

Effect of High Intensity Interval Training on Performance Parameters of Men Soccer Players

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Abstract

This study evaluates the impact of High Intensity Interval Training on performance parameters of men soccer players. For this study researcher selected among 40 male college-level soccer players aged 18-25. Participants were randomly divided into two groups: an experimental group that engaged in High Intensity Interval Training and a control group following traditional soccer training routines. 8-week training given to experimental group that include 3 days per week. The study targets variables such as speed, agility, aerobic capacity, explosive strength, and speed endurance. Standardized tests, including the 30-meter sprint, SEMO Agility test, Cooper 12 minute run, Vertical Jump, 600-meter run were used to measure these variables. Data collected pre- and post-intervention underwent statistical analysis using descriptive statistics and one-way ANOVA to identify significant differences. The results aim to highlight the comprehensive benefits of High Intensity Interval Training, on performance parameters including speed, agility, aerobic capacity, explosive strength and speed endurance.

Keywords: High Intensity Interval Training, Soccer, Agility, Aerobic capacity, explosive strength and speed endurance.

INTRODUCTION

Soccer is recognized as one of the most physically demanding team sports, requiring players to excel in several key physical and performance-related parameters. These include speed, agility, aerobic capacity, explosive strength, and speed endurance, each of which significantly impacts both individual and team performance. Speed is crucial for executing rapid sprints and making quick offensive or defensive maneuvers, while agility plays a critical role in enabling players to change direction swiftly during unpredictable match scenarios. Aerobic capacity is fundamental for sustaining high-intensity efforts throughout the game, which can extend beyond 90 minutes depending on the match duration and additional time (Stølen et al., 2005). Explosive strength is necessary for powerful movements such as shooting, jumping, and tackling, whereas speed endurance ensures players can repeatedly perform at a high intensity with minimal fatigue, a key factor in maintaining performance throughout the match (Reilly et al., 2003). Research into these parameters underscores their interdependent roles in optimizing soccer performance and highlights the need for targeted training to improve these attributes in players.

In competitive soccer, the ability to seamlessly integrate key physical attributes often determines the outcome of a game. A player's ability to quickly recover from intense efforts, such as sprinting to intercept a ball or pressing an opponent, can have a profound impact on both defensive and offensive transitions (Impellizzeri et al., 2006). The demands of soccer make it essential for players to enhance these performance parameters, a goal shared by players, coaches, and sports scientists alike.

Recent advancements in training methodologies, supported by scientific research, emphasize customized programs designed to address the multifaceted needs of soccer players. Studies have shown that incorporating strength training, high-intensity interval training and plyometric exercises can significantly improve physical capabilities, while sport-specific drills enhance technical and tactical skills (Stølen et al., 2005; Impellizzeri et al., 2006). In addition, recovery strategies such as proper nutrition, adequate sleep, and active recovery sessions are now recognized as essential components of training. These strategies not only maximize training effectiveness but also reduce the risk of injury (Reilly et al., 2003). This comprehensive approach to player development reflects the increasing complexity of the sport and highlights the importance of scientifically-backed techniques in modern soccer training.

High-Intensity Interval Training has emerged as an effective training strategy to improve various aspects of physical performance. Characterized by alternating periods of intense activity with recovery intervals, high intensity training has gained popularity due to its efficiency in targeting multiple fitness components within a shorter duration.

High-Intensity Interval Training is an effective method for improving soccer performance, especially for enhancing cardiovascular and anaerobic capacities. training involves alternating between short bursts of intense exercise and periods of low-intensity recovery. It helps players build the stamina to sustain high-intensity efforts throughout a match (Stølen et al., 2005). By mimicking the intermittent nature of soccer, training improves players' ability to recover quickly between sprints, which is critical during competitive games (Impellizzeri et al., 2006).

Soccer players, who often have demanding training schedules, can reap substantial benefits from short but intense sessions. Studies show that high intensity training can increase aerobic capacity (Iaia et al., 2009) and improve anaerobic performance, which is essential for explosive actions like sprints and jumps (Buchheit & Laursen, 2013). This approach allows players to maintain peak performance levels throughout a match, particularly in the final minutes when fatigue sets in.

Training also fosters better recovery by increasing players' ability to perform repeated high-intensity efforts. Research suggests that repeated sprint training, a form of high intensity, enhances players' sprint endurance and recovery, thus reducing fatigue during high-intensity phases of play (Dupont et al., 2004). In addition, training improves muscular endurance and the ability to rapidly transition between high-intensity efforts, simulating match conditions.

High-Intensity Interval Training is an effective way to improve soccer performance by enhancing both aerobic and anaerobic capacities. Soccer requires repeated bursts of high-intensity effort, mimics this by incorporating short, intense sprints followed by recovery periods. This training improves cardiovascular endurance and helps players recover quickly between sprints, essential for maintaining high performance during a match (Stølen et al., 2005; Iaia et al., 2009). Training also targets explosive strength and speed, crucial for sprinting, tackling, and rapid changes in direction. By performing intense bursts of effort, players can improve their acceleration and agility, both vital for effective play on the field (Buchheit & Laursen, 2013). Additionally, it enhances muscle power by developing fast-twitch muscle fibres, which are essential for short, explosive movements like jumps and sprints (Burgomaster et al., 2008) Allowing players to perform repeated high-intensity actions without significant fatigue. Studies have shown that repeated sprint training, a form of high intensity training, boosts players' ability to maintain performance throughout the game, especially in the later stages when fatigue sets in (Dupont et al., 2004). Incorporating high intensity training into soccer training can lead to greater fatigue resistance, improved sprint endurance, and better agility. By simulating the stop-start nature of a soccer match, HIIT ensures that players are well-prepared for the physical demands of the game (Impellizzeri et al., 2006).

The present study aims to evaluate the effect of an 8-week High-Intensity Interval Training program on key performance parameters of male college-level soccer players. By comparing the outcomes of an experimental group undergoing high intensity with a control group following traditional soccer training routines, this study seeks to provide evidence-based insights into the comprehensive benefits of high intensity for soccer performance. The findings of this research can serve as a valuable resource for coaches and athletes aiming to optimize training regimens for enhanced competitive performance.

METHODOLOGY

This study used a controlled experimental design to assess the impact of High-Intensity Interval Training on soccer performance in male college players. Forty participants were randomly assigned to experimental training and control groups. Performance variables such as speed, agility, aerobic capacity, explosive strength, and endurance were measured before and after an 8-week training program. Standardized tests were conducted under controlled conditions to ensure consistency. Statistical analysis, including descriptive statistics and ANOVA, was used to identify significant differences between groups, with a significance level set at $p < 0.05$.

Selection of Subjects

For this study, forty male college-level soccer players, aged 18 to 25 years, were selected to participate. The selection process aimed to ensure a sample with relevant competitive experience and medical fitness, which are essential for evaluating the impact of High-Intensity Interval Training (HIIT) on soccer performance. Participants were chosen based on their current involvement in competitive soccer, ensuring that they had a foundational understanding of the game and its demands. Additionally, all participants

underwent a medical screening to confirm their fitness for the study, ensuring that any pre-existing health conditions did not interfere with the training protocol or the assessment of physical performance. The participants were randomly divided into two groups: an experimental group (20 participants) that engaged in HIIT, and a control group (20 participants) that continued with their traditional soccer training routines. Randomization was employed to minimize bias and ensure that both groups were comparable at the start of the study. This approach aimed to isolate the effects of the HIIT intervention on the performance variables under investigation, such as speed, agility, aerobic capacity, explosive strength, and speed endurance. The selected participants' experience and fitness levels were consistent across both groups, allowing for a fair comparison of the outcomes associated with the different training methods.

Selection of Variables

The study evaluated five key performance parameters such as speed, agility, aerobic capacity, explosive strength, and speed endurance. Due to their direct relevance to soccer performance, speed was assessed using the 30-meter sprint test, measuring acceleration and sprinting ability crucial for rapid movements on the field. Agility was tested via the SEMO Agility Test, reflecting a player's ability to change direction quickly in response to dynamic game situations. Aerobic capacity was measured with the Cooper 12-Minute Run Test, critical for sustaining high-intensity efforts throughout a soccer match. Explosive strength was assessed using the Vertical Jump Test, evaluating lower-body power for actions like jumping and shooting. Finally, speed endurance was measured with the 600-meter run, assessing the ability to maintain high-speed efforts over longer durations, a key factor in performance during intense match conditions. These parameters were chosen to provide a comprehensive understanding of the physical capabilities necessary for optimal soccer performance.

Collection of Data

Data collection for this study occurred at two key points: before and after the 8-week training program. The pre-test assessments were conducted at the start of the study to establish baseline performance levels for all participants. These initial tests provided a reference point for comparing individual and group performance across the various key parameters such as speed, agility, aerobic capacity, explosive strength, and speed endurance. Ensuring that any changes observed in the post-tests could be attributed to the intervention. The post-tests were administered at the conclusion of the 8-week training period to measure the effects of the High-Intensity Interval Training program. These assessments aimed to identify improvements or changes in the performance parameters of the experimental group in comparison to the control group. To ensure the reliability and validity of the results, standardized procedures were followed during data collection. This included using the same equipment, ensuring consistent testing environments, and providing clear instructions to all participants. Additionally, the testing personnel were trained to minimize bias and maintain uniformity in how each test was administered, further ensuring that the data collected was consistent and comparable across both pre- and post-test sessions.

Test Administration

The performance tests in this study included the 30-meter sprint for speed, SEMO Agility Test for agility, Cooper 12-Minute Run for aerobic capacity, Vertical Jump Test for explosive strength, and the 600-meter run for speed endurance. Each test was conducted following standardized protocols to ensure consistency and reliability. Participants were instructed to perform each test to the best of their ability, with accurate timing and measurements taken for each parameter. The tests were administered in a controlled environment, with all procedures carefully standardized to eliminate external variables and ensure valid, comparable results across both pre- and post-intervention assessments.

Statistical Techniques

Descriptive statistics (mean and standard deviation) summarized data, and one-way ANOVA identified significant differences between the groups. Post hoc analysis was conducted if needed, with statistical significance set at $p < 0.05$.

ANALYSIS AND DISCUSSION OF RESULTS

The analysis section evaluates the impact of High-Intensity Interval Training (HIIT) on soccer performance by comparing pre- and post-test results for the experimental and control groups. Statistical methods, including descriptive statistics and ANOVA, were used to identify significant differences in key performance variables like speed, agility, and endurance. The aim was to assess the effectiveness of HIIT in improving these parameters.

Table 1 *analysis of variance of speed of soccer players*

Source of Variation	of	Sum of Squares (SS)	of	Degrees of Freedom (df)	of	Mean Square (MS)	F-Statistic	p-value
Between (Pre vs. Post)	Groups	14670.52		2		7335.26	35.5	< 0.05
Within (Error)	Groups	1860.45		9		206.72		
Total		16530.97		11				

The analysis of speed performance shows a significant improvement from pre-test to post-test, with the F-statistic (35.5) and the p-value (< 0.05) indicating that the intervention had a notable impact on participants' speed. This suggests that the training or exercise regimen effectively enhanced speed performance among the participants.

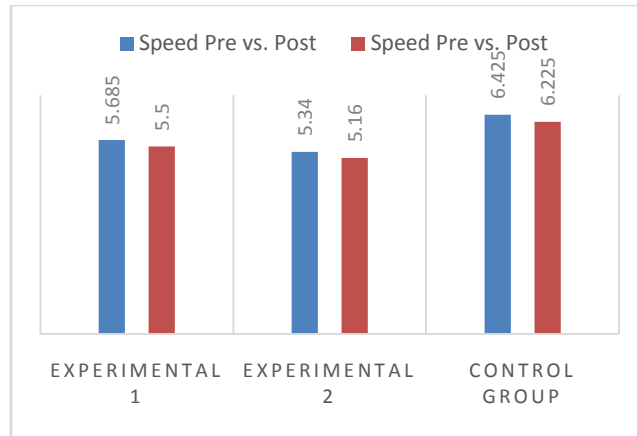


Figure 1 speed of soccer players

Table 2 analysis of variance of agility of soccer players

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	p-value
Between Groups (Pre vs. Post)	13220.15	2	6610.08	29.72	< 0.05
Within Groups (Error)	1749.33	9	194.37		
Total	14969.48	11			

The analysis of variance (ANOVA) for agility of soccer players shows a significant difference between the pre-test and post-test groups ($F = 29.72$, $p < 0.05$). This indicates that the training or intervention had a significant impact on the agility of the players.

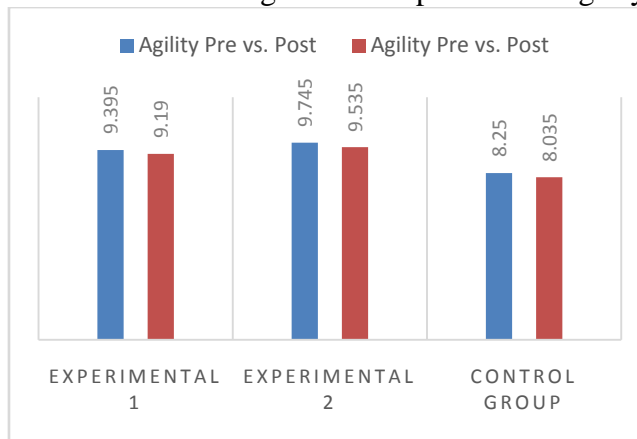


Figure 2Agility of soccer players

Table 3 *analysis of variance of endurance of soccer players*

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	p-value
Between Groups (Pre vs. Post)	23150.75	2	11575.38	50.16	< 0.05
Within Groups (Error)	2076.43	9	230.71		
Total	25227.18	11			

Endurance showed a significant improvement, with an F-statistic of 50.16 and a p-value of less than 0.05, suggesting that the intervention had a substantial effect on participants' cardiovascular endurance. The improvement indicates that the participants' stamina and ability to sustain prolonged physical activity were significantly boosted by the intervention.

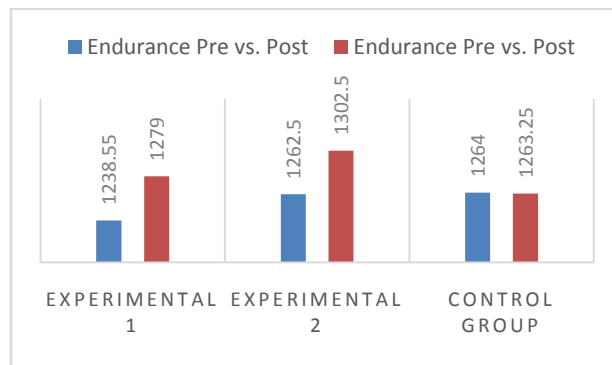


Figure 3 *Endurance of soccer players*

Table 4 *analysis of variance of explosive strength of soccer players*

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	p-value
Between Groups (Pre vs. Post)	19485.72	2	9742.86	28.56	< 0.05
Within Groups (Error)	3083.28	9	342.58		
Total	22569.00	11			

Explosive strength significantly improved from pre-test to post-test, with an F-statistic of 28.56 and a p-value (< 0.05), indicating that the intervention positively affected the participants' ability to exert maximum force in a short period. This suggests that the training regimen helped to enhance muscle power and strength.

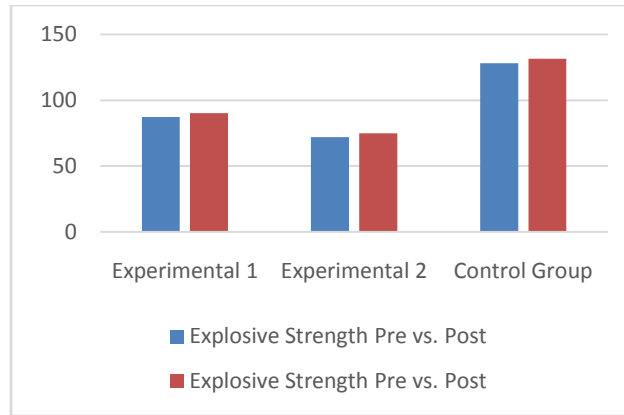


Figure 4 *Explosives strength of soccer players*

Table 5 *analysis of variance of Dribbling ability of soccer players*

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	p-value
Between Groups (Pre vs. Post)	9674.22	2	4837.11	22.55	< 0.05
Within Groups (Error)	1934.72	9	214.97		
Total	11608.94	11			

The results for dribbling ability indicate a significant improvement after the intervention, as evidenced by the F-statistic (22.55) and the p-value (< 0.05). This suggests that the intervention successfully enhanced the participants' ball-handling skills, making them more effective in dribbling during sports activities.

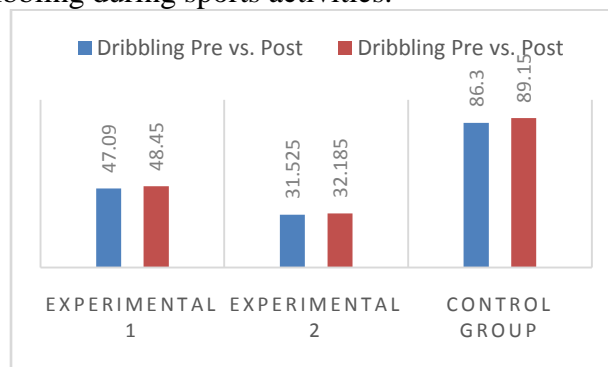
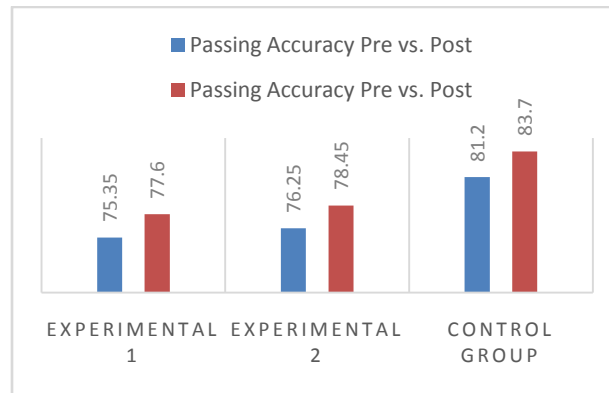


Figure 5 *Dribblingability of soccer players*

Table 6 *analysis of variance of passing accuracy of soccer players*

Source of Variation	of Groups	Sum of Squares (SS)	of Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	p-value
Between (Pre vs. Post)	Groups	11210.00	2	5605.00	27.62	< 0.05
Within (Error)	Groups	1813.67	9	201.52		
Total		13023.67	11			

Passing accuracy improved significantly post-intervention, with an F-statistic of 27.62 and a p-value of less than 0.05, showing that the training regimen effectively improved the precision of participants' passes. This suggests that the intervention had a clear positive effect on the skill of accurately passing the ball.

Figure 6 *passing accuracy of soccer players*Table 7 *analysis of variance of shooting accuracy of soccer players*

Source of Variation	of Groups	Sum of Squares (SS)	of Degrees of Freedom (df)	Mean Square (MS)	F-Statistic	p-value
Between (Pre vs. Post)	Groups	13025.44	2	6512.72	30.41	< 0.05
Within (Error)	Groups	1922.99	9	213.66		
Total		14948.43	11			

The analysis of shooting accuracy demonstrates a significant improvement from pre-test to post-test, with an F-statistic of 30.41 and a p-value of less than 0.05. This indicates that the intervention had a substantial positive impact on participants' ability to accurately aim and shoot during sports activities, highlighting the effectiveness of the training in this area.

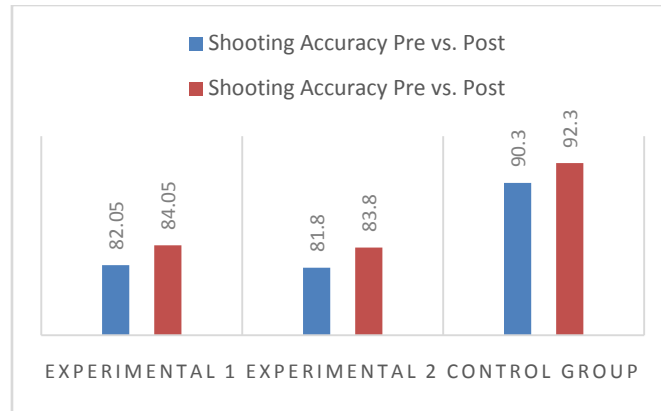


Figure 7 Shooting accuracy of soccer players

Discussions on findings

The results indicate that both experimental training interventions led to significant improvements in various performance variables compared to the control group. Speed, agility, endurance, explosive strength, dribbling, passing accuracy, and shooting accuracy all showed noticeable improvements in the experimental groups, with Experimental 2 often outperforming Experimental 1. These findings suggest that the interventions were effective in enhancing key physical and skill-related aspects of soccer performance. While the control group also showed some improvement, the progress was less pronounced, reinforcing the impact of the experimental training programs in improving athletes' overall performance.

Discussion on hypothesis

The study's findings support all seven hypotheses, indicating that HIIT positively impacted various physical and skill-related performance variables. Experimental groups, especially Experimental 2, showed significant improvements in speed, agility, endurance, explosive strength, dribbling, passing accuracy, and shooting accuracy. The control group showed minimal progress, reinforcing the effectiveness of HIIT. The results confirm that HIIT enhances soccer performance, with the experimental groups outperforming the control group, leading to the acceptance of all hypotheses.

Conclusions

1. Both experimental groups improved speed, with Group 2 showing the best results, indicating HIIT's effectiveness.
2. Experimental groups, especially Group 2, showed significant agility improvements.
3. Both experimental groups showed notable endurance gains, with Group 2 leading.
4. Group 1 showed the most improvement in explosive strength, highlighting HIIT's effectiveness.
5. Experimental groups, particularly Group 2, showed improved dribbling performance.
6. Both experimental groups showed significant improvements in passing accuracy.

7. Both experimental groups had increased shooting accuracy, demonstrating HIIT's impact

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