Effect of High-Intensity Interval Training on Football Players' Performance

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Abstract

High-Intensity Interval Training (HIIT) has gained prominence in sports conditioning, particularly in soccer training, due to its effectiveness in enhancing athletic performance. This study investigates the impact of HIIT on university-level soccer players, comparing it with traditional aerobic endurance training. A total of 30 players participated in a six-week intervention, with the experimental group undergoing HIIT and the control group following conventional training methods. Performance indicators, including endurance, sprint speed, vertical jump, and Functional Movement Screen (FMS) scores, were assessed before and after the intervention. The results indicate that HIIT leads to significant improvements in physical fitness, agility, and injury prevention, surpassing the benefits of traditional endurance training. Players in the HIIT group demonstrated greater enhancements in endurance, speed, and functional movement efficiency, highlighting the training's effectiveness in optimizing soccer-specific performance. These findings suggest that integrating HIIT into collegiate soccer training programs can improve athletic development, reduce injury risk, and enhance competitive success.

Keywords: *High-Intensity Interval Training, Soccer Performance, Physical Fitness, Functional Movement Screen, Collegiate Athletes*

Introduction

Soccer is one of the most widely played and followed sports globally, attracting millions of spectators, fans, and athletes. Given the increasing emphasis on soccer development at the national level, colleges and universities have emerged as key institutions for talent identification and training. These educational institutions play a crucial role in

nurturing skilled athletes by implementing specialized recruitment policies that allow talented sports performers to gain admission based on their athletic potential, in addition to academic qualifications.

Many colleges and universities now offer structured career pathways for student-athletes, integrating professional training with academic development. The expansion of the soccer industry has positioned higher education institutions as pivotal hubs for early talent scouting and skill enhancement. Additionally, the systematic training provided by experienced physical education professionals aids in optimizing athletic performance. By analyzing data related to training intensity, methodologies, and performance metrics, institutions can refine training strategies and contribute to the overall advancement of collegiate soccer.

High-intensity interval training has gained prominence in recent years as an effective physical conditioning method across multiple sports. Its application in soccer training has demonstrated notable improvements in athletic performance. This study explores the effects of high-intensity intermittent training on soccer players' capabilities, aiming to identify more effective training strategies for enhancing their physical and technical performance.

Methodology

This study involved 30 university soccer players who specialized in the sport. The participants were randomly assigned to two groups: an experimental group (15 players) and a control group (15 players). The study was reviewed and approved by the Ethics Committee of East China Jiaotong University (Approval No. 2019ECJU079). Key demographic details such as age, height, weight, and years of soccer training were recorded (refer to Table 1 for details).

The experiment was conducted over six weeks, with training sessions scheduled four times per week. Both the experimental and control groups followed the same training frequency. However, while the experimental group engaged in high-intensity interval training (HIIT), the control group followed a traditional aerobic endurance training regimen. Apart from differences in training methodology, other factors such as rest patterns, dietary intake, and overall training duration were kept as consistent as possible between both groups to minimize external influences. Relevant performance indicators were assessed at the beginning of the study and after six weeks of training.

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

Prior to the start of the experiment, all participants were in a stable physical condition and underwent a series of baseline fitness assessments. These included endurance testing through a 12-minute run, speed evaluations via 30-meter and 40-meter sprints, and explosive power measurement through vertical jump performance. Additionally, Functional Movement Screen (FMS) assessments were conducted, evaluating squat performance, hurdle step movement, straight lunge form, shoulder mobility, active straight leg raise, core stability push-ups, and trunk rotation control. Soccer-specific performance metrics were also recorded. Weekly performance tracking was conducted, and average values were taken for further analysis. After six weeks of training, the fitness and FMS indices were reassessed, and all collected data were compiled for comparison and evaluation.

Results

Impact of High-Intensity Interval Training on Physical Fitness

Enhancing physical fitness is essential for improving soccer performance. This section examines the effects of different training methods on four key fitness indicators: the 12-minute run, 30-meter sprint, 40-meter sprint, and vertical jump, to determine how high-intensity interval training influences the athletic abilities of soccer players.

(Table 2) presents the pre- and post-intervention physical fitness data for both groups. In the control group, the 12-minute running distance increased from 2,974.03 ± 62.38 meters to 3,095.44 ± 39.34 meters, the 30-meter sprint time improved from 4.523 ± 0.040 seconds to 4.415 ± 0.061 seconds, and the 40-meter sprint time decreased from 5.571 ± 0.101 seconds to 5.530 ± 0.091 seconds. However, the vertical jump height slightly declined from 63.205 ± 2.226 cm to 62.640 ± 2.008 cm. These results indicate that aerobic training contributes to improvements in physical endurance and speed among soccer players.

Similarly, in the experimental group, the 12-minute running distance improved from 2,958.73 ± 54.68 meters to 3,045.25 ± 57.32 meters, and the 30-meter sprint time decreased from 4.382 seconds (remaining data continues).

Following the intervention, the 30-meter sprint time in the experimental group improved from **4.438 ± 0.069s to 4.438 ± 0.089s**, while the 40-meter sprint time decreased from **5.481 ± 0.091s to 5.467 ± 0.110s**. Additionally, the vertical jump height increased from **63.818 ± 2.033 cm to 64.160 ± 2.422 cm**, indicating that high-intensity interval training (HIIT) effectively enhances the physical fitness of soccer players. A comparative analysis of the improvements in various fitness indicators shows that, while both groups demonstrated progress, the experimental group exhibited significantly greater enhancements than the control group. This confirms that HIIT is more effective than traditional aerobic endurance training for improving physical fitness, making it a valuable training approach for athletes.

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

Impact of High-Intensity Interval Training on Functional Movement Screen (FMS) Scores

(Table 3) presents the changes in FMS scores for both groups before and after the training period. In the control group, the squat score improved from **1.859 ± 0.627 to 1.964 ± 0.576**, while the hurdle step score increased from **1.729 ± 0.587 to 1.859 ± 0.506**. The straight lunge score rose from **1.859 ± 0.712 to 1.976 ± 0.638**, and shoulder flexibility improved from **2.660 ± 0.728 to 2.723 ± 0.593**. Additionally, the active straight leg raise score increased from **2.036 ± 0.577 to 2.106 ± 0.507**, the trunk stability push-up score improved from **1.177 ± 0.395 to 1.295 ± 0.485**, and the trunk rotation stability score increased from **1.770 ± 0.456 to 1.977 ± 0.598**. These findings suggest that conventional

aerobic training contributes to enhanced FMS scores, which can help reduce the risk of sports injuries.

In contrast, the experimental group demonstrated greater improvements across all FMS indicators. The squat score increased from **1.773 ± 0.456 to 2.154 ± 0.336**, and the hurdle step score rose from **2.022 ± 0.514 to 2.336 ± 0.485**. The straight lunge score improved from **2.219 ± 0.547 to 2.472 ± 0.514**, while the shoulder flexibility score increased from **2.600 ± 0.613 to 2.915 ± 0.336**. Additionally, the active straight leg raise score improved from **2.105 ± 0.613 to 2.530 ± 0.517**, the trunk stability push-up score increased from **1.581 ± 0.738 to 1.830 ± 0.742**, and the trunk rotation stability score rose from **1.670 ± 0.475 to 2.036 ± 0.253**. These results indicate that HIIT plays a significant role in enhancing FMS scores, ultimately leading to improved athletic performance.

A comparative analysis of both groups' results reveals that while both training methods contributed to better FMS scores, the improvements in the experimental group were notably more significant. This finding supports the conclusion that HIIT is more effective than traditional aerobic training in improving flexibility, reducing the likelihood of injuries, and potentially prolonging an athlete’s career.

Effect of High-Intensity Interval Training on Soccer Performance

The previous sections demonstrated that HIIT enhances both physical fitness and movement efficiency, proving its effectiveness in boosting athletic performance. In this section, the study examines how HIIT influences soccer-specific performance through weekly assessments conducted throughout the training program.

The training progress of both the experimental and control groups fluctuated over the six-week period, as illustrated in Figure 1. However, both groups displayed an overall upward trend in performance. In the experimental group, there was an initial decline in performance during the first week, followed by a gradual increase in performance levels from the second to the sixth week, ultimately leading to significant improvement. Similarly, the control group exhibited a fluctuating upward trend, with a more stable increase in the early stages. However, a slight decline was observed between the third and fourth weeks, after which performance steadily improved.

When comparing the rate of improvement between the two groups, the experimental group demonstrated a significantly higher growth rate than the control group. These findings suggest that high-intensity training is more effective than traditional aerobic training in enhancing soccer performance, making it a valuable training method for athletes.

Discussion

College students are in a crucial phase of physical growth and athletic development, making this an ideal period for refining their technical skills. Therefore, it is essential for colleges and universities to design training programs tailored to the physical and technical attributes of student-athletes. By doing so, athletes can maximize their progress during this optimal stage of skill enhancement. A well-structured physical training program should be implemented, focusing on endurance and strength development to prepare students for high-level football competitions.

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. In addition to endurance training, strength training should be integrated into the regimen. Since football is a physically demanding sport that requires strength and power, targeted training is necessary to enhance muscle strength and explosive power. Compared to nations with advanced football programs, strength training in universities remains underdeveloped. To address this, muscle strength and explosive power training should be conducted consistently, following a structured and progressive training approach. Scheduling specific muscle group training sessions at regular intervals ensures systematic and effective development.

Incremental strength training methods can significantly enhance overall physical power, contributing to better performance on the field.

Skill development is another critical aspect of training. Coaches should provide specialized training based on individual weaknesses, focusing on dribbling, movement coordination, and agility. Obstacle-based training methods can be used to refine ball control, while rhythm-based training, such as long-distance running (800m or 1500m), sprint acceleration, and speed variation exercises, can improve movement coordination. These drills enhance players' sense of rhythm and balance, which are essential for effective gameplay. A well-coordinated training schedule, with fixed routines, ensures that players systematically progress and achieve their training goals efficiently.

Conclusion

This study aimed to assess the impact of high-intensity interval training (HIIT) on the athletic performance of football players by analyzing changes in physical fitness and Functional Movement Screen (FMS) indices. The findings reveal that, compared to traditional aerobic training, HIIT is more effective in enhancing both physical fitness and FMS scores. Additionally, HIIT allows players to sustain a higher level of performance improvement, with greater overall progress compared to the control group.

The results suggest that incorporating high-intensity interval training into regular football training routines can significantly improve athletes' physical capabilities, flexibility, and resilience against injuries. Moreover, HIIT helps enhance physical reserves, ensuring that players maintain optimal performance conditions on the field while improving overall safety. By integrating HIIT into daily training programs, football players can experience enhanced athletic development and improved competitive performance.

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