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Analyzing The Effect of High Intensity Interval Training Among University Level Men Football Players

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ABSTRACT

Physical fitness is of paramount importance for football players due to the demanding nature of the sport. Football matches can be intense and last for 90 minutes or more. Players need high levels of aerobic endurance to maintain performance throughout the game. Football requires players to engage in physical contests such as tackling, shielding the ball, and competing in aerial duels. High Intensity Interval Training can be particularly beneficial for football players due to its focus on functional movements, strength, endurance, and agility. The study investigates the impact of High-Intensity Interval Training (HIIT) on specific physical and physiological attributes of university-level male football players. For this purpose, 30 male football players, aged 18 to 22 years, were randomly selected from SRM Institute of Science and Technology in Tamil Nadu, India. The participants were separated into two random groups: Group I, comprising 15 players, endured High-Intensity Interval Training, while Group II, also consisting of 15 players, served as the control group. Group I engaged in a single 60-minute training session per day, five days a week, for six weeks. Meanwhile, Group II did not follow any specialized training regimen but continued with their regular daily activities. Data on key physical and physiological parameters, including agility, flexibility, breath-holding time, and vital capacity, were gathered using standardized tests. Measurements were taken both before and after the training program to evaluate the selected variables. The dependent t-test and analysis of covariance (ANCOVA) were employed to analyze the pre- and post-test results for each variable separately. The findings revealed that the group undergoing High-Intensity Interval Training demonstrated significant improvements in the chosen physical and physiological characteristics. In contrast, the control group did not exhibit any notable enhancements in these measures.

Keywords: *Football, Physical Demand, HIIT, Performance Enhancement.*

1. INTRODUCTION

Modern football, often referred to as soccer in some parts of the world, has undergone significant evolution since its formalization in the 19th century. Rooted in ancient ball games played in various cultures, the modern version was codified in England with the establishment of the Football Association in 1863. Over time, it has become the world's most popular sport, transcending cultural, social, and economic barriers. The professionalization of the game has brought not only increased viewership but also a transformation in how players train, prepare, and perform on the pitch. The physical demands of football today are significantly higher than in its earlier iterations, requiring athletes to maintain peak physical fitness and exhibit a diverse range of skills including speed, strength, endurance, and tactical intelligence (Stolen et al., 2005).

The fitness demands of modern football have been shaped by the game's dynamic nature and its emphasis on both aerobic and anaerobic activities. Matches typically last 90 minutes and require players to cover distances of up to 10-12 kilometers, involving intense bursts of activity such as sprints, quick directional changes, and jumps. This high-intensity intermittent exercise profile necessitates exceptional cardiovascular endurance and muscular strength. Moreover, the game demands mental resilience and cognitive sharpness to make split-second decisions in high-pressure situations. Recent advancements in sports science and technology have further refined training methodologies, enabling players to enhance performance and reduce the risk of injuries (Bangsbo et al., 2006; Helgerud et al., 2001).

As the sport continues to evolve, so too do the expectations placed on players and coaching staff. Modern football clubs invest heavily in fitness programs, incorporating elements like nutrition, recovery, and psychological well-being into their regimens. These holistic approaches underscore the multifaceted nature of football fitness, where success is determined by a combination of physical prowess, technical skill, and mental preparation. The increasing pace and intensity of the game underline the need for continuous innovation in training practices and fitness strategies, ensuring players can meet the rigorous demands of contemporary football (Krustrup et al., 2005).

HIIT among Football Players

High-Intensity Interval Training (HIIT) has emerged as a cornerstone of modern athletic preparation, particularly in football, where the physical and tactical demands are exceptionally high. HIIT involves alternating periods of intense activity with short recovery intervals, mirroring the high-intensity intermittent nature of football matches. This training method is highly effective in improving both aerobic and anaerobic fitness, making it particularly beneficial for football players who need to sustain prolonged physical exertion while executing short, explosive movements such as sprints, jumps, and quick directional changes (Buchheit et al., 2013; B**uchheit & Laursen,** 2023).

Incorporating HIIT into football training regimens has proven to be a game-changer, optimizing player performance while reducing the risk of overtraining. Its multifaceted benefits align perfectly with the demands of modern football, ensuring players are not only fit but also prepared to excel in the ever-intensifying pace of the sport.

2. LITERATURE REVIEW

A systematic review using Meta analytics (SRMA) was carried out by Clemente et al. (2021) to examine and contrast the effects of running-based HIIT therapies and “SSG-based interventions on soccer players' sprinting time (ST), vertical height jump (VJH), and change of direction time (CODt)”. The results of the meta-analysis showed that running-based HIIT was more effective than SSG-based treatments in improving sprinting performance, but there were no discernible differences in leaping or CODt performance.

Eranoch et al., (2023) proposed the impact of high interval training (HIIT) with masks on soccer players forced vital capacity. A total of fourteen male soccer players aged 20 ± 2 years were randomly assigned to either of the two different mask groups or the no mask group (CON). The HIIT program was conducted three times a week and consisted of six exercises each session. Percutaneous oxygen saturation and body composition forced vital capacity tests were performed both before and after the 4-week intervention. Based on the findings both types of masks significantly increased forced vital capacity.

Sharif et al., (2024) examined the impact of continuous aerobic and high-intensity interval training on several physical fitness factors in young football players. Measurements such as sprint speed test, 4x9 shuttle run agility test, and explosive leg power test were taken at the start and after the 6-week training regimen. The gathered data were subsequently analyzed through covariance analysis (ANCOVA), using pre-test values as a covariate and conducting pairwise comparisons. When comparing each group to the control group and to each other the results showed significant differences in every aspect of physical fitness.

3. METHODOLOGY

The study aimed to examine the effects of High-Intensity Interval Training (HIIT) on physical and physiological variables in football players. To conduct the study, 30 male football players from SRM Institute of Science and Technology, Tamil Nadu, India, were randomly selected as participants. The age range of the subjects was between 18 and 22 years, and a random sampling method was employed. There were two groups of participants: Group I, consisting of 15 players, underwent High-Intensity Interval Training, while Group II, also comprising 15 players, served as the control group. Group I participated

in HIIT sessions lasting 60 minutes per day, five days a week, over a six-week training period. Group II did not follow any specific training program but continued their regular daily activities. Data on physical and physiological parameters, including agility, flexibility, breath-holding time, and vital capacity, were collected using the hexagon test, sit-and-reach test, nostril clip method, and wet spirometer, respectively. Measurements were made prior to and right after the training session. Analysis of covariance (ANCOVA) and the dependent t-test were used independently to examine each variables pre- and post-test result at a significance level of 0.05 as shown in Figure 1.

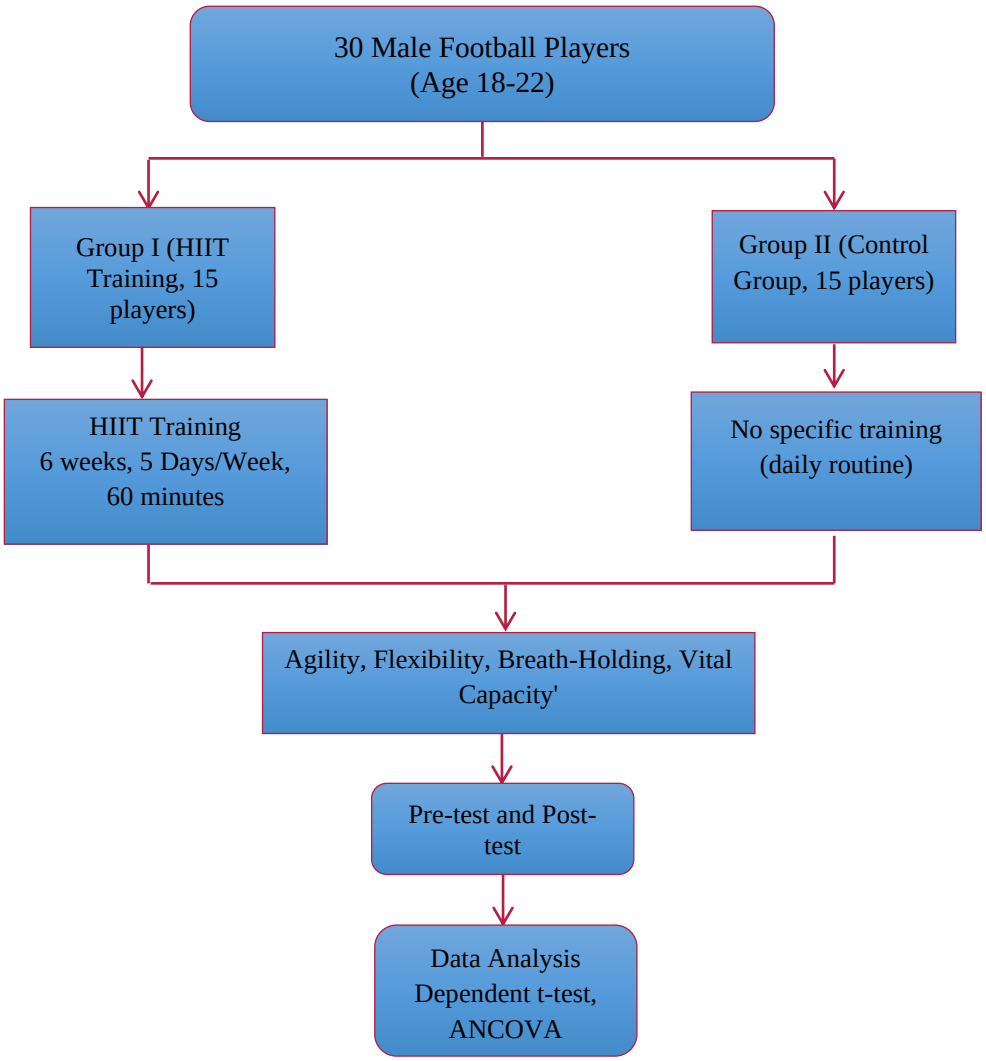

Figure 1. HIIT Study Methodology

Short bursts of high-intensity exercise are interspersed with rest or low-intensity activity sessions in a fitness regimen called "High-Intensity Interval Training (HIIT)" (Themistocleous et al., 2024). Among the advantages of this kind of exercise are enhanced cardiovascular health improved muscular endurance higher calorie expenditure and better metabolic performance. Additionally time-efficient are HIIT sessions which typically last 15 to 30 minutes. HIIT workouts include Burpees, jump squats, sprint intervals, and Tabata. Soccer players may benefit most from HIIT when it comes to increasing their speed agility strength endurance and overall fitness. By adding HIIT into their training routines soccer players can improve their performance on the field and obtain a competitive advantage.

In order to evaluate the impact of High-Intensity Interval Training (HIIT) on football players the study measured a number of physiological variables. These factors included vital capacity breath-holding time agility and flexibility. The hexagon test was used to measure agility since it evaluates the capacity to change direction and speed rapidly. The sit-and-reach test which assesses the range of motion in the lower back and hamstrings was used to measure flexibility. The nostril clip method which evaluates a person's capacity to hold their breath and withstand elevated carbon dioxide levels was used to measure breath-holding time. Utilizing a wet spirometer which assesses the maximum volume of air that can be expelled from the lungs vital

capacity was finally determined. These physiological factors offer important information about football player's physical condition and athletic ability.

4. RESULT AND FINDINGS

The study findings offer a thorough examination of the effects of High-Intensity Interval Training (HIIT) on the physiological and physical characteristics of male football players competing at the collegiate level. Pre-test and post-test results for the experimental group which participated in a structured HIIT program and the control group which did not receive any specialized training were compared to arrive at the conclusions. Agility flexibility breath-holding time and vital capacity were among the important parameters that were examined using ANCOVA and dependent t-tests to assess the interventions efficacy. The pre-test and post-test mean scores of the experimental and control groups for the selected physical and physiological variables were analyzed using the dependent 't' test, and the findings are presented in Table 1.

TABLE 1: MEANS, STANDARD DEVIATION AND DEPENDENT-'T' TEST VALUES ON SELECTED PHYSICAL AND PHYSIOLOGICAL VARIABLES OF EXPERIMENTAL AND CONTROL GROUPS

Variable Name	Test	Experimental Group	Control Group
Agility	Pre Test	18.46	18.44
	Post Test	16.85	18.41
	t- test	**11.47***	1.09
Flexibility	Pre Test	26.79	27.14
	Post Test	39.11	27.85
	t- test	**9.18***	0.99
Breath Holding Time	Pre Test	42.78	42.95
	Post Test	56.13	43.27
	t- test	**15.94***	1.00
Vital Capacity	Pre Test	3.94	3.91
	Post Test	4.37	3.95
	t- test	**10.67***	0.63

**Significant at 0.05 level. (Table value required for significance at .05 level for 't'-test with df 14 is 2.15)*

Table 1 reveals that the experimental group showed significant improvements in selected physical and physiological variables, including agility, flexibility, breath-holding time, and vital capacity, compared to the control group. These findings confirm that the experimental group experienced notable positive changes in the chosen variables among football players. In contrast, the control group did not exhibit any significant changes, as the calculated 't' value was lower than the critical table value, indicating their lack of participation in specific training. The analysis of covariance (ANCOVA) results for the selected physical and physiological variables of the experimental and control groups are presented in Table II.

TABLE 2: ANALYSIS OF COVARIANCE ON SELECTED PHYSICAL AND PHYSIOLOGICAL VARIABLES OF EXPERIMENTAL & CONTROL GROUPS

Test	Experimental Group	Control Group	SOV	SS	Df	MS	F-ratio
	Adjusted Post-Test Mean						
Agility	16.87	18.42	B.M	33.29	1	33.29	**30.54***
			W.G	29.43	27	1.09	
Flexibility	40.02	28.14	B.M	138.16	1	138.16	**27.91***

			W.G	133.65	27	4.95	
Breath Holding Time	56.21	43.31	B.M	84.84	1	84.84	**40.79***
			W.G	56.16	27	2.08	
Vital Capacity	4.39	3.96	B.M	10.80	1	10.80	**25.11***
			W.G	11.61	27	0.43	

**Significant at 0.05 level. Table value for df 1, 27 was 4.21.*

Table 2 indicates that the adjusted post-test mean values for the experimental and control groups on selected physical and physiological variables were as follows: agility (16.87 & 18.42), flexibility (40.02 & 28.14), breath-holding time (56.21 & 43.31), and vital capacity (4.39 & 3.96), respectively. These variables had F-ratios of 30.54, 27.91, 40.76 and 25.11 which at degrees of freedom of 1 and 27 were higher than the critical table value of 4.21. At the 0.05 confidence level, this indicates that the experimental groups adjusted post-test mean values were significantly higher than the table value. The study's findings revealed a significant mean difference between the adjusted post-test means of the experimental and control group.

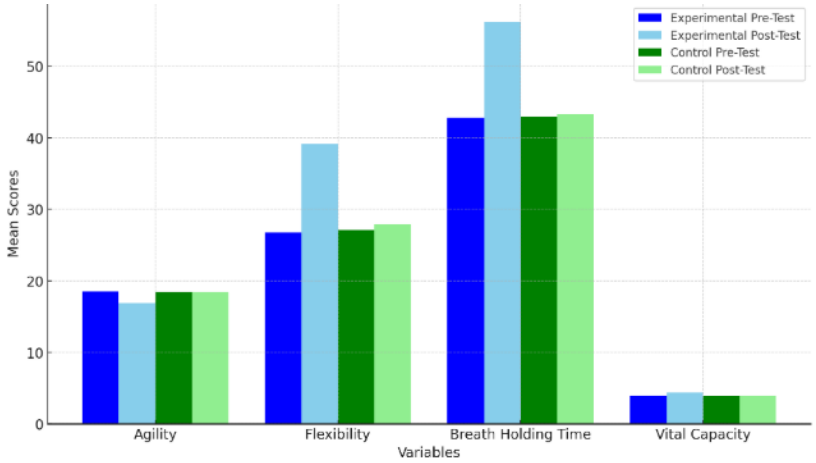

Figure 2. Pre-test and Post-test Mean Scores

The experimental and control groups mean scores before and after tests for the four variables of agility flexibility breath-holding time and vital capacity are shown in Figure 2. Following the intervention the experimental group showed notable improvements in every variable as evidenced by the higher post-test scores relative to pre-test scores. For example flexibility rose from 26.79 to 39.11 and agility improved from 18.46 to 16.85. The control group on the other hand displayed very little change with post-test results almost exactly matching pre-test results. For example agility remained at 18.44 and 18.41 respectively.

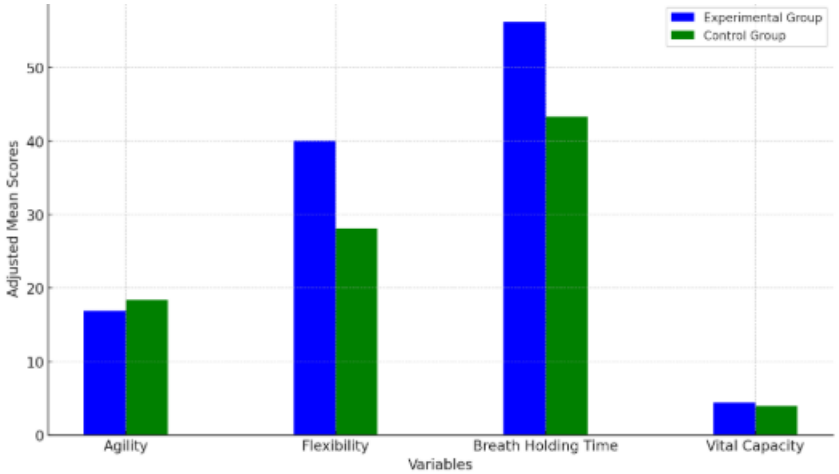

Figure 3. Adjusted Post-test Mean Scores

Figure 3 depicts the adjusted post-test average scores for both groups, indicating that the experimental group exceeded the control group in every variable. For example, the flexibility score of the experimental set was 40.02, whereas the control group scored 28.14, and their breath-holding time was 56.21, compared to 43.31. These differences imply the substantial impact of the training on the experimental group. Overall, the findings confirm that the specific intervention applied to the experimental group led to notable improvements in physical and physiological performance, whereas the control group displayed minimal changes.

5. DISCUSSION

A systematic review examined HIIT's impact on strength, speed, and endurance among racket sports athletes. It concluded that HIIT improves cardiorespiratory and sprint performance but highlighted a need for sport-specific protocols, **PLOS ONE** (2023). HIIT significantly improved VO_2max and running-based aerobic performance in team sports like basketball, soccer, and volleyball. Duration varied from 2 to 10 weeks, showing effectiveness even in shorter protocols **Martins et al.** (2019). A meta-analysis found HIIT enhances VO_2max and anaerobic capacities in football, basketball, and handball players. The study emphasized HIIT's suitability for time-limited training regimens. Comparing HIIT to small-sided games, it was shown to be effective in improving aerobic and anaerobic fitness, although its advantages over alternative protocols were not always significant, **Jensen et al.** (2023). HIIT improved cognitive performance and altered neurobiological markers more effectively than moderate-intensity continuous exercise in trained athletes (BMC Sports Science, Medicine and Rehabilitation, 2023) **Candelaria et al.** (2023). Among young athletes, HIIT protocols enhanced endurance and VO_2peak, supporting its utility in improving sport-specific fitness efficiently **Alford et al.** (2023). Studies indicate significant improvements in sprint and shuttle-run performance with HIIT, highlighting its relevance for high-intensity sports like basketball and soccer. Across various team sports, HIIT was effective in improving strength, power, and speed, especially for athletes engaged in time-restricted training programs. HIIT protocols demonstrated better or equal improvements in fitness outcomes compared to traditional steady-state training, supporting its growing adoption in diverse sports **Alford et al.** (2023).

6. CONCLUSION

High-Intensity Interval Training (HIIT) has been shown to significantly improve both physical and physiological variables among football players. Studies highlight enhanced agility, flexibility, breath holding time and vital capacityy following HIIT protocols, which are crucial for the high-intensity, intermittent nature of football. This time-efficient training method proves beneficial for football players by improving fitness without the need for extensive training hours, making it a valuable tool in optimizing athletic performance in competitive environments.

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