

# EFFECT OF HIGH-INTENSITY INTERVAL TRAINING ON FOOTBALL PLAYERS' PERFORMANCE

EFEITOS DO TREINAMENTO INTERVALADO DE ALTA INTENSIDADE SOBRE O DESEMPENHO DOS JOGADORES DE FUTEBOL

EFFECTOS DEL ENTRENAMIENTO DE INTERVALOS DE ALTA INTENSIDAD EN EL RENDIMIENTO DE LOS FUTBOLISTAS



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Minjie Wang<sup>1</sup>   
(Physical Education Professional)  
Jianwei Zhang<sup>1</sup>   
(Physical Education Professional)

1. East China Jiaotong University,  
College of Physical and Health  
Education, Nanchang, Jiangxi,  
China.

## Correspondence:

Jianwei Zhang  
Nanchang, Jiangxi, China. 330013.  
1339@ecjtu.edu.cn

## ABSTRACT

**Introduction:** High-intensity interval training contributes expressively to physical training and has been gradually applied to the soccer field. This sport has received more attention in colleges and universities in the country. However, studies are needed on the most appropriate training methods to improve the players' ability among college students, increasing the competitive level among athletes. **Objective:** Investigate the influence of high-intensity intermittent training on soccer players' sports performance. **Methods:** 30 student soccer players were selected at a university for six weeks, and four training sessions were held per week. The experimental group performed intermittent high-intensity training for training; the control group used the traditional aerobic resistance training method. For the experiment, indicator information was collected for integration and analysis before the start of activities and at the end of the six weeks. **Results:** High-intensity intermittent training can improve the fitness index and FMS index of players and also can keep the fluctuation level in players' performance higher; the range of performance improvement is considerably larger than the traditional aerobic training method. **Conclusion:** High-intensity intermittent training can improve players' fitness and agility, reduce sports injuries, improve physical reserve, and promote the progress of soccer players' sports achievements.

**Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** High-Intensity Interval Training; Soccer; Athletic Performance.

## RESUMO

**Introdução:** O treinamento intervalado de alta intensidade contribui expressivamente ao treino físico e gradualmente tem sido aplicado no campo de futebol, esporte que tem recebido maior atenção nas faculdades e universidades do país. Porém, são necessários estudos sobre os métodos de treino mais adequado para melhorar a capacidade dos jogadores entre estudantes universitários, aumentando o nível competitivo entre os atletas. **Objetivo:** Investigar a influência do treinamento intermitente de alta intensidade no desempenho esportivo dos jogadores de futebol. **Métodos:** 30 estudantes futebolistas foram selecionados em uma universidade durante seis semanas e quatro sessões de treinamento foram realizadas por semana. O grupo experimental efetuou treinamento intermitente de alta intensidade para treinamento, o grupo controle utilizou o método tradicional de treinamento de resistência aeróbica para treinamento. Para o experimento, foram coletadas informações de indicadores para integração e análise antes do início das atividades e ao final das seis semanas. **Resultados:** O treinamento intermitente de alta intensidade pode melhorar o índice de aptidão física e o índice FMS dos jogadores, também pode manter o nível de flutuação no desempenho dos jogadores mais elevado, a gama de melhoria de desempenho é consideravelmente maior do que o método tradicional de treinamento aeróbico. **Conclusão:** O treinamento intermitente de alta intensidade pode melhorar o condicionamento físico e a agilidade dos jogadores, reduzir lesões esportivas, melhorar a reserva física e promover o progresso das conquistas esportivas dos jogadores de futebol. **Nível de evidência II; Estudos terapêuticos - investigação dos desfechos do tratamento.**

**Descritores:** Treinamento intermitente de alta intensidade; Futebol; Desempenho Atlético.

## RESUMEN

**Introducción:** El entrenamiento de intervalos de alta intensidad contribuye de forma expresiva al entrenamiento físico y poco a poco se ha ido aplicando al campo de fútbol, un deporte que ha recibido más atención en los colegios y universidades del país. Sin embargo, se necesitan estudios sobre los métodos de entrenamiento más adecuados para mejorar la capacidad de los jugadores entre los estudiantes universitarios, aumentando el nivel competitivo entre los atletas. **Objetivo:** Investigar la influencia del entrenamiento intermitente de alta intensidad en el rendimiento deportivo de los futbolistas. **Métodos:** Se seleccionaron 30 estudiantes de fútbol en una universidad durante seis semanas y se realizaron cuatro sesiones de entrenamiento por semana. El grupo experimental realizó un entrenamiento intermitente de alta intensidad para entrenar, el grupo de control utilizó el método tradicional de entrenamiento aeróbico



de resistencia para entrenar. Para el experimento, se recogió información de los indicadores para su integración y análisis antes del inicio de las actividades y al final de las seis semanas. Resultados: El entrenamiento intermitente de alta intensidad puede mejorar el índice de aptitud física y el índice FMS de los jugadores, también puede mantener el nivel de fluctuación en el rendimiento de los jugadores más alto, el rango de mejora del rendimiento es considerablemente mayor que el método de entrenamiento aeróbico tradicional. Conclusión: El entrenamiento intermitente de alta intensidad puede mejorar la condición física y la agilidad de los jugadores, reducir las lesiones deportivas, mejorar la reserva física y promover el progreso de los logros deportivos de los futbolistas. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptor:** Entrenamiento De Intervalos De Alta Intensidad; Fútbol; Rendimiento Atlético.

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## INTRODUCTION

Football has become one of the most popular sports in the world, with a large number of spectators, fans, athletes, training teams and coaches.<sup>1</sup> Under the background of the country's vigorous development of football, football training in Colleges and universities has been paid attention to. Colleges and universities have become an important training base for talent training and talent transportation of professional football players. Many colleges and universities have begun to implement various talent selection policies, so that students not only rely on cultural scores to enter colleges and universities, but also students with strong sports ability and high professional talent can enter colleges and universities through various sports assessment. In addition, during their study in Colleges and universities, they plan the career path for specially recruited students through professional teams. Since the development of football related industries, colleges and universities have become an important link in the preliminary selection of talents, and the talent training system has been gradually improved. The professional training methods of the team of professional physical education teachers in Colleges and universities can help college athletes improve their sports performance efficiently, and collect and sort out the data of training intensity, training methods and sports performance, which is convenient for analysis and summary.<sup>2</sup> As the data support for improving the training mode, it can help to improve the overall ability of football players among college students and maintain the competitive state of athletes, Through improving the overall ability to improve the overall performance of football, a team competitive project.<sup>3</sup>

As a hot topic in physical training in recent years, high-intensity interval training has played a good role in many sports fields and greatly improved the effect of physical training. Therefore, it has been gradually applied in the field of football.<sup>4</sup> Through the method of high-intensity intermittent training, this paper carries out a series of physical training for football players, so as to explore the impact of high-intensity intermittent training on football players' performance, and explore more methods for football physical training.<sup>5</sup>

## METHOD

In this paper, 30 football majors in a university are selected as the research object. They are divided into two groups by random lot, including 15 athletes in the experimental group and 15 athletes in the control group. The study and all the participants were reviewed and approved by Ethics Committee of East China Jiaotong University (NO.2019ECJU079). The relevant contents of athletes' age, height, weight and their football training years are shown in Table 1.

The experiment was carried out in the way of controlling variables for six weeks, and four times a week. The experimental group and the control group were carried out at the same frequency. The experimental group chose high-intensity interval

**Table 1.** Basic information of two groups of athletes.

Option	Control (N=15)	Test (N=15)	P value
Age	19.724±0.599	19.764±0.400	0.12815
Height (cm)	174.208±9.383	173.308±8.684	0.68377
Weight (kg)	61.932±10.412	64.384±7.492	0.17421
Training years	12.014±0.499	12.115±0.699	0.19066

training for training, and the control group used the traditional aerobic endurance training method for training. In addition to different exercise methods, the work and rest habits, diet design and training duration of the experimental group and the control group should be consistent as far as possible, so as to eliminate the interference of irrelevant factors. The relevant indexes were measured before and 6 weeks after the experiment.

Before the experiment, both the experimental group and the control group maintained a good exercise state, and carried out physical fitness index tests including 12 min run, 30 m sprint, 40 m sprint and bounce, FMS index tests including squat, hurdle step, straight lunge, shoulder flexibility, active straight knee lift, trunk stable pushups and trunk rotation stability, as well as football sports tests FMS indicators and preliminary football scores were recorded. Then, the football results are recorded in weeks, and the average value is taken. The physical fitness index and FMS index are measured again after 6 weeks of training, and the collected data are integrated and analyzed.

## RESULTS

### Effect of high intensity interval training on physical fitness index

The improvement of physical fitness is the basis for improving the sports performance of football players. Therefore, in this section, the changes of physical fitness training are analyzed through four indicators: 12 min run, 30 m sprint, 40 m sprint and bounce, so as to explore the impact of high-intensity intermittent training on the physical factors of football players.

(Table 2) shows the changes of physical fitness indexes of the two groups of athletes before and after intervention. Among them, the 12 minute running performance of the control group increased from 2974.030 ± 62.379 m to 3095.440 ± 39.341 m after the intervention, the 30 m sprint time decreased from 4.523 ± 0.040s to 4.415 ± 0.061s after the intervention, the 40 m sprint time decreased from 5.571 ± 0.101s to 5.530 ± 0.091s after the intervention, and the bounce height decreased from 63.205 ± 2.226cm to 62.640 ± 2.008cm after the intervention, which proves that aerobic training can enhance the physical fitness of football players. The 12 minute running performance of the experimental group increased from 2958.726 ± 54.683m to 3045.252 ± 57.323m after the intervention, the running time of 30 m sprint decreased from 4.382 ± 0.069s to 4.438 ± 0.089s after the intervention, the running time of 40 m sprint decreased from 5.481 ± 0.091s to 5.467 ± 0.110s after the

**Table 2.** Changes of physical fitness indexes of athletes in the two groups before and after intervention.

Item	Control		Test	
	Before	After	Before	After
12 min run(m)	2974.030±62.379	3095.440±39.341	2958.726±54.683	3045.252±57.323
30 m sprint (s)	4.523±0.040	4.415±0.061	4.382±0.069	4.438±0.089
40 m sprint (s)	5.571±0.101	5.530±0.091	5.481±0.091	5.467±0.110
Bounce height (cm)	63.205±2.226	62.640±2.008	63.818±2.033	64.160±2.422

intervention, and the jumping height increased from 63.818 ± 2.033cm to 64.160 ± 2.422cm after the intervention, indicating that high-intensity intermittent training can effectively improve the physical fitness level of football players. A comprehensive comparison of the increment of various physical fitness indicators shows that although the physical fitness of the two groups has improved before and after the intervention, the physical fitness of the experimental group is significantly greater than that of the control group, which also proves that the effect of high-intensity interval training on physical fitness is better than that of traditional aerobic training, so it is worth promoting.

### Effect of high intensity interval training on FMS index

(Table 3) shows the changes of FMS test indexes of the two groups of athletes before and after intervention. Among them, the squat index of the control group increased from 1.859 ± 0.627 to 1.964 ± 0.576 after the intervention, the hurdle step index increased from 1.729 ± 0.587 to 1.859 ± 0.506 after the intervention, the straight lunge index increased from 1.859 ± 0.712 to 1.976 ± 0.638 after the intervention, the shoulder flexibility index increased from 2.660 ± 0.728 to 2.723 ± 0.593 after the intervention, and the active straight knee lift index increased from 2.036 ± 0.577 to 2.106 ± 0.507 after the intervention, The trunk stability push up index increased from 1.177 ± 0.395 to 1.295 ± 0.485 after the intervention, and the trunk rotation stability index increased from 1.770 ± 0.456 to 1.977 ± 0.598 after the intervention. The results show that traditional aerobic training can improve the FMS index, so as to enhance the ability of athletes to prevent sports injury. The squat index of the experimental group increased from 1.773 ± 0.456 to 2.154 ± 0.336 after the intervention, the hurdle step index increased from 2.022 ± 0.514 to 2.336 ± 0.485 after the intervention, the straight lunge index increased from 2.219 ± 0.547 to 2.472 ± 0.514 after the intervention, the shoulder flexibility index increased from 2.600 ± 0.613 to 2.915 ± 0.336 after the intervention, and the active straight knee lifting index increased from 2.105 ± 0.613 to 2.530 ± 0.517 after the intervention, The trunk stability push up index increased from 1.581 ± 0.738 to 1.830 ± 0.742 after the intervention, and the trunk rotation stability index increased from 1.670 ± 0.475 to 2.036 ± 0.253 after the intervention. The results show that high-intensity interval training can promote the optimization of FMS indexes of football players, so as to improve their sports performance. By comprehensively comparing and analyzing the research results of the experimental group and the control group, it can be seen that both sports methods can optimize the FMS test results of football players, but the improvement range of the experimental group is significantly greater than that of the control group. Therefore, it also proves that high-intensity intermittent training can better improve the flexibility of football players and reduce the occurrence of sports injuries as much as possible compared with traditional aerobic sports methods, so as to prolong the sports life of athletes.

## Influence of high intensity interval training on football performance

In the first two sections, through the analysis of physical fitness index and FMS index, it is proved that high-intensity intermittent training can not only enhance athletes' physical performance, but also improve sports flexibility. Therefore, in this section, through weekly regular football test, this paper discusses the impact of high-intensity intermittent training on football performance.

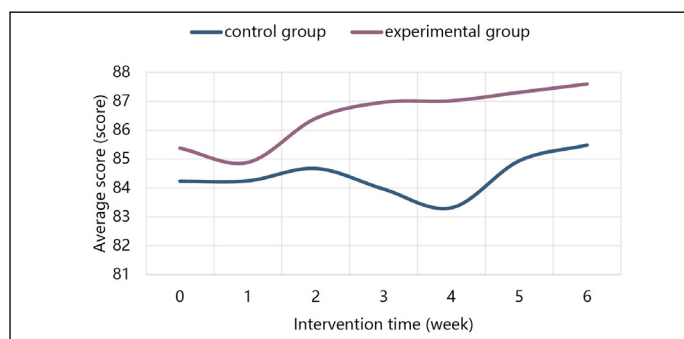
As shown in Figure 1, the training results of the experimental group and the control group fluctuated during the 6-week training process, but on the whole, they showed an upward trend. It can be seen from the curve of the experimental group that there was a fluctuating decline in the performance in the first week, and then showed a slow increase in different increases in the training time of 2-6 weeks, and finally achieved a better performance. The control group also showed a fluctuating upward state. The upward trend in the early stage was more stable than that in the experimental group. There was a certain downward trend from the third week to the fourth week, and then showed a slow upward trend. Finally, the football performance improved slightly. By comparing the growth rate of football performance between the experimental group and the control group, the growth rate of the experimental group is significantly higher than that of the control group. Therefore, compared with the traditional aerobic training, high-intensity advanced training can better promote the improvement of football performance, which is worthy of promotion.

## DISCUSSION

The body of college students is tending to the mature period of physical growth and development, which is also the period of technical improvement of athletes. Therefore, colleges and universities should customize the training plan according to the physical and technical characteristics of college athletes. Ensure that athletes make efficient progress in the best golden period of technical improvement. Focus on the physical training of athletes, arrange the physical training plan scientifically and reasonably, so as to improve students' physical strength and endurance to meet the basic requirements of high-level football games. While paying attention to

**Table 3.** Changes of FMS test indexes of two groups of athletes before and after intervention.

Item	Control		Test	
	Before	After	Before	After
Deep squat	1.859±0.627	1.964±0.576	1.773±0.456	2.154±0.336
Hurricane	1.729±0.587	1.859±0.506	2.022±0.514	2.336±0.485
Straight bow arrow	1.859±0.712	1.976±0.638	2.219±0.547	2.472±0.514
Shoulder flexibility	2.660±0.728	2.723±0.593	2.600±0.613	2.915±0.336
Practice straight knee leg	2.036±0.577	2.106±0.507	2.105±0.613	2.530±0.517
Torso stability push-ups	1.177±0.395	1.295±0.485	1.581±0.738	1.830±0.742
Torso Rotation Stability	1.770±0.456	1.977±0.598	1.670±0.475	2.036±0.253



**Figure 1.** Change of average score of two groups of athletes during intervention.

physical training, we should also cooperate with the arrangement of strength training. Football has more confrontation, which puts forward requirements for the strength of athletes. Strength training in Colleges and universities in China is still relatively backward compared with countries with high football level. Due to physical talent, strength and jumping strength need targeted training. We should adhere to muscle strength training and muscle explosive strength training at a fixed time every day, and form a scientific and regular training habit by fixing the training time of specific muscle groups every week. When the specific training is implemented, the incremental strength training mode is adopted, which can effectively improve the body strength.<sup>6</sup> Finally, it is the training at the skill level. Teachers should carry out special training for the weak items in different skill links of different students, and train the students in the skills of carrying the ball during the March. The obstacle method is more commonly used. Then there is the training of rhythm skills. The specific training methods are roughly 800 meters or 1500 meters of long-distance running training, ball acceleration or variable speed running and other targeted methods. Through the training of students' acceleration and variable speed skills, students can improve their sense of movement rhythm and indirectly intersperse balance training. All training shall be carried out in coordination, and the training time shall be fixed to help students complete the training plan efficiently.

## CONCLUSION

In order to explore the impact of high-intensity interval training on the sports performance of football players, this paper selects the physical fitness index and FMS index as the reference index in the research process, and discusses the football performance including physical ability and flexibility from three aspects: the change of sports performance, physical fitness index and FMS index, so as to make the research more systematic. The results show that compared with the traditional aerobic training, high-intensity interval training can not only promote the improvement of athletes' physical fitness index and FMS index, but also keep the athletes' football performance fluctuating and rising, and the improvement range of performance is slightly larger than that of the control group. Therefore, high-intensity interval training can be applied to the daily training of football, so as to promote the progress of athletes' physical quality and flexibility, reduce sports injuries, improve physical reserves, lay better physical conditions for athletes in the arena, improve sports safety, and promote the progress of football players' sports performance.

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All authors declare no potential conflict of interest related to this article

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