CHARACTERISTICS OF THE MEANS AND METHODS USED IN SOCCER TRAINING

CARACTERÍSTICAS DOS MEIOS E MÉTODOS UTILIZADOS NO TREINAMENTO DE FUTEBOL

CARACTERÍSTICAS DE LOS MEDIOS Y MÉTODOS UTILIZADOS EN EL ENTRENAMIENTO DE FÚTBOL

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Bin Yang[1]
(Physical Education Professional)
Xing Liu[2]
(Physical Education Professional)
Zhe Sun[3]
(Physical Education Professional)
Jingyi Gao[4]
(Physical Education Professional)
Chao Tian[5]
(Physical Education Professional)

1. Beijing Youth Politics College, Humanistic Quality Education Center, Department of Physical Education, Beijing, China.
2. Shandong First Medical University, Department of Physical Education, Jinan, China.
3. Chengdu Sports University, Football College, Chengdu, China.
4. Beijing Sport University, Sports Coach College, Beijing, China.
5. Dalian Maritime University, Department of Sports, Dalian, China.

Correspondence:
Xing Liu, Shandong First Medical University, Jinan, China. xin.liu6230@unesp.co.uk

ABSTRACT

Introduction: The correct understanding and implementation of the tasks set by the coach for the player are achieved through a wide variety of training sessions. To date, the question of training effectiveness and the preparation of professional soccer players for matches has not been sufficiently studied. Objective: Study the means and methods used in soccer training. By comparison, find out which method is most effective in achieving a positive result during the game and maintaining the players' health. Methods: The study used mathematical and physical methods and comparative analysis. In the study, the main training methods in a team were considered. A comparative analysis was made between two types of individual soccer players' training to improve physical and technical parameters. Result: We established which parameters influence the choice of the training scheme. The effectiveness of both training systems is proven by the statistical indicators of soccer players who train according to these methods. Conclusion: The effectiveness of the training methodology chosen by a soccer player depends on his initial physical abilities and professional skills. The study's practical significance is determined by the fact that the proposed methods can be used in training professional athletes. ***Evidence level II; Therapeutic studies - outcomes research.***

Keywords: Sports; Exercises; Physical Education and Training; Soccer.

RESUMO

Introdução: A correta compreensão e implementação das tarefas definidas pelo treinador para o jogador é alcançada através de uma ampla variedade de sessões de treinamento. Até hoje, a questão da eficácia do treinamento e a preparação dos jogadores profissionais de futebol para os jogos não foi suficientemente estudada. Objetivo: Estudar os meios e métodos utilizados no treinamento de futebol e, por comparação, descobrir qual dos métodos é mais eficaz para obter um resultado positivo durante o jogo e manter a saúde dos jogadores. Métodos: O estudo utilizou métodos matemáticos e físicos, assim como análise comparativa. No decorrer do estudo, foram considerados os principais métodos de treinamento em uma equipe. Foi realizada uma análise comparativa entre dois tipos de treinamento individual de jogadores de futebol, objetivando melhorar parâmetros físicos e técnicos. Resultado: Foram estabelecidos quais parâmetros influenciam a escolha do esquema de treinamento. A eficácia de ambos os sistemas de treinamento é comprovada pelos indicadores estatísticos dos jogadores de futebol que treinam de acordo com estes métodos. Conclusão: A eficácia da metodologia de treinamento escolhida por um jogador de futebol depende de suas habilidades físicas iniciais e habilidades profissionais. O significado prático do estudo é determinado pelo fato de que os métodos propostos podem ser utilizados no treinamento de atletas profissionais. ***Evidência nível II; Estudos terapêuticos – pesquisa de resultados.***

Descritores: *Esportes; Exercícios; Educação Física e Treinamento, Futebol.*

RESUMEN

Introducción: La correcta comprensión y ejecución de las tareas establecidas por el entrenador para el jugador se consigue a través de una amplia variedad de sesiones de entrenamiento. Hasta hoy, la cuestión de la eficacia del entrenamiento y la preparación de los futbolistas profesionales para los partidos no se ha estudiado suficientemente. Objetivo: Estudiar los medios y métodos utilizados en el entrenamiento de fútbol y, por comparación, averiguar qué método es más eficaz para conseguir un resultado positivo durante el juego y mantener la salud de los jugadores. Métodos: El estudio utilizó métodos matemáticos y físicos, así como análisis comparativos. En el transcurso del estudio, se consideraron los principales métodos de formación en un equipo. Se realizó un análisis comparativo entre dos tipos de entrenamiento individual de jugadores de fútbol, con el objetivo de mejorar los parámetros físicos y técnicos. Resultado: Se estableció qué parámetros influyen en la elección del esquema de entrenamiento. La eficacia de ambos sistemas de entrenamiento queda demostrada por los indicadores estadísticos de los futbolistas que entrenan según estos métodos. Conclusión: La eficacia de la metodología de entrenamiento elegida por un futbolista depende de sus capacidades físicas iniciales y de sus habilidades profesionales. La importancia práctica del estudio viene determinada por el hecho de que los métodos propuestos pueden utilizarse en el entrenamiento de atletas profesionales. ***Nivel de evidencia II; Estudios terapéuticos - investigación de resultados.***

Descriptores: *Deportes; Ejercicios; Educación y Entrenamiento Físico; Fútbol.*

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INTRODUCTION

During national championships, such as the World Cup or European Championship, fans from all over the country unite to support the national team from their country; the feeling of patriotism and pride for the homeland intensifies in people, which only football can provoke.[1-5] However, a lot of work and many problems are behind the great popularity, commercial success and demand among the fans. One of these problems is the selection of the ideal football tactics for dribbling, the construction of which is directly related to the use of mathematical and physical methods. Football tactics is a scheme for moving players during a match, an algorithm for the actions of each player individually, depending on his role on the field, and the team as a whole. The choice of football tactics depends on the goals and objectives that the coach sets for the players for the match, as well as on the composition of the players that the club has in hand. At the moment, there are three main schemes of ball possession based on the location of the players on the field: 4-4-2 (four defenders, four midfielders and two forwards), 4-3-3 (four defenders, three midfielders, three forwards) and 3-5-2 (three defenders, five midfielders and two forwards).[6-7]

During the match, each of the above-mentioned tactics can be adjusted by the coach, including individually, since each player has individual tactics for the match, depending on his fitness level and abilities. The correct understanding and implementation of the tasks set by the coach for the player is achieved through a wide variety of training sessions. To date, the issue of training effectiveness and, in general, the preparation of professional football players for matches has not been sufficiently studied.[8-12] Therefore, the purpose of the paper was to find out which of the methods is most effective for obtaining positive result during the game and maintaining the health of the players.

MATERIALS AND METHODS

Sports, in particular football, are directly related to the methods used in mathematics and physics, since many physical factors affect the movement of the ball: environmental resistance, impact force, wind speed, as well as the Magnus effect. This physical phenomenon was discovered by the German physicist Heinrich Magnus, and its essence is as follows. During the rotation of an object under certain specific conditions, namely under the action of liquid or gas flow, a force arises around it, which acts on the rotating object perpendicular to the direction of the flow. Thus, a vortex motion is formed around a rotating object, the magnitude of the force of which is calculated according to the Kutta-Joukowski theorem (Eq. 1):[13]

$$\vec{F} = p\vec{u}_{\infty} \times \vec{\Gamma} l \quad (1)$$

where: $\vec{F}$ – lifting force, p – fluid density, $\vec{u}_{\infty}$ – fluid flow velocity at infinity, $\vec{\Gamma}$ – velocity circulation, l – length of the considered part of the wing.

In football, the Magnus effect is used when performing special kicks on the ball, in which the ball rotates around an inclined axis. Such a kick is called a "falling leaf shot" and has a special trajectory. The first 60-70% of the distance the ball flies in a complex arc, rotating around the vertical and horizontal axes, and then abruptly (which is typical for this type of blow) changes its trajectory and falls down, reaching its goal. Usually the "falling leaf shot" is used for long-range shots (more than 20 metres) to the goal (when executing free kicks, corners, etc.), and is performed by hitting the ball with a toe, but a kick with the outside of the foot is considered a classic.

Combinatorial formulas are used to select tactics and the composition of players for a football match. They are used to find the optimal movements, positioning, and combinations of players on the field. With 23-25 players in the lineup, 3-6 for each position, the coach is faced with a difficult choice of which player will be included in the lineup, considering that they are all in the optimal physical condition. The number of possible variations in the positioning of players on the field is calculated by the equation (Eq. 2):[14]

$$A_n^k = n(n-1)(n-2)\ldots(k - multiplying\ factors) \quad (2)$$

where: A_n^k – positioning number, k – items contained in positioning from the number of *n* data.

Every professional football player performs a set of training programmes on a daily basis, both group and individual. One of the main qualities of a football player is endurance since about 70% of the match the player has to be in constant motion (which also depends on his role on the field), most of which is running. The more an athlete is trained, the lower his pulse will be when running, which is an indicator of running efficiency and is calculated by the following equation (Eq. 3):[15]

$$PR = \frac{P \times t}{60 \times L} \quad (3)$$

where: PR – the pulse rate (in beats per 1 km), P – average pulse rate during the workout (in beats per minute), t – training time (in seconds), L – distance covered (in kilometres). This parameter helps to track the effectiveness of workouts that develop speed and endurance while running.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. A study was approved by Ethics Commission of the Ministry of Health of the China, No. 189/7.

RESULTS AND DISCUSSION

The success of every professional football player lies in daily training and honing his skills by repeating the basic football movements many times to achieve the automation of a motion. To play at a high level and consistently get into the lineup for a match, a player needs to select the right training system that will maximise his innate abilities and allow him to acquire new necessary skills. In the system of football practice, two main categories of training should initially be distinguished – team and individual. Team training is a mandatory type of training that takes place at the training base of the club under the guidance of a coach and coaching staff, which usually includes a fitness coach, goalkeeper coach, therapist, etc. Their actions are aimed at maintaining the optimal physical fitness of every player.[16-18]

It is important for every professional athlete to form an exercise culture from the first stages of sports practice, including for football players. Improvement of the player's basic skills – the technique of receiving and kicking the ball, increasing speed while running, endurance, etc. – is achieved through long and intensive practice. The in-person practice is aimed at developing the skills of a particular football player and increasing his level. The coach develops an individual training programme based on the skills and goals of the player, as well as his physical capabilities. As a rule, tall and oversized players focus on the development of physical abilities, as well as skills such as speed, kick power, jump height, etc. For players of average height and below, a higher level of technique is characteristic: dribbling, agility in movement, etc. Based on this, the

authors will consider two types of training that are suitable for players of different types, both in terms of anthropometric data and in terms of behaviour on the field. As an example, the training systems of Cristiano Ronaldo (exercises aimed at developing physical abilities) and Lionel Messi (exercises aimed at developing football skills) were studied.

Football practice aimed at the development of physical abilities is represented by a forward Cristiano Ronaldo; the athlete is 187 cm tall and weighs 84 kg. Ronaldo's exercise culture is known throughout the football world, as he devotes himself to developing his physical characteristics almost every day. Ronaldo usually practices 3-4 hours a day (excluding team training) 5-6 times a week, while observing a special diet and sleep schedule. An athlete's training complex consists of mixing different types of exercises: warm-up, football exercises, cardio and strength training. During football practice, Ronaldo performs technical exercises, leg exercises and intense cardio exercises, which collectively train his endurance on the field. In the gym, a soccer player does more cardio, core exercises, and strength training.

The athlete's weekly set of exercises can be conditionally divided into three blocks: strength (training that exerts a load on all major muscle groups; performed using additional weight), plyometrics (training aimed at developing speed and muscle strength; performed using own body weight) and a block of endurance development (repetition of a large number of exercises without interruptions).

On the first day of the workout cycle – Monday – Ronaldo works the lower body by doing a circuit workout three times, which consists of five exercises: Barbell Squats (8 reps), Box Jumps (10 reps), Broad Jumps (8 reps). Jumping Lunges (8 reps per leg), Lateral Bounds (10 reps). On the third day (Wednesday), the main emphasis is on training the upper body also through a circuit training with three circles, consisting of five exercises: Burpee Pull-ups (10-15 reps), Bench Dips (20 reps), Pushups (20- 30 reps), Medicine Ball Toss (15 reps), Push Press (10 reps). The fourth day (Thursday) focuses on cardio and quadriceps workout, such a workout consists of two exercises: Clean and Jerks (5 sets, 5 reps) and Sprinting (8 sets, 200 metres). Since professional athletes perform most of the cardio loads during team practice, less time is devoted to individual exercises than strength or technique improvement.

On the fifth day (Friday), Ronaldo trains core strength to keep him fit and provide power when kicking the ball. This workout consists of the following exercises: One-Arm Side Deadlift (5 reps for each arm in 3 sets), Dumbbell One-Legged Deadlift (2 sets, 10 reps), Knee Tuck Jump (3 sets, 10-12 reps), Overhead Slam (3 sets, 10-12 reps), One-Leg Barbell Squat (2 sets, 5 reps) and Hanging Leg Raise (2 sets, 10-15 reps). On the seventh day (Sunday), the final in the training cycle, Ronaldo does simple cardio workouts: Rope Jumping (10 sets, rest 1 minute) and Resistance Sprinting (10 sets, 50 metres). The second (Tuesday) and sixth (Saturday) days are rest days, but this schedule is regulated depending on the match calendar.

The effectiveness of Ronaldo's training is confirmed by his physical data: at the age of 35, he is able to reach speeds of up to 34.6 km/h on the field, being one of the fastest players according to statistics for 2020, and the percentage of subcutaneous fat of a football player is only 7% of the total body weight, which 3% less than the average for professional football players. In addition to the complex of exercises, Cristiano Ronaldo maintains physical fitness with a protein diet, proper sleep schedule and recovery procedures.

Consider the training system of another outstanding football player of our time – Lionel Messi; the athlete is 170 cm tall and weighs 72 kg. Messi's training programme is not as busy and saturated with weight exercises compared to Ronaldo, but it also has its own features and difficulties. Messi's training is aimed at practicing speed when moving with the ball, as well as improving agility, manoeuvrability, and ball control. For the Argentinean, it is important to develop football skills, which helps him to act most effectively on the field. His workouts help to keep the body in good shape, develop endurance, and also improve football performance.

Messi's training cycle takes three days a week, each of which is aimed at working out different qualities. The first day of training consists of a warm-up: a plank position (to strengthen the abdominal muscles), Lunges and exercises to train balance, which is important when moving around the field with a ball, – Swallow stand scale; The main part of the workout consists of running with high knees, jumping in place and very short distances, and dribbling skills (without ball). The second training day is aimed at increasing the power of the leg muscles and consists of the following exercises: jumping over barriers (in particular, to the side), Pillar skips (14 metres each side), and Full squats with gymnastic elastic bands. This set of exercises helps to keep the whole body in good shape, since almost all muscles are involved in the exercise. The third training day (the final one in the cycle) is focused on increasing the speed, for this the player performs an exercise against the wall, imitating an intense run. To perform such an exercise, it is necessary to stand near the wall and rest hands on it, then start "running", raising knees high, trying to accelerate with each movement. Also, after training with the team Messi runs very short distances, the distance of which usually does not exceed nine metres.

The effectiveness of Messi's training is confirmed by his statistics showing the number of techniques used during the game. So, Lionel Messi is the world leader among active players by the number of ground moves (a movement in which the player passes by the defender, keeping the ball in his possession), having made a professional manoeuvre more than 1900 times (more than half of which were successful). The technique of dribbling a football player is unique and only a small number of professional football players can repeat it, the peculiarity is as follows: when the player touches the ball, the player's toes point down (usually the players dribble the ball, pointing the foot to the side), and the time of touching the ball is also important. Typically, players hit the ball when it is in front of them, but Messi does it differently: he touches the ball when the ball is centred on his body, which allows for the faster movements.

Thus, two systems of training football players were considered, one of which is aimed at developing the athletic abilities, and the second is at developing professional football skills. The effectiveness of both training systems is proved by the statistical indicators of football players who train according to these methods. When choosing the optimal set of exercises, a football player should, first of all, focus on his physical data and professional abilities in order to achieve maximum performance through training.

CONCLUSIONS

Training is the basis of activity for any professional athlete since it develops the skills necessary for participating in sports events: speed, agility, technique, as well as other physical and psychological skills. Each player carries out two daily sets of training: team, which are mandatory in preparation for the match, and individual, aimed at developing personal skills. It is necessary to choose the right training programme, guided by physiological characteristics. It will be difficult for a tall and large athlete to perform exercises aimed at improving dribbling, while a short football player will not get the expected result by training high jumps. Therefore, it is important to understand which skills should be prioritised in training in order to be most effective and efficient during a match.

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REFERENCES

1. Zhao YB. Enlightenment of developed sports in Europe on China's sports training system-taking football as an example. Agro Food Ind Hi-Tech. 2017;28(3):1103-7.
2. Antipov AV, Kulishenko IV, Guba VP. Training microcyle planning specifics in multiannual training systems at football sport reserve academies. Teoriya i Praktika Fizicheskoy Kultury. 2019;2019(4):9-10.
3. Wu C. Investigation and statistical analysis on the development of college football based on sports value and multimedia teaching. Bol Tec. 2017;55(18):260-6.
4. González JR, Sánchez JS. Strength training methods for improving actions in football. Apunts Educ Fis Deport. 2018;132:72-93.
5. Zlygostev OV, Tatyanenko SA, Guba VP. Special physical training system design for initial specialization stage in football. Teoriya i Praktika Fizicheskoy Kultury. 2019;2019(3):58-9.
6. Kostiukevych V, Lazarenko N, Shchepotina N, Poseletska K, Stasiuk V, Shynkaruk O, et al. Programming of the training process of qualified football players in the competitive period of the macrocycle. J. Phys Educ Sport. 2019;19(6):2192-9.
7. Tafuri D, Raiola V, Donini L. Football training proposal to improve athletes' physical performance. Acta Med Mediterr. 2019;35(6):3005-8.
8. Yue Y, Yang Y. Biomechanical study of muscle movement in the process of football technical training. J Mech Med Biol. 2020;20(2):1950082.
9. Tai SSM, Miltenberger RG. Evaluating behavioral skills training to teach safe tackling skills to youth football players. J Appl Behav Anal. 2017;50(4):849-55.
10. Radi ET, Sabt MH, Shihab IH. The effect of using the Mccarthy and merle instructional models on some physical abilities and skills in basketball and football. Ind J Public Health Res Develop. 2019;10(12):1217-22.
11. Canapini L, Varde'i CH, Cejudo-Palomo A, Izzo R. Analysis of the physical efficiency index in football teams and correlation with goal events: A survey of the Italian Serie A championship. J Human Sport Exerc. 2019;14(5):S2390-9.
12. Chen Q, Li X, Peng S. Research on mathematical model construction of soccer teaching and training based on linear programming. J Adv Oxid Technol. 2018;21(2):201807143.
13. Lagas IF, Meuffels DE, Visser E, Groot FP, Reijman M, Verhaar JAN, et al. High knee loading in male adolescent pre-professional football players: Effects of a targeted training programme. J Sci Med Sport. 2019;22(2):164-8.
14. Ritchie D, Keogh J, Stern S, Reaburn P, O'Connor F, Bartlett JD. The effects of endurance-based skills-specific running loads on same-day resistance-training performance in professional Australian rules football players. Int J Sports Physiol Perform. 2020;15(9):1281-8.
15. Yu H, Liu Y. Strength of knee flexor and extensor in football athletes after vibration training. Chinese J Tiss Eng Res. 2019;23(15):2327-31.
16. Zhu Z, Chen B, Qiu S, Wang R, Qiu X. Simulation and modeling of free kicks in football games and analysis on assisted training. Communic Comp Inf Sci. 2017;751:413-27.
17. Doğanay M, Bingül BM, Álvarez-García C. Effect of core training on speed, quickness and agility in young male football players. J Sports Med Phys Fitness. 2020;60(9):1240-6.
18. Gómez-Carmona CD, Bastida-Castillo A, Ibáñez SJ, Pino-Ortega J. Accelerometry as a method for external workload monitoring in invasion team sports. A systematic review. PLoS ONE. 2020;15(8):e0236643.