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Review

Influence of Physiotherapist-Supervised Endurance Programs on Improving Cardiorespiratory Efficiency in Football Players: A Narrative Review

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Abstract

Background: Football is a challenging and tough sport that keeps going in demand of both aerobic and anaerobic endurance to play. Cardiorespiratory fitness is often measured by VO_2 max and is important for a player's ability to sustain high-intensity performance throughout a full 90-minute match. While traditional coaching has mainly focused on tactical program, there is growing attention on physiotherapist-led conditioning programs. These programs aim to reduce injury risk, manage training load, and enhance physiological performance. Training strategies such as high-intensity interval training (HIIT), small-sided games (SSG), and functional training are commonly used to develop these physical abilities.

Objective: The main aim of this narrative review is to examine existing research on how different endurance training programs, specifically high-intensity interval training (HIIT), small-sided games (SSG), combined training and continuous training affect the cardiorespiratory fitness of football players and is to guide according on the evidence-based physiotherapy practice.

Methods: A literature search was conducted for studies published between 2017 and 2025. Thirteen relevant studies were included in the review. The studies involved football players from high school to elite levels who participated in endurance training interventions, including high-intensity interval training (HIIT), small-sided games (SSG), continuous training, and resistance training. Data on VO_2 max, physical performance, and physiological adaptations were collected and summarized.

Results: All high-intensity protocols—HIIT, High-Intensity Functional Training (HIFT), and Interval Training—resulted in significant improvements in VO2 Max or VO2 peak across various player levels. SSGs were found to be physiologically equivalent to running-based HIIT in enhancing intermittent

endurance capacity (VIFT). The most contemporary studies demonstrated that Combined Training such as DHIRT and Stretching protocols elicited superior, holistic gains in overall endurance.

Conclusion: High-intensity interventions, particularly (SSG) and (Combined Training), are effective strategies for maximizing cardiorespiratory endurance in football. Physiotherapists should include trainings such as SSG as the primary sport-specific conditioning tool and consider Combined Training for comprehensive physical development.

Keywords: Aerobic Capacity, Cardiorespiratory Endurance, Combined training, Football Players, High-Intensity Functional Training (HIFT), High-Intensity Interval Training (HIIT), Interval Training, Physiotherapy, Small-Sided Games (SSG), VO2 Max.

Introduction

Football is physiologically classified as an intermittent sport due to its non-stop, yet fragmented nature of activity. A match is defined by frequent, short-duration bouts of high-intensity efforts, including maximal sprints, changes of direction, tackling, and jumping, which are interspersed with periods of low-to-moderate intensity activity, such as walking, jogging, or passive recovery. These are repeated high-intensity efforts that impose significant and distinctive metabolic effects on players and to perform technical skills effectively and sustain optimal decision-making throughout the approximately 90-minute match, athletes need the ability to rapidly recover between sprints and multiple anaerobic bursts.[1, 3]

Cardiorespiratory Endurance is the cornerstone of physical fitness, representing the efficiency of the body's circulatory and respiratory systems to collect, transport, and utilize oxygen to fuel sustained physical activity. Typically, it is measured as maximal oxygen uptake, as it is a critical component of physical fitness in football, directly influencing a player's capacity to sustain high-level performance throughout a match and recover effectively between high-intensity efforts. [3] In the context of football, cardiorespiratory endurance is quantitatively assessed by the maximal oxygen uptake which represents the highest rate at which the body can consume and utilize oxygen.[3] As a critical component of physical fitness, VO_2 max directly influences a player's ability to maintain high-level performance throughout a match and recover effectively between high-intensity efforts.[1]

Maximizing this physiological capacity is therefore a fundamental objective of athletic preparation, requiring physiotherapists to play a key role in integrating conditioning protocols that are not only effective but also minimize injury risk.[4]

Training methodologies have shifted toward high-intensity and time-efficient protocols just in case to address the high aerobic demands and the necessity for repeated high-intensity efforts. The principal, evidence-based conditioning protocols available for football players now include High-Intensity Interval Training (HIIT), Small-Sided Games (SSGs), High-Intensity Functional Training (HIFT), and various forms of Combined Training.[4,5]

High-Intensity Interval Training is a training method that alternates between short, maximal efforts i.e. near or above maximum heart rate and brief periods of recovery or low-intensity exercise. It is considered as a viable and time-saving alternative to traditional endurance conditioning, proving highly effective for improving aerobic fitness and VO_2 max even in elite players.[1, 3, 10]

Small-Sided Games are a sport-specific training method characterized by playing a form of football on a reduced area with a low number of players such as 3 vs 3, 6 vs 6. It trains physical, technical, and tactical components simultaneously. Proven to be physiologically equivalent to running-based HIIT for improving intermittent endurance capacity.[2, 6,7]

High-Intensity Functional Training is a specialized protocol involving complex, multipoint, and functional movements like lifts, carries, or sport-relevant motions and is

performed at a consistently high intensity. It is effective for enhancing $VO_{2\ peak}$ and overall physical performance by integrating resistance and aerobic work into a single, functional session.[5]

It also leads to superior improvements in VO_2 max compared to traditional continuous aerobic training in adolescent and elite football players.[3, 11]

Combined Training is an integrated training regimen where two or more distinct physical modalities, such as Dynamic High-Intensity Resistance Training (DHIRT) and stretching, or Maximal Aerobic Speed (MAS) work and SSG are used together. It is a holistic approach designed to promote simultaneous gains across multiple physical parameters such VO_2 max, strength, power, flexibility, leading to superior athletic development.[4, 8]

The diversity of effective, high-intensity training methods (HIIT, HIFT, SSG, and Combined Training) presents a challenge for physiotherapists in selecting the most optimal, evidence-based strategy for a given player population. Such programs are particularly beneficial for youth players undergoing physiological development [9, 12]

Therefore, this review aims to synthesize the chronological evidence from the provided literature to guide training prescription for enhancing cardiorespiratory endurance in football players.

Need of Study

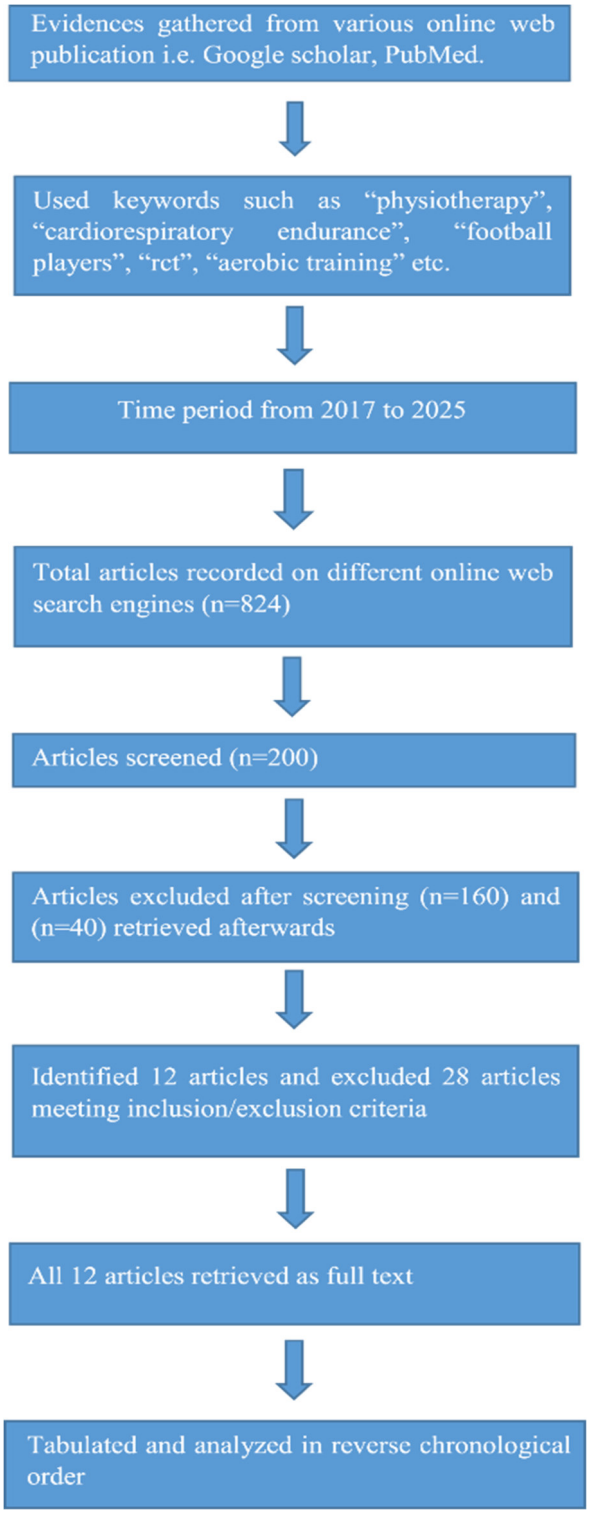
The complexity of football's high-intensity demands and the rapid development of diverse, highly effective training protocols HIIT, SSG, HIFT and Combined training needs a structured, up-to-date review to translate chronological scientific findings into realistic, evidence-based training decisions for enhancing cardiorespiratory endurance and overall physical ability in football players.

Objective of Study

- To systematically review recent literature on training interventions for improving cardiorespiratory endurance in football players.

Methodology

The evidence was gathered from online web publications obtained from different search engines, including Google Scholar and PubMed. A tailored search was conducted using keywords such as "physiotherapy", "cardiorespiratory endurance", "football players", "rct", "aerobic training", and more to retrieve relevant publications. The time period was designated as



2017 to 2025 to gather precise and current facts from throughout the globe over the course of the past decade. In total, we found 12 articles that matched our requirements. All 12 publications were collected in their complete form and subjected to further analysis. The literatures were then tabulated and analysed in reverse chronological order to prioritize the most current research findings in the discussion section.

Materials and Methods:

Inclusion Criteria

- Randomized controlled trials (RCTs) or comparative experimental studies from 2017 to 2025.
- Studies involving male and female football players.
- Age category from 14 to 25± years.
- Different training interventions including HIIT, SSG, HIFT, Interval Training, or Combined Training protocols.
- All sort of football players such as adolescent's players, amateur players, moderately trained participants, national level players and high school players.

Exclusion Criteria

- Studies not involving football/soccer players.
- Players with any orthopaedic conditions, cardiovascular conditions or any neurological signs and symptoms.
- Narrative review and other literature articles were excluded except systemic review.
- Articles published prior to 2017 were excluded.

Result

Every high-intensity protocol—Interval Training, HIFT, and HIIT—successfully leads to a significant rise in a player's VO_2 max or $VO_{2peak.}$ SSGs were found to perform just as well as running-based HIIT in boosting intermittent endurance capacity, as measured by VIFT. However, the most cutting-edge studies confirm that using Combined Training strategies such as DHIRT plus Stretching is the most effective way to achieve better, all-around increases in VO_2 max and general stamina.

Review of Literature

Author	Sample Size	Study Duration	Outcome Measures	Age Group	Intervention	Cardiorespiratory Outcome
Singh AJ et al. (2025)	30 male youth football players	6 weeks	40-yard sprint (Speed) 10x4m shuttle run (Agility) Standing broad jump (Strength)	12 to 16 years	Interval training program	The main focus was on motor skills, the study tells that such high-intensity interval training (HIIT) is effective for improving cardiovascular function and metabolic efficiency.
Ziab et al. (2025)	46 Novice Players	6 weeks	12-minute Cooper test (for VO_2 max)	15–18 years (Novice/Adolescent	Combined Dynamic High-Intensity Resistance	Significant improvement in $V0_{2\ max}$ (5.83% increase) and

					Training (DHIRT) + Static Stretching	overall endurance.
Niknam et al. (2025)	20 Adolescent Players	8 weeks	20-meter shuttle-run test (for VO_2 Max)	Adolescent 14–16 years (Well-trained)	High-Intensity Functional Training (HIFT) vs. Moderate-Intensity Technical Training (MITT)	VO_2 peak was significantly higher in the HIFT group post-intervention compared to MITT.
Arslanoglu et al. (2024)	60 amateur male football players	12 weeks	Yo-Yo Intermittent Recovery Test Level 1 (Aerobic Capacity)	Mean age: - 23.40 ± 2.92 for Combined Training (CT) 23.93 ± 2.46 for Maximal Aerobic Speed (MAS) 24.80 ± 5.84 for Normal Training (NT)	Combined Training: Maximal Aerobic Speed (MAS) + Small-Sided Games (SSG)	Effective method for aerobic capacity development; SSG and running training were equally effective.
Singh et al. (2024)	30 Male Players	6 weeks	Cardiorespiratory Endurance (Cooper's 12-min Run Test)	18–24 years (National level)	Interval Training Program	Significant improvement in cardiorespiratory endurance in the experimental group.
Samavati Sharif et al. (2024)	45 young players	6 weeks	Sprint speed test, 4x9 shuttle run agility test, Explosive leg test	Young football players (no specific age mentioned)	Continuous High-Intensity Aerobic Training High-Intensity Interval Training Control Group	Both training types improved fitness, continuous aerobic training potentially resulted in greater overall improvements.
Arifan et al. (2024)	40 football players	16 training sessions	Yo-Yo Intermittent Recovery Test for Maximum Oxygen	14–17 years	Small-Sided Game (SSG) Method	Confirmed that an increase in VO_2 Max is achieved

			Volume (VO_2 Max)			using the SSG method.
Nayıroğlu et al. (2022)	24 Female Players	8 weeks	Final Velocity at 30-15 Intermittent Fitness Test (VIFT)	Under-19	SSG vs. Running-based HIIT	Significant improvements in (VIFT) for both groups, with no significant difference between SSG & HIIT.
Maujud et al. (2021)	51 Football Players	Intervention period likely lasted several weeks	Multistage Fitness Test (VO_2 Max)	Under-14 Football Players	SSG (3 vs 3 and 6 vs 6)	VO_2 Max increased in both the 3 vs 3 and 6 vs 6 SSG groups.
Devereux et al. (2021)	16 Moderately Trained Participants	4 weeks	Cortex Metalyzer-3B on a cycle ergometer (VO_2 Max)	Mean Age: - Females (25.8±7.6) Males (22.2±3.5)	HIIT Cycling (with Elevation Training Mask (ETM) vs. Control)	ETM group showed a significant increment in VO_2 max highlighting the potency of short-duration HIIT.
Belsuch asišanin (2017)	23 National-level Players	8 weeks	Pseudo-ramp treadmill test with VO_2 Max uptake.	25+ years (Elite/National level)	High-Intensity Interval Training (HIIT) (Billat method)	Significant improvement in VO_2 Max.
Howard & Stavrianeas (2017)	32 High School Players	10 weeks	Yo-Yo Intermittent Recovery Test Level 1 (IR1)	High School (Junior varsity)	HIIT vs. Traditional Endurance Running.	Both groups showed significant IR1 improvement; HIIT compared favourably to traditional conditioning.

Discussion

The research on improving cardio-respiratory endurance in football players tells about the: various forms of high-intensity training are highly effective, and there is an increasing trend toward combining methods or using sport-specific drills like SSGs.

In a research study of Singh AJ et al. (2025), it demonstrated that both continuous high-intensity aerobic training and high-intensity interval training (HIIT) effectively improve the physical fitness of young football players, enhancing key performance areas such as sprint speed, agility, and explosive leg power. Both the groups showed gains; continuous aerobic training

appeared to have overall improvements in these fitness factors compared to HIIT. As a result, coaches can use these training protocols to better prepare athletes for the varied physical demands of a competitive match.

In a research study of Ziab et al. (2025), shows evidence on emphasizing the benefit of integrated and functional training on novice players underscores the value of combining conditioning types, finding that Dynamic High-Intensity Resistance Training (DHIRT) with stretching was effective in significantly increasing VO_2 max by 5.83%. This finding also suggests that a holistic protocol addressing strength, power, and flexibility alongside endurance is highly effective for global athletic improvement, a key consideration for physiotherapists aiming for injury prevention and performance.

In a research study of Niknam et al. (2025), highlighted the functional aspect, they found that High-Intensity Functional Training (HIFT), characterized by complex, multipoint movements, was superior to Moderate-Intensity Technical Training (MITT) in enhancing VO_2 max in adolescent male soccer players. This validates HIFT as a time-efficient, sport-relevant method for driving aerobic adaptation.

In a research study of Arslanoglu et al. (2024), demonstrated the efficacy of a combined Training protocol (Maximal Aerobic Speed plus SSG) for amateur players. Importantly, their findings reinforced the value of Small-Sided Games, noting that SSG and running training were equally effective for improving aerobic capacity. Crucially, they noted that SSG and running-based training were found to be equally effective, providing flexibility in training prescription.

In 2024, Singh et al. conducted a study that confirmed that a focused six-week Interval Training Program is sufficient to elicit significant cardiorespiratory endurance gains in national-level players. This confirms that structured interval training remains a robust method for improving fitness, even at higher performance levels.

In a research study of Samavati Sharif et al. (2024), it shows that a six-week interval training program significantly improves the physical performance of young football players. The training led to clear gains in speed, agility, and explosive leg power. The program also enhanced cardiorespiratory effectiveness by alternating high-intensity work with improvement in endurance. Coaches can use these findings to create better training routines that help players reach higher performance levels.

The research study of Arifan et al. (2024), contributed to the conceptual body of work, affirming the general utility of the SSG method for increasing VO_2 max.

The research study of Nayıroğlu et al. (2022), found that SSGs and running-based HIIT produced comparable and significant improvements in intermittent endurance (VIFT) in under-19 female soccer players over eight weeks. This established SSG as a primary, sport-specific conditioning tool that achieves physiological gains equivalent to running-based HIIT. This suggests that SSGs should be a preferred choice for physiotherapists due to the simultaneous technical and tactical development they afford.

Research findings by Maujud et al. (2021) tell that both of the interventions were effective for increasing VO2 max in youth players. They investigated the impact of different SSG sizes in youth players (Under-14). They found that both SSG 3 vs 3 and 6 vs 6 significantly increased VO_2 max indicating that varied SSG formats can be effectively manipulated by coaches and physiotherapists to achieve aerobic adaptation.

In research study of Devereux et al. (2021), they provided general physiological context on the potency of HIIT. Using a short-duration cycling protocol, their study reported a significant increment in VO_2 max with a large effect size in moderately trained participants, underscoring the high adaptive stimulus generated by HIIT regardless of the modality i.e. cycling or running.

The research study of Belegišanin (2017) demonstrated the clear physiological power of a specific HIIT protocol using Billat method, resulting in a clinically significant improvement in VO_2 max in elite Serbian players ($p < .001$). This study validated the use of HIIT even during the competitive season.

The exploration study of Howard & Stavrianeas (2017), who concluded that in-season HIIT compared favourably to traditional aerobic

exercise in high academy players, emphasizing its practical, time saving benefits.

Conclusion

The scientific literature consistently demonstrates that high-intensity training, whether it is general or specific to the sport, is exceptionally effective at enhancing cardiorespiratory endurance in football players across all skill levels and ages. Specifically, High-Intensity Interval Training, along with its functional adaptation HIFT, reliably produces significant increases in VO_2 max and VO_{2peak}. A key finding is that Small-Sided Games serve as a functionally equivalent alternative to running-based HIIT for boosting intermittent endurance capacity. The strongest evidence, however, suggests that utilizing Combined Training protocols such as DHIRT plus stretching provides the most superior and holistic improvements, benefiting both cardiorespiratory endurance and strength/power characteristics in players.[2,3,4,5]

Limitations of the Study

The reviewed studies involve diverse populations (novice to elite; adolescent to adult) and varying intervention durations (4 to 12 weeks), which limits the ability to perform a direct quantitative meta-analysis or draw specific, universally applicable protocols.

Recommendations

Physiotherapists and coaches should prioritize Small-Sided Games (SSGs) as the primary method for cardiorespiratory conditioning, particularly when seeking equivalent benefits to running-based HIIT, due to their simultaneous technical and tactical advantages.[2]

For novice or developing players, Combined Training protocols, such as Dynamic High-Intensity Resistance Training (DHIRT) alongside stretching, are recommended to promote holistic athletic gains in endurance, speed, and power.[4]

Future studies should focus on standardizing outcome measures and directly comparing the chronic effects of HIFT vs. SSG on VO_2 max over a full competitive season.

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