

APPLICATION OF FUNCTIONAL TRAINING IN SOCCER FITNESS

APLICAÇÃO DO TREINAMENTO FUNCIONAL NA APTIDÃO FÍSICA DO FUTEBOL

APLICACIÓN DEL ENTRENAMIENTO FUNCIONAL EN LA PREPARACIÓN FÍSICA DEL FÚTBOL



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ABSTRACT

Introduction: Although Chinese soccer has experienced many updates in its methods, there is still a large gap in players' physical endurance compared to the world powers. Therefore, strengthening soccer players' physical endurance through specific training methods is important in optimizing current performance. **Objective:** Study the application of functional training in soccer players' physical conditioning. **Methods:** 20 junior soccer physical education student-athletes in colleges and universities were selected as the research object. The global functional training was divided into three stages: practice, adaptation, and promotion. Data were compared, integrated, and analyzed before and after the intervention. **Results:** Conducting targeted functional training for soccer players can effectively increase athletes' physical endurance, reducing sports injuries and improving overall fitness scores at the technical and stability level. **Conclusion:** From the research of this article, it can be seen that there is a lack of physical fitness and technical strength in Chinese soccer today. The performance of targeted functional training is relevant and should be applied to soccer training. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Endurance Training; Soccer; Physical Education and Training.

RESUMO

Introdução: Embora o futebol chines tenha experimentado muitas atualizações em seus métodos, ainda há uma grande discrepância em termos de resistência física dos jogadores quando comparados às potências mundiais. Portanto, fortalecer a resistência física dos jogadores de futebol através de métodos específicos de treinamento é um importante fator para a otimização do desempenho atual. **Objetivo:** Estudar a aplicação do treinamento funcional no condicionamento físico dos jogadores de futebol. **Métodos:** 20 atletas estudantes de educação física de futebol júnior em faculdades e universidades foram selecionados como objeto de pesquisa. A formação funcional global foi dividida em três etapas: estágio de prática, fase de adaptação e etapa de promoção. Os dados foram comparados, integrados e analisados antes e após a intervenção. **Resultados:** A realização de treinamentos funcionais direcionados para jogadores de futebol pode efetivamente aumentar a resistência física dos atletas, reduzindo a ocorrência de lesões esportivas e melhorando a pontuação geral do condicionamento físico a nível técnico e de estabilidade. **Conclusão:** A partir da pesquisa deste artigo, pode-se ver que há falta de aptidão física e força técnica no futebol chinês atual. A realização de treinamento funcional direcionado é relevante e merece ser aplicado ao treinamento de futebol. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descriptores: Treino de Resistência Física; Futebol; Educação Física e Treinamento.

RESUMEN

Introducción: Aunque el fútbol chino ha experimentado muchas actualizaciones en sus métodos, sigue habiendo una gran discrepancia en cuanto a la resistencia física de los jugadores si se compara con las potencias mundiales. Por lo tanto, reforzar la resistencia física de los futbolistas mediante métodos de entrenamiento específicos es un factor importante para optimizar el rendimiento actual. **Objetivo:** Estudiar la aplicación del entrenamiento funcional en el acondicionamiento físico de los futbolistas. **Métodos:** Se seleccionaron como objeto de investigación 20 estudiantes atletas de educación física de fútbol juvenil en colegios y universidades. El entrenamiento funcional global se dividió en tres etapas: etapa de práctica, etapa de adaptación y etapa de promoción. Los datos se compararon, integraron y analizaron antes y después de la intervención. **Resultados:** La realización de un entrenamiento funcional específico para los futbolistas puede aumentar eficazmente la resistencia física de los deportistas, reduciendo la aparición de lesiones deportivas y mejorando la puntuación global de la aptitud a nivel técnico y de estabilidad. **Conclusión:** De la investigación de este artículo se desprende que en el fútbol chino actual hay una falta de aptitud física y de fuerza técnica. El rendimiento del entrenamiento funcional dirigido es relevante y merece ser aplicado al entrenamiento del fútbol. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Entrenamiento de Resistencia; Fútbol; Educación y Entrenamiento Físico.



INTRODUCTION

Football is one of the most popular sports in the world today. Competitions such as the world cup have attracted the attention of countless people and have a very broad market. However, at present, Chinese football continues to be in a relatively depressed state. Although it has experienced many reforms and discussed more optimized training methods, there is still a large gap with the world football powers.¹ By analyzing the differences between Chinese football and world football powers, we can see that at present, Chinese football has physical shortcomings. In football games that need a lot of running, it is often exhausted in the second half and can not complete the whole game well.² Therefore, strengthening the physical foundation of football through certain training methods is an important branch of the current football training optimization.³

Functional training, in short, is to purposefully select appropriate training methods according to the actual needs of sports, so as to achieve the purpose of functional improvement of relevant aspects.⁴ According to the literature, the physical fitness training of football should include strength quality, endurance quality, flexibility quality, speed quality and sensitivity quality, so as to promote the improvement of football physical fitness through the comprehensive development of many qualities.⁵ According to the literature, functional training can improve the muscle control of football players, so as to improve the balance and stability of players, and then promote the shooting hit rate and passing accuracy.⁶ This paper selects 20 football major student athletes in Colleges and universities to carry out relevant functional training, and discusses the scores of various indicators before and after training, so as to analyze the advantages of functional training on football physical development, and then explore its application.

METHOD

20 junior football major PE student athletes in Colleges and universities are selected as the research object, the study and all the participants were reviewed and approved by Ethics Committee of Hunan Normal University (NO. 2019HNUN055). And their basic information is shown in Table 1.

According to the movement law of human body, the overall functional training is divided into three stages: practice stage, adaptation stage and promotion stage. The training phase lasts for one week, which is mainly

used to get familiar with relevant functional movements, master their movement rules and make the movement more smooth. The second is the adaptation stage, which lasts for three weeks. The main performance is that the body gradually adapts to the relevant sports types and sports intensity, gradually adjusts its own state, adjusts the concept of proprioception, and improves the flexibility of joint parts and the strength training of core parts. The last 5 ~ 10 weeks is the promotion stage, which mainly includes two parts. One part is the exercise promotion of 5 ~ 8 weeks, which is to gradually increase the exercise load according to the actual situation of the body to make it more in line with the actual needs of the body when the body fully adapts to the relevant exercise types and exercise intensity. During this period of time, the core strength was further enhanced, and the muscle group strength of relevant key joints was further improved. The final 9th and 10th weeks are the stage of improvement and development. It mainly exercises the combination of overall strength, makes the combination between physical enhancement effect and related actions closer, promotes the outbreak of functional strength, and more meets the actual needs of football.

In order to further explore the effect of functional training on the improvement of football physical fitness, this paper measures it from three parts: FMS score, physical index score and technical score. The small indexes of each part are as follows:

FMS scores of football players: squat, hurdle step, straight lunge, shoulder flexibility, active straight knee lift, trunk stable push ups, trunk rotation stability.

Scores of physical fitness indexes of football players: sitting forward flexion, pull up, sit ups, free squat, dumbbell curl, standing long jump, throw out of bounds with both hands, 30-meter run and 5X25 meter run

Technical score of football players: ball speed, shooting hit rate, shooting stability, 28-meter accurate kick and over shot.

Before and after the experiment, the relevant indexes of 20 football players were measured, and the data before and after were compared, integrated and analyzed, so as to draw relevant conclusions.

RESULTS

Effect of functional training on FMS score of football players

(Table 2) shows the FMS scores of football players before and after functional training. It can be seen from (Table 2) that the score of squatting before training is (1.7473 ± 0.4558) and after training is (2.1682 ± 0.3461) , $P = 0.0010 < 0.01$; The score of trunk rotation stability before training was (1.6773 ± 0.4886) and after training was (2.0867 ± 0.2532) , $P = 0.0090 < 0.01$, indicating that there was a very significant difference. The score of hurdle step before training was (1.9559 ± 0.5033) , and after training was (2.3515 ± 0.4764) , $P = 0.0198 < 0.05$; The score of straight lunge before training was (2.1735 ± 0.5335) , and after training was (2.5699 ± 0.5293) , $P = 0.0194 < 0.05$; The score of active straight knee lifting before training was (2.0830 ± 0.6153) , and after training was (2.5928 ± 0.5166) , $P = 0.0139 < 0.05$; The score of trunk stable push ups before training was (1.5100 ± 0.7289) and after training was (1.8425 ± 0.7443) , $P = 0.0421 < 0.05$, indicating that there was a significant difference.

Table 2. FMS scores of football players before and after functional training.

Option	Before	After	P
Squat	1.7473 ± 0.4558	2.1682 ± 0.3461	0.0010
Step by step	1.9559 ± 0.5033	2.3515 ± 0.4764	0.0198
Straight bow and arrow step	2.1735 ± 0.5335	2.5699 ± 0.5293	0.0194
Shoulder flexibility	2.5983 ± 0.6373	2.9173 ± 0.3444	0.1053
Active knee -to -knee lifting legs	2.0830 ± 0.6153	2.5928 ± 0.5166	0.0139
Stable push -ups of trunk	1.5100 ± 0.7289	1.8425 ± 0.7443	0.0421
Trunk rotation stability	1.6773 ± 0.4886	2.0867 ± 0.2532	0.0090

The score of shoulder flexibility before training was (2.5983 ± 0.6373) and after training was (2.9173 ± 0.3444), $P = 0.1053 > 0.05$, indicating that there was no significant difference. Through the analysis, it can be seen that carrying out targeted functional training for football players can effectively increase the FMS score of athletes, so as to reduce the occurrence of sports injury as much as possible and improve the safety of athletes in the process of sports training.

Effect of functional training on physical fitness score of football players

(Table 3) shows the scores of physical fitness indexes of football players before and after functional training. It can be seen from table 3 that the score of sitting forward flexion before training is (15.9455 ± 6.3806) and after training is (19.9110 ± 4.1430), $P = 0.0010 < 0.01$; The pull-up score before training was (11.9603 ± 3.7750) and after training was (18.7913 ± 3.1163), $P = 0.0000 < 0.01$; The score of sit ups before training was (64.3612 ± 4.2679) and after training was (79.1313 ± 5.7412), $P = 0.0000 < 0.01$; The score of free squat before training was (74.0663 ± 12.5409) and after training was (80.5394 ± 20.4382), $P = 0.0000 < 0.01$; The score of dumbbell curl before training was (5.9850 ± 1.2902) and after training was (6.3198 ± 1.3168), $P = 0.0000 < 0.01$; The score of throwing out of bounds with both hands before training was (12.8425 ± 3.9191) and after training was (15.0625 ± 4.1221), $P = 0.0020 < 0.01$, indicating that there was a very significant difference. The score of standing long jump before training was (2.0036 ± 0.3095) and after training was (2.2598 ± 0.3672), $P = 0.0195 < 0.05$; The score of 30 meter run before training was (5.2002 ± 0.5957) and after training was (4.7158 ± 0.4186), $P = 0.0197 < 0.05$; The score of 5x25m before training was (41.1940 ± 4.0942) and after training was (38.6067 ± 5.2614), $P = 0.0283 < 0.05$, indicating that there was a significant difference. Through the analysis, it can be seen that at present, strengthening functional training can enhance the comprehensive scores of athletes' physical fitness, and these scores correspond to the enhancement of athletes' physical fitness level. Only by obtaining excellent physical conditions, can they have good endurance ability in the subsequent sports competition, so that athletes can complete the whole sports training with full spirit and good physical strength, so as to provide a good foundation for the improvement of competitive level.

Effect of functional training on technical score of football players

The improvement of football players' physical fitness and the reduction of sports injury problems are finally reflected in the technical scores related to football, including the ball speed, shooting hit rate and stability, etc. these indicators can more intuitively reflect the competitive state of players in the game, which is also the ultimate purpose of functional training.

(Table 4) shows the technical scores of football players before and after functional training. It can be seen from Table 4 that the score of ball speed before training is (72.5184 ± 3.7676) and after training is (90.2409 ± 1.6796), $P = 0.0060 < 0.01$; The score of shooting hit rate

Table 4. Technical scores of football players before and after functional training.

Option	Before	After	P
Velocity	72.5184 ± 3.7676	90.2409 ± 1.6796	0.0060
Shooting rate	47.1370 ± 0.1162	58.4301 ± 0.0595	0.0059
Shooting stability	2.6872 ± 0.9252	3.2617 ± 0.7191	0.0000
28-meter kick	1.2811 ± 0.1737	3.4232 ± 0.2694	0.0079
Pass the rod shoot	11.0728 ± 0.5902	10.0453 ± 0.4683	0.0091

before training was (47.1370 ± 0.1162) and after training was (58.4301 ± 0.0595), $P = 0.0059 < 0.01$; The score of shooting stability before training was (2.6872 ± 0.9252) and after training was (3.2617 ± 0.7191), $P = 0.0000 < 0.01$; The score of 28-meter kick accuracy before training was (1.2811 ± 0.1737), and after training was (3.4232 ± 0.2694), $P = 0.0079 < 0.01$; The score of over shot before training was (11.0728 ± 0.5902) and after training was (10.0453 ± 0.4683), $P = 0.0091 < 0.01$, indicating that there was a very significant difference. Through comparative analysis, it can be seen that with the development of functional sports, the players' ball speed has gradually improved, the shooting hit rate and stability have increased greatly, and the scores of various techniques have been improved to a certain extent. Therefore, strengthening functional training can not only promote the physical foundation of football players, but also help their technical play and stability.

DISCUSSION

Through the comparative analysis of athletes' FMS scores before and after the experiment, it can be seen that the functional training selected in this paper can effectively optimize the scoring structure of athletes' FMS, so as to reduce sports injury as much as possible. Therefore, the safety principle of athletes can be guaranteed in the overall functional training.

For football training, the replacement or optimization of training scheme is a step-by-step process. Just like the experimental design of this paper, it takes some time to learn and adapt, and finally gradually strengthen the intensity, consolidate and improve. If we rashly carry out relatively high-intensity functional training, it is easy to make the body unable to adapt to the training changes in a short time, resulting in certain sports injuries. In view of this problem, this paper believes that when designing relevant functional training, we should pay attention to the principle of safety, which is mainly reflected in two aspects: first, when selecting the content of functional training, we should fully combine the actual situation, including the athletes' own sports load intensity threshold and the actual needs of sports, and choose and design the corresponding training scheme. So that the training program can not only achieve a certain intensity and promote the improvement of athletes' ability level, but also prevent sports injury caused by excessive exercise below the maximum load of athletes. In addition, in the training process, we should also pay attention to step by step, design a corresponding buffer improvement scheme, and gradually optimize the relevant scheme, so as to gradually improve the perceptual adaptability of the body. Only by paying attention to the safe application of functional training can the optimized training scheme really play a role and promote the improvement of athletes' competitive level.

CONCLUSION

From the research of this paper, it can be seen that there is a lack of physical fitness and technical strength in the current Chinese football. In view of the various needs in the process of football, combined with the safety and athletes' own sports characteristics, actual needs and so on. Carry out relevant transitional functional training. It can not only effectively optimize the physical structure of current athletes, improve their FMS scores and reduce the occurrence of sports injuries, but also

Table 3. Scores of physical indexes of football players before and after functional training.

Option	Before	After	P
Sitter	15.9455 ± 6.3806	19.9110 ± 4.1430	0.0010
Tag up	11.9603 ± 3.7750	18.7913 ± 3.1163	0.0000
Sit-ups	64.3612 ± 4.2679	79.1313 ± 5.7412	0.0000
Free squatting	74.0663 ± 12.5409	80.5394 ± 20.4382	0.0000
Dumbbells bend	5.9850 ± 1.2902	6.3198 ± 1.3168	0.0000
Standing long jump	2.0036 ± 0.3095	2.2598 ± 0.3672	0.0195
Throw the ball with both hands	12.8425 ± 3.9191	15.0625 ± 4.1221	0.0020
30 meters running	5.2002 ± 0.5957	4.7158 ± 0.4186	0.0197
5x25 meters	41.1940 ± 4.0942	38.6067 ± 5.2614	0.0283

comprehensively improve the technical level of football players, which can greatly improve the shooting hit rate, stability, football speed and so on. Therefore, functional training should be applied to football training.

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REFERENCES

- Ivarsson A, Stenling A, Fallby J, Johnson U. The predictive ability of the talent development environment on youth elite football players' well-being: A person-centered approach. *JSEP*. 2014;16:15-23.
- Sparks M, Coetzee B, Gabbett JT. Variations in high-intensity running and fatigue during semi-professional soccer matches. *International Int. J Perform Anal Sport*. 2016;16(1):122-32.
- Lockie RG, Jalilvand F, Moreno MR, Orjalo AJ, Risso FG, Nimphius S. Yo-yo intermittent recovery test level 2 and its relationship with other typical soccer field tests in female collegiate soccer players. *J Strength Cond Res*. 2017;31(10):2667-77.
- Hogarth LW, Burkett BJ, McKean MR. Activity profiles and physiological responses of representative tag football players in relation to playing position and physical fitness. *PLoS One*. 2015;10(12):e0144554.
- De Hoyo M, Sañudo B, Carrasco L, Mateo-Cortes J, Domínguez-Cobo S, Fernandes O, et al. Effects of 10-week eccentric overload training on kinetic parameters during change of direction in football players. *J Sports Sci*. 2016;34(14):1380-7.
- Muscella A, Vetrugno C, Spedicato M, Stefano E, Marsigliante S. The effects of training on hormonal concentrations in young soccer players. *J Cell Physiol*. 2019;62(4):1-9.