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Review

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### A literature review on effectiveness of HIIT for improving aerobic performance in badminton players

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#### Abstract:

**Objective:** To explore the effectiveness of High-Intensity Interval Training (HIIT) on aerobic performance in badminton players.

**Methods:** Searches were conducted in Google Scholar, PubMed, and other scientific databases. A literature review was performed including only experimental and quasi-experimental studies that provided extractable data related to HIIT and aerobic performance. The search included all studies published from 2015 to 2025. Out of the identified articles, a total of six relevant studies were included.

**Results:** After the segregation process, six eligible studies were identified and summarized in tabular form. The study selection process and criteria are outlined in the accompanying flowchart. The reviewed evidence consistently demonstrated that HIIT significantly improves VO<sub>2</sub>max, endurance, agility, and overall aerobic capacity in badminton players.

**Conclusion:** Based on the reviewed studies, HIIT-based conditioning—particularly badminton-specific HIIT formats such as multi-shuttle or footwork interval training—was found to be more effective in improving aerobic performance compared to conventional continuous training methods.

**Keywords:** High-Intensity Interval Training, aerobic performance, VO<sub>2</sub>max, badminton, endurance training.

#### INTRODUCTION:

Badminton is a dynamic racket sport characterised by repeated bursts of high-intensity activities such as smashes, lunges, rapid directional shifts, and fast footwork. These movements occur intermittently throughout a match and are separated by brief recovery periods, placing considerable demand on both the aerobic and anaerobic energy systems [7, 8]. To maintain rally intensity, recover effectively between points, and sustain movement precision over long durations, players require well-developed aerobic endurance. Insufficient aerobic conditioning often results in early fatigue, reduced rally duration, slower recovery, decreased movement efficiency, and an overall decline in performance [1, 5].

The Intermittent pattern of badminton closely resembles the structure of High-Intensity Interval Training (HIIT), making HIIT an appropriate and sport-specific conditioning strategy for players. HIIT alternates high-intensity efforts with short rest intervals and has been shown to enhance several physiological functions, including cardiac output, oxygen utilisation, mitochondrial efficiency, and lactate processing [9–14]. These adaptations contribute to better endurance, quicker recovery, and the improved ability to repeatedly perform high-intensity actions during competition [11, 12].

While continuous aerobic training has traditionally been used to improve endurance, such methods do not fully replicate the pace, intensity, or recovery demands of badminton. HIIT, being more time-efficient and reflective of actual match-play patterns, allows players to simultaneously develop cardiovascular fitness and badminton-specific movement qualities. Interventions such as multi-shuttle training, footwork-based HIIT, and

shuttle-run intervals have demonstrated improvements in aerobic capacity and sport-specific performance measures [1–4, 6].

A player's aerobic performance is influenced by multiple factors, including physical fitness, energy utilisation efficiency, recovery capacity, agility, and coordination. Since badminton involves repetitive high-intensity bouts, athletes with superior aerobic capacity are better able to maintain tactical execution, minimise fatigue-related errors, and sustain optimal performance levels throughout a match [2, 4, 6]. For this reason, developing VO<sub>2</sub>max and overall aerobic conditioning remains a key performance priority.

Evidence across various studies consistently demonstrates that HIIT enhances VO<sub>2</sub>max, endurance, agility, and movement speed among badminton athletes at different competitive levels [1–6]. These findings support the integration of HIIT as an effective conditioning approach in sports training and physiotherapy practice [7, 8].

This review aims to summarise the existing research on the impact of High-Intensity Interval Training on aerobic performance in badminton players, providing insight into how HIIT can be effectively incorporated into training programmes to optimise performance and recovery.

## **NEED OF THE STUDY**

Aerobic endurance is essential for sustaining high-intensity rallies in badminton, but many players experience early fatigue due to poor aerobic conditioning. This study is needed to review existing evidence on the effectiveness of HIIT in improving VO<sub>2</sub>max, endurance, and overall aerobic performance in badminton players.

## **OBJECTIVE OF THE STUDY**

This literature review will specifically examine the existing evidence regarding the effectiveness of High-Intensity Interval Training in improving aerobic performance in badminton players.

## **MATERIALS AND METHODS**

### **Inclusion Criteria**

This study will include experimental, quasi-experimental, and controlled trial publications that specifically investigate the effects of High-Intensity Interval Training on aerobic performance in badminton players.

Only articles published in the English language will be considered.

The articles were published between 2015 and 2025.

Studies involving badminton players of any competitive level will be included.

Both male and female participants are incorporated.

### **Exclusion Criteria**

Articles published in languages other than English were omitted.

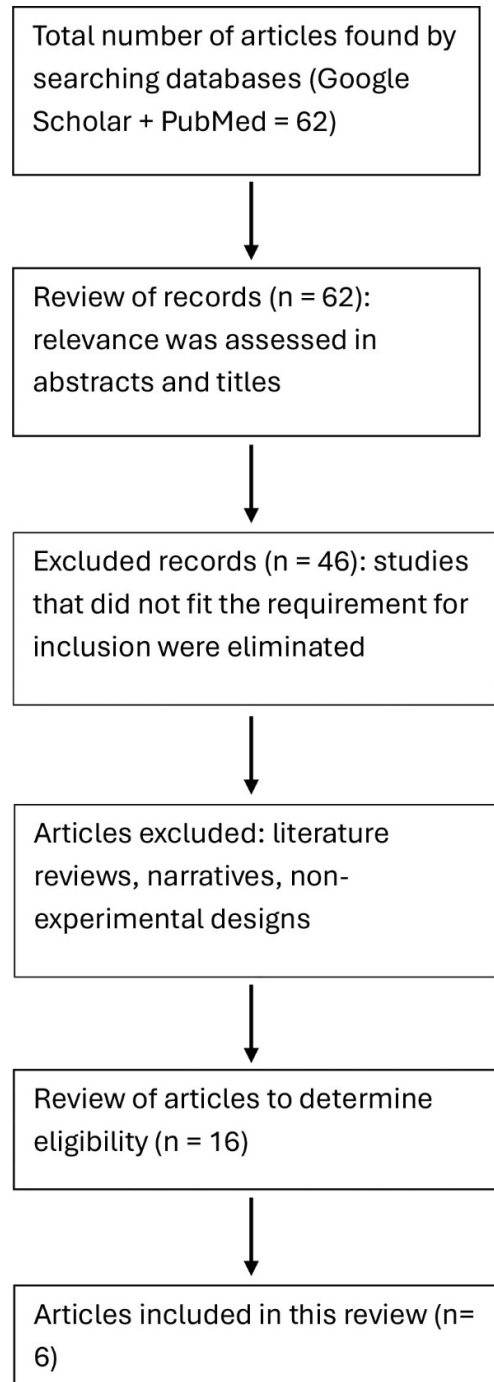
Narrative reviews, systematic reviews, and conference abstracts were excluded.

Articles published prior to 2015 were excluded.

Studies that are not relevant to the specified keywords or do not examine HIIT effects on badminton players were excluded.

## **METHODOLOGY**

The evidence for the present study was gathered from reputable online databases and search engines, including Google Scholar and PubMed. A focused search strategy was used with specific keywords such as “High-Intensity Interval Training,” “aerobic performance,” and “badminton players” to identify relevant publications. The search was restricted to studies published between 2015 and 2025 to ensure the inclusion of recent and sport-specific research. Based on the predefined inclusion and exclusion criteria, a total of six articles were identified as suitable for review. All selected studies were obtained in full text, carefully examined, and the extracted information was organized and presented in a comparative tabular format to provide clarity and support interpretation of findings.



**REVIEW OF LITERATURE**

<b>AUTHOR (YEAR)</b>	<b>SAMPLE SIZE</b>	<b>AGE GROUP</b>	<b>STUDY DURATION</b>	<b>INTERVENTION</b>	<b>OUTCOME MEASURES</b>	<b>KEY FINDINGS</b>
Wee et al. (2017)	18	University badminton players	4 weeks	Badminton specific Multi- shuttle HIIT	VO <sub>2</sub> max, Endurance	VO <sub>2</sub> max increased by ~10%; HIIT improved aerobic performance

Donie & Hermanzoni (2021)	30	University badminton athletes	Not specified	Footwork-based HIIT	VO2max, anaerobic capacity	Significant improvement in aerobic and anaerobic fitness
Bimo et al. (2024)	24	Competitive badminton players	6 weeks	Shuttle run based HIIT	VO2max, speed, agility	Aerobic capacity and agility improved significantly
Ko et al. (2021)	20	Youth badminton players	Short term program	Wingate-based HIIT	VO2max, lactate threshold	Moderate improvement in aerobic performance and recovery
Aydoğmuş et al. (2015)	20	Adolescent badminton players	12 weeks	Badminton specific high intensity vs match play training	VO2max	Both groups showed significant increases in VO2max
Chandu & Johnson (2021)	30	Inter-collegiate male badminton players	8 weeks	HIIT vs Control	VO2max	HIIT produced significant improvement compared to control

## DISCUSSION

The purpose of this review was to compile and evaluate research examining the effectiveness of High-Intensity Interval Training (HIIT) in enhancing aerobic performance among badminton players. The selected studies consistently demonstrated that HIIT contributes to improvements in VO<sub>2</sub>max, endurance, agility, and recovery ability, aligning well with the intermittent and high-intensity physiological demands of badminton [1–6]. Understanding these adaptations provides valuable insight into how HIIT can be integrated as a targeted conditioning strategy across various competitive levels.

A systematic search of scientific databases such as PubMed and Google Scholar Identified several relevant studies, and after applying specific inclusion and exclusion criteria, six articles published between 2015 and 2025 were selected. Although additional work has explored alternative conditioning methods, this review specifically focused on HIIT and its documented effects on aerobic capacity in badminton athletes [7, 8].

The selected studies shared key methodological strengths, including structured training protocols and objective physiological measurements, enabling meaningful comparison between HIIT and conventional or sport-specific training methods. All six studies consistently reported beneficial effects of HIIT, with structured interval-based training producing more pronounced improvements than traditional continuous aerobic conditioning [1–6].

Training duration across the studies ranged from short-term interventions to programs lasting up to 12 weeks. Even with these variations, all studies reported measurable improvements in aerobic capacity, suggesting that HIIT is capable of eliciting meaningful adaptations over both short and extended training periods [2, 4, 5]. These findings align with broader HIIT research demonstrating rapid enhancement of cardiorespiratory function due to the high-intensity stimulus and repeated physiological stress [9–14].

The reviewed studies evaluated outcome measures such as VO<sub>2</sub>max, lactate threshold, agility, shuttle-run performance, and movement efficiency. These measures reflect the energy system demands of badminton, where athletes repeatedly perform explosive, high-intensity movements with brief recovery periods. HIIT interventions such as multi-shuttle routines, footwork intervals, shuttle-run sessions, and Wingate-based protocols successfully targeted these sport-specific demands and demonstrated improvements across multiple performance metrics [1–4].

Wee et al. reported a significant increase in VO<sub>2</sub>max following multi-shuttle HIIT, highlighting the suitability of badminton-specific HIIT drills for improving aerobic performance in trained athletes [1]. Donie and Hermanzoni found similar improvements using a footwork-based HIIT approach, with additional gains in anaerobic capacity, which is essential for repeated explosive actions during rallies [2]. Bimo et al. showed that shuttle-run-based HIIT also enhanced agility and speed, reinforcing the importance of integrating movement-specific training modalities [3]. Ko et al. demonstrated that even short-term Wingate-based HIIT improved

VO<sub>2</sub>max and lactate threshold in youth players, suggesting its usefulness across different age groups [4]. Aydoğmuş et al. observed improvements in VO<sub>2</sub>max in both high-intensity and match-play training groups, confirming the value of intermittent high-intensity work for aerobic development [5]. Chandu and Johnson further strengthened the evidence, showing that HIIT produced greater VO<sub>2</sub>max improvements compared to traditional conditioning in collegiate athletes [6].

Collectively, these findings reinforce that HIIT effectively enhances aerobic capacity and related performance variables in badminton players. The intermittent design of HIIT closely mirrors the physiological and movement patterns required in badminton, making it a particularly relevant training method [7, 8]. Furthermore, evidence from broader HIIT literature supports its efficiency in improving aerobic and anaerobic markers within relatively short training durations [9–14].

HIIT also offers practical advantages, including time efficiency, ease of integration into existing training schedules, and the ability to target multiple physiological systems simultaneously. Based on the compiled evidence, HIIT emerges as a scientifically supported conditioning strategy that can effectively enhance aerobic performance, endurance, and recovery in badminton athletes [1–15].

## LIMITATION AND RECOMMENDATION

A key limitation is the limited number of studies available on HIIT specifically for badminton players, which prevents sport-specific comparison. Future researchers can use this review to design further RCTs and systematic reviews to establish stronger evidence on the effectiveness of HIIT for improving aerobic performance.

## CONCLUSION

Based on this literature review, various HIIT-based training methods are effective in improving aerobic performance in badminton players. All included studies demonstrated meaningful improvements in VO<sub>2</sub>max, endurance, and overall aerobic capacity following HIIT interventions. However, the results suggest that sport-specific or structured HIIT formats (such as multi-shuttle or footwork-based intervals) may produce greater benefits compared to general conditioning methods. We recommend conducting additional studies on this topic, including systematic reviews and randomized controlled trials, to further quantify the long-term effectiveness of different HIIT protocols used by researchers.

## DECLARATIONS

Ethics approval and consent to participate: NA

Availability of data and material: Data openly available in public research databases used for this review.

Competing interest: None

Funding: NA

Authors' contribution:

Mohammed Tabarak M.R – Conceptualization, design, data collection, analysis, interpretation, and manuscript writing.

Sindhura K. Prasanth – Title formation and final manuscript review.

Arnold Nikhilesh – Title formation and final manuscript review.

## ABBREVIATIONS

- HIIT – High-Intensity Interval Training
- VO<sub>2</sub>max – Maximal Oxygen Consumption
- HR – Heart Rate
- RTS – Return to Sport
- LT – Lactate Threshold
- IAT – Illinois Agility Test
- YBT – Y Balance Test
- CMJ – Countermovement Jump
- SP – Speed Performance
- AP – Aerobic Performance

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