or tighten the joints. The main cause of football players' injury is their poor physical quality such as muscle strength, coordination and so on. After core stability training, the physical fitness and

football skills of the subjects have significant differences, which shows that the effect of physical fitness training is better than that of traditional training methods. Theoretically, a full understanding of the coordination ability of football players helps to find more effective ways to train and improve the coordination ability of football players in the training work. Combined with physical training practice, the coaches athletes will be given a theoretical lecture on physical training, which will enable the coaches to have a more profound subjective understanding of physical training. In training, you should not only focus on the athlete's skill training, but also strengthen the athlete's physical training. In particular, the training of physical functions enables the harmonious development of motor skills and physical fitness in order to improve athletic performance.

Human Subjects Approval Statement

This paper did not include human subjects.

Conflict of Interest Disclosure Statement

None declared.

Acknowledgements

National Social Science Foundation of China (Project No. 16BTY021)

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