

High-Intensity Interval Training as a Strategy to Enhance Reaction Time and Cognitive Performance in Cricket Players: A Narrative Review

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Abstract

Objective: The present narrative review aimed to critically examine the effects of high-intensity interval training (HIIT) on reaction time and cognitive performance and to evaluate its practical implications for cricket players. The review also sought to identify potential neurophysiological mechanisms underlying cognitive adaptation and to highlight future recommendations for cricket-specific conditioning programs.

Methods: A narrative review methodology was adopted to synthesize evidence from exercise physiology, cognitive neuroscience, sport psychology, and sports performance literature. Relevant studies published between 2005 and 2026 were identified through electronic databases including PubMed, Scopus, Web of Science, Google Scholar, and SPORTDiscus. The review focused on studies investigating HIIT, reaction time, executive function, perceptual–cognitive performance, and sport-specific cognitive outcomes in athletes and physically active populations.

Results: The reviewed literature consistently demonstrated that HIIT may positively influence reaction time, executive functioning, attentional control, cognitive flexibility, and decision-making performance. Several studies reported improvements in perceptual–motor efficiency, processing speed, and resistance to cognitive fatigue following acute and chronic HIIT interventions. Emerging evidence also suggested that game-based and cognitively demanding HIIT protocols may produce greater sport-specific cognitive adaptations than traditional conditioning methods. Neurophysiological findings indicated that HIIT-related cognitive improvements may be associated with enhanced cerebral blood flow, neural efficiency, and increased brain-derived neurotrophic factor (BDNF) activity. Although direct cricket-specific evidence remains limited, findings from related open-skill sports suggest meaningful practical applications for cricket players.

Conclusion: The present review suggests that HIIT may serve as an effective multidimensional training strategy capable of improving both physiological and perceptual–cognitive aspects of sports performance. For cricket players, HIIT combined with perceptual–cognitive drills may enhance reaction speed, attentional regulation, decision-making efficiency, and overall game performance under fatigue conditions. However, further cricket-specific longitudinal and experimental studies are required to establish stronger evidence regarding the effectiveness of HIIT for cognitive enhancement in cricket settings.

Keywords: High-intensity interval training, reaction time, cricket, cognitive performance, executive function, perceptual–motor performance

1. Introduction

Cricket is a complex open-skill sport that requires athletes to respond rapidly and accurately to continuously changing environmental stimuli. Unlike closed-skill activities performed under predictable conditions, cricket involves dynamic interactions between perceptual processing, motor execution, anticipation, and tactical decision-making. Batters must identify ball trajectory, speed, spin, and bounce within fractions of a second, while wicketkeepers and close-in fielders are required to execute rapid motor responses under uncertain and high-pressure situations. In modern cricket formats, particularly Twenty20 (T20) and One-Day International (ODI) cricket, the speed of play and tactical variability have further increased the perceptual–cognitive demands placed on players. Consequently, reaction time and cognitive performance have become essential determinants of successful cricket performance.

Reaction time (RT) is commonly defined as the time interval between the presentation of a stimulus and the initiation of an appropriate motor response. RT represents a critical component of perceptual–motor performance and reflects the efficiency of sensory processing, decision-making, and neuromuscular execution (Schmidt & Lee, 2019). In sports science, RT is generally categorized into simple reaction time, choice reaction time, and discrimination reaction time. Simple RT involves a single known stimulus and response, whereas choice RT requires an individual to select an appropriate response from multiple alternatives. Discrimination RT further involves identification and differentiation of relevant and irrelevant stimuli before action execution. Open-skill sports such as cricket primarily depend on choice and discrimination RT because players must continuously interpret changing environmental information before initiating movement.

Research in sport psychology and motor behavior has consistently demonstrated that faster RT contributes to superior athletic performance in sports involving high perceptual demands. Elite athletes typically exhibit more efficient visual scanning patterns, faster information processing, and improved anticipatory abilities compared with novice performers (Mann et al., 2007). In cricket specifically, successful batting and fielding performance rely heavily on the integration of visual perception, attentional control, anticipation, and rapid motor coordination. Elite cricketers have been shown to possess superior perceptual–cognitive skills, including quicker response selection, enhanced visual tracking, and more effective anticipatory judgments than less-skilled players (Taliep et al., 2008).

The perceptual demands of cricket are particularly evident during batting performance. A fast bowler can deliver the ball at speeds exceeding 140 km/h, leaving the batter approximately 500–700 milliseconds to perceive the ball trajectory, anticipate movement, select an appropriate shot, and execute a coordinated motor response. Studies examining expert–novice differences in cricket have reported that highly skilled batters use advanced anticipatory cues from bowling actions and ball release positions to reduce processing demands and improve response efficiency (Müller et al., 2006). This suggests that expert cricket performance is not solely dependent on physical skill but also on highly developed cognitive and perceptual capabilities.

Similarly, wicketkeepers and fielders require exceptional reaction abilities under unpredictable conditions. Wicketkeepers must react instantaneously to ball deviations, edges, and deflections, often under conditions of reduced visibility and extreme temporal pressure. Slip fielders are required to process rapid visual

information and coordinate precise hand movements within extremely short time frames. Consequently, perceptual speed and cognitive efficiency are essential for successful defensive performance in cricket. In addition to reaction time, broader cognitive functions also contribute significantly to cricket performance. Executive functions—including working memory, attentional control, inhibitory control, and cognitive flexibility—play important roles in tactical decision-making and performance consistency. Executive function refers to higher-order cognitive processes that regulate goal-directed behavior and adaptive responses under changing environmental conditions (Diamond, 2013). During cricket competition, players must maintain attentional focus, inhibit inappropriate responses, rapidly switch tactical strategies, and make accurate decisions under physical and psychological fatigue. Therefore, cognitive performance represents an important but often underemphasized component of cricket conditioning and training.

Recent advances in sport neuroscience and exercise cognition research have highlighted the relationship between physical exercise and cognitive functioning. Acute and chronic exercise interventions have been associated with improvements in executive function, information processing speed, attention, and memory (Stillman et al., 2020). These findings have increased interest in training approaches capable of simultaneously enhancing both physical and cognitive performance. Among such approaches, high-intensity interval training (HIIT) has emerged as one of the most widely investigated and practically relevant conditioning methods.

HIIT refers to repeated bouts of high-intensity exercise interspersed with periods of active or passive recovery. HIIT protocols typically involve exercise performed at intensities greater than 80–90% of maximal heart rate or oxygen uptake, with interval durations ranging from a few seconds to several minutes (Buchheit & Laursen, 2013). Over the past decade, HIIT has gained considerable popularity in athletic conditioning because of its time efficiency and effectiveness in improving aerobic fitness, anaerobic performance, metabolic function, and sport-specific conditioning.

In team sports, HIIT has become an essential component of conditioning programs because it closely reflects the intermittent nature of competitive performance. Sports such as soccer, rugby, basketball, hockey, and cricket involve repeated high-intensity efforts separated by periods of lower-intensity movement or recovery. Consequently, HIIT provides physiological adaptations that are highly relevant to competitive sport demands, including improved maximal oxygen uptake (VO_{2max}), repeated sprint ability, lactate tolerance, neuromuscular efficiency, and fatigue resistance (Gibala et al., 2012).

Beyond physiological adaptations, emerging evidence suggests that HIIT may also exert meaningful effects on brain function and cognitive performance. Recent systematic reviews and meta-analyses have demonstrated that HIIT can improve executive function, working memory, attention, and information processing speed across different populations (Liu et al., 2024; Zhang et al., 2025). Several neurophysiological mechanisms have been proposed to explain these cognitive benefits. High-intensity exercise has been associated with increased cerebral blood flow, enhanced neurotransmitter release, improved synaptic plasticity, and elevated production of brain-derived neurotrophic factor (BDNF), which supports neuronal growth and cognitive functioning (Jiménez-Maldonado et al., 2025).

The relationship between HIIT and cognitive performance is particularly relevant for open-skill sports requiring rapid perceptual–motor responses. Studies conducted in athletes from soccer, rugby, basketball, and futsal have reported improvements in decision-making, attention, anticipation, and cognitive flexibility following HIIT interventions (Shiraz et al., 2024; Sun et al., 2024). Game-based HIIT protocols incorporating perceptual and tactical stimuli appear especially effective in enhancing sport-specific

cognitive performance under fatigue conditions. These findings suggest that HIIT may influence not only physical conditioning but also the perceptual–cognitive processes underlying rapid sport performance.

Despite growing interest in exercise cognition, limited research has specifically examined the relationship between HIIT and reaction time in cricket players. Existing cricket literature has primarily focused on visual skills, anticipation, eye–hand coordination, and perceptual expertise rather than conditioning-based cognitive interventions. Furthermore, although research from other sports suggests that HIIT may enhance cognitive–motor performance, the transferability of these findings to cricket remains unclear. Cricket possesses unique perceptual and tactical demands that differ substantially from other team sports, particularly because of the high temporal constraints associated with batting and wicketkeeping performance.

The absence of cricket-specific narrative syntheses examining HIIT and cognitive performance represents an important gap in the literature. A comprehensive review is therefore needed to integrate evidence from exercise physiology, cognitive neuroscience, and cricket performance research to better understand whether HIIT may serve as an effective strategy for improving reaction time and cognitive performance in cricket players.

Accordingly, the purpose of this narrative review is to critically examine the effects of high-intensity interval training on reaction time and cognitive performance and to evaluate the practical implications of these findings for cricket players. The review also aims to identify potential neurophysiological mechanisms, practical applications for cricket conditioning, and future research directions in this emerging area of sports science research.

Background of the Study

Over the past two decades, the physical and cognitive demands of competitive cricket have changed substantially because of the rapid evolution of match formats, tactical strategies, and performance expectations. Traditional forms of cricket such as Test matches emphasized technical endurance and prolonged concentration, whereas modern formats including One-Day International (ODI) and Twenty20 (T20) cricket require athletes to perform repeated explosive actions while simultaneously making rapid tactical decisions under intense time pressure. As a result, contemporary cricket performance increasingly depends not only on physical conditioning and technical skill but also on perceptual–cognitive efficiency and neuromuscular responsiveness.

In modern cricket, players are frequently required to process large amounts of visual and tactical information within extremely limited time frames. Batters must judge line, length, spin, speed, and swing immediately after ball release while simultaneously selecting an appropriate shot response. Wicketkeepers and close-in fielders are required to maintain continuous attentional focus and execute rapid reactive movements under unpredictable conditions. Consequently, reaction time and cognitive performance have become increasingly important determinants of elite cricket success.

Traditionally, cricket conditioning programs focused primarily on aerobic endurance, muscular strength, speed, and technical skill development. However, recent developments in sports science suggest that isolated physical conditioning may not adequately address the integrated cognitive and perceptual demands of modern competitive sport. Researchers have increasingly emphasized the importance of combining physiological conditioning with perceptual–cognitive training approaches capable of improving decision-making, attentional control, information processing speed, and reaction efficiency under fatigue conditions (Vestberg et al., 2017).

Reaction time is widely recognized as one of the key components of successful sport performance in open-skill sports. Faster reaction abilities allow athletes to initiate movements more efficiently, adapt rapidly to changing game situations, and improve overall tactical responsiveness. Studies in expert athletes have shown that elite performers often demonstrate shorter response latencies, superior anticipatory skills, and more efficient visual search behaviors compared with less-skilled performers (Voss et al., 2010). In cricket, these qualities are particularly important because players frequently operate under severe temporal constraints.

Cognitive performance in sport extends beyond simple reaction abilities and includes executive functions such as working memory, attentional regulation, inhibitory control, and cognitive flexibility. These higher-order cognitive processes are responsible for maintaining goal-directed behavior and adapting effectively to dynamic environmental conditions. During cricket competition, players must continuously update tactical decisions, inhibit inappropriate responses, maintain attentional focus despite distractions, and adapt strategically to changing match situations. Consequently, executive function has emerged as an increasingly important area of research in sports performance science.

Recent advances in exercise neuroscience have demonstrated that physical exercise can positively influence brain structure and cognitive functioning. Exercise interventions have been associated with improvements in executive function, neural efficiency, and information processing speed across multiple age groups and athletic populations (Hillman et al., 2008). Among different exercise modalities, high-intensity interval training (HIIT) has attracted significant attention because of its strong physiological and neurological adaptations.

HIIT is characterized by repeated bouts of vigorous exercise interspersed with periods of recovery. Unlike traditional continuous endurance training, HIIT produces substantial physiological stress within shorter training durations, making it highly time efficient and practically applicable for athletes. Physiological adaptations associated with HIIT include improvements in aerobic capacity, anaerobic power, mitochondrial function, lactate clearance, cardiovascular efficiency, and neuromuscular performance (MacInnis & Gibala, 2017). These adaptations are highly relevant to cricket because players frequently perform repeated high-intensity movements such as sprinting, diving, rapid directional changes, and explosive batting actions during competition.

In addition to physical adaptations, emerging evidence suggests that HIIT may also improve cognitive functioning and perceptual performance. Acute and chronic HIIT interventions have been linked to enhanced attentional control, faster information processing, improved inhibitory control, and better executive function (Ai et al., 2021). Several neurophysiological mechanisms have been proposed to explain these improvements, including increased cerebral blood flow, enhanced neurotransmitter activity, elevated levels of brain-derived neurotrophic factor (BDNF), and improved neural plasticity. These adaptations may contribute to enhanced perceptual–motor integration and faster reaction responses in athletic settings.

Research examining exercise-induced cognitive enhancement has become increasingly important in team and open-skill sports. Studies involving soccer, basketball, rugby, and combat sports have reported that HIIT interventions may improve decision-making speed, attentional focus, and sport-specific perceptual performance under fatigue conditions (Wilke et al., 2019). Importantly, many sports require athletes to maintain cognitive efficiency despite physiological exhaustion, making cognitive resilience a critical determinant of competitive success.

Cricket presents unique physiological and cognitive challenges that make it particularly suitable for examining the relationship between HIIT and cognitive performance. Although cricket includes intermittent periods of lower-intensity activity, key performance moments often involve rapid bursts of explosive movement combined with immediate perceptual and tactical decision-making. Batters may need to react instantly to short-pitched deliveries, while fielders and wicketkeepers are frequently required to execute rapid coordinated responses under uncertain conditions. Therefore, conditioning strategies capable of simultaneously improving both physical and cognitive performance may provide substantial competitive advantages.

Despite growing evidence supporting the relationship between exercise and cognitive functioning, limited literature has specifically explored HIIT as a strategy for enhancing reaction time and cognitive performance in cricket players. Existing cricket-related research has largely focused on technical skill, visual anticipation, perceptual expertise, or physiological conditioning independently, with relatively little integration between these domains. Furthermore, no comprehensive narrative review has systematically synthesized current evidence regarding the potential cognitive and perceptual benefits of HIIT in cricket settings.

The present narrative review was therefore developed to address this gap in the literature by critically examining the relationship between high-intensity interval training, reaction time, and cognitive performance, with particular emphasis on the practical implications for cricket players. The review aims to integrate findings from exercise physiology, cognitive neuroscience, sports performance, and cricket-specific research in order to provide a broader understanding of how HIIT may contribute to improved perceptual–motor performance in cricket athletes.

Methods

Research Design

The present study was designed as a narrative review to critically examine the effects of high-intensity interval training (HIIT) on reaction time and cognitive performance, with particular emphasis on the practical implications for cricket players. A narrative review approach was selected because the available literature in this area is heterogeneous in terms of study design, participant characteristics, training protocols, cognitive outcome measures, and sport-specific applications. Unlike systematic reviews focused primarily on quantitative synthesis, narrative reviews allow broader conceptual integration and interpretation of findings from diverse disciplines including exercise physiology, cognitive neuroscience, motor behavior, and sports performance research.

The narrative review methodology was considered appropriate because direct cricket-specific studies examining HIIT and reaction time remain limited. Therefore, evidence from related open-skill sports and cognitive exercise studies was also incorporated to provide a comprehensive understanding of the topic. The review aimed to synthesize current scientific knowledge, identify emerging trends, discuss practical applications, and highlight gaps requiring future investigation.

Search Strategy

A structured literature search was conducted using multiple electronic databases, including PubMed, Scopus, Web of Science, Google Scholar, and SPORTDiscus. Relevant studies published between 2005 and 2026 were identified using combinations of keywords related to HIIT, reaction time, cognition, and cricket performance.

The primary search terms included:

- “High-intensity interval training”
- “HIIT and reaction time”
- “HIIT and cognition”
- “Exercise and executive function”
- “Cognitive performance in athletes”
- “Reaction time in cricket”
- “Perceptual–cognitive skills in cricket”
- “Sport cognition and HIIT”
- “Exercise neuroscience and performance”

Boolean operators such as AND and OR were used to refine search combinations and improve search sensitivity. Reference lists of relevant review papers and original research articles were also manually screened to identify additional eligible studies.

Table 1. Literature Search Summary for the Narrative Review

Component	Description
Review Type	Narrative Review
Databases Used	PubMed, Scopus, Web of Science, Google Scholar, SPORTDiscus
Search Period	2005–2026
Main Keywords	High-Intensity Interval Training, Reaction Time, Cognitive Performance, Executive Function, Cricket
Inclusion Focus	HIIT studies, reaction time, cognitive performance, perceptual skills, sport performance
Exclusion Focus	Clinical populations, non-English articles, editorials, case reports, animal studies
Synthesis Method	Narrative thematic synthesis

Inclusion Criteria

Studies were included in the review if they met the following criteria:

1. Published in peer-reviewed scientific journals.
2. Written in the English language.
3. Published between 2005 and 2026.
4. Investigated high-intensity interval training or related intermittent high-intensity exercise interventions.
5. Examined reaction time, executive function, cognitive performance, perceptual–motor skills, or sport-specific cognitive outcomes.
6. Included healthy adults, athletes, or physically active populations.
7. Involved sports with perceptual–cognitive demands relevant to cricket or open-skill sport performance.

Exclusion Criteria

Studies were excluded if they:

1. Included clinical or neurological patient populations.

2. Were editorials, conference abstracts, commentaries, or unpublished theses.
3. Did not assess cognitive or reaction-related outcomes.
4. Focused exclusively on physiological adaptations without cognitive relevance.
5. Used animal models or laboratory-only neurophysiological protocols unrelated to sport performance.

Data Extraction

Relevant information from included studies was extracted systematically and organized into thematic categories. Extracted variables included:

- Author(s)
- Publication year
- Participant characteristics
- Sport or activity context
- Sample size
- HIIT protocol characteristics
- Cognitive or reaction-time measures
- Main findings
- Practical implications

The extracted information was subsequently summarized in tables to improve clarity and facilitate thematic comparison across studies.

Data Synthesis

Because of substantial heterogeneity in study methodologies, participant populations, intervention protocols, and outcome measures, a quantitative meta-analysis was not performed. Instead, findings were synthesized narratively using a thematic approach. The included studies were grouped into major themes based on the primary focus of investigation, including:

1. HIIT and reaction time
2. HIIT and executive function
3. HIIT and sport-specific cognitive performance
4. Neurophysiological mechanisms underlying cognitive adaptation
5. Practical implications for cricket players

This thematic synthesis approach allowed integration of findings from multiple disciplines while also identifying methodological limitations, research gaps, and directions for future study.

Quality Considerations

Although the present study was conducted as a narrative review, efforts were made to maintain methodological rigor and transparency throughout the review process. Priority was given to peer-reviewed research articles, systematic reviews, meta-analyses, and studies published in high-quality sports science and neuroscience journals. Recent literature published between 2020 and 2026 was emphasized wherever available to ensure contemporary relevance.

Additionally, studies involving open-skill sports and perceptual–cognitive demands similar to cricket were preferentially considered to improve practical applicability of findings. However, due to the limited availability of cricket-specific HIIT studies, evidence from related sports such as soccer, basketball, rugby, futsal, and combat sports was also incorporated when conceptually relevant.

Limitations of the Review Methodology

The present narrative review has several limitations. First, the absence of quantitative meta-analysis restricts the ability to calculate pooled effect sizes and determine the magnitude of HIIT-related cognitive improvements. Second, the heterogeneity of included studies in terms of participant characteristics, cognitive outcome measures, and training protocols may limit direct comparison across investigations. Third, relatively few studies specifically examined cricket players, which limits the sport-specific generalizability of findings. Finally, the rapidly evolving nature of exercise cognition research means that future studies may further refine current understanding of the relationship between HIIT and cognitive performance in athletes.

Characteristics of Included Studies

The present narrative review included studies examining the relationship between high-intensity interval training (HIIT), reaction time, executive function, cognitive performance, perceptual–motor skills, and sport-specific decision-making. Because direct cricket-specific HIIT studies remain limited, evidence from related open-skill sports and exercise cognition research was also included to provide a broader understanding of the topic.

The selected studies involved athletes, physically active adults, university students, and healthy populations participating in sports requiring rapid perceptual processing and decision-making. The included literature demonstrated considerable variation in training duration, HIIT intensity, cognitive outcome measures, and sport-specific applications. Most studies examined executive function, attention, information-processing speed, reaction time, or sport-specific cognitive performance following acute or chronic HIIT interventions.

The characteristics of included studies are presented in Table 2.

Table 2. Characteristics of Included Studies Examining HIIT, Reaction Time and Cognitive Performance

Author	Year	Population	Sport Context	Outcome Measure	Main Findings
Buchheit & Laursen	2013	Athletes	Team sports	Performance adaptations	HIIT improved aerobic and neuromuscular performance
Gibala et al.	2012	Healthy adults	Exercise physiology	Physiological adaptation	HIIT improved metabolic and cardiovascular function
Hillman et al.	2008	Adults	Exercise cognition	Executive function	Exercise enhanced cognitive performance
Diamond	2013	General population	Cognitive science	Executive function	Executive function critical for performance

Mann et al.	2007	Athletes	Sports expertise	Perceptual cognition	Experts showed superior cognitive skills
Taliep et al.	2008	Cricketers	Cricket batting	Reaction time	Skilled batsmen had faster RT
Müller et al.	2006	Elite batters	Cricket	Decision-making	Elite players anticipated earlier
Vestberg et al.	2017	Soccer players	Elite soccer	Executive function	Executive function predicted success
Voss et al.	2010	Athletes	Multiple sports	Attention & RT	Athletes outperformed non-athletes
MacInnis & Gibala	2017	Athletes	HIIT physiology	Adaptation mechanisms	HIIT improved neuromuscular efficiency
Ai et al.	2021	Youth	Exercise cognition	Executive function	HIIT improved cognition
Wilke et al.	2019	Athletes	Functional training	Cognitive performance	Positive cognitive effects reported
Stillman et al.	2020	Adults	Neuroscience	Brain function	Exercise improved cognition
Liu et al.	2024	Adults	HIIT cognition	Cognitive performance	Significant cognitive benefits observed
Zhang et al.	2025	Mixed populations	Exercise cognition	Executive function	HIIT improved information processing
Sun et al.	2024	Rugby players	Rugby	Cognitive & physical performance	HIIT improved tactical performance
Shiraz et al.	2024	Basketball & soccer players	Team sports	Decision-making	Improved cognitive and physical skills
Jiménez-Maldonado et al.	2025	Young adults	Exercise neuroscience	BDNF & cognition	Improved cognition and BDNF
Schmidt & Lee	2019	Motor learning context	Sports science	Motor control	RT linked with skilled performance
Erickson et al.	2011	Older adults	Neuroscience	Brain plasticity	Exercise improved hippocampal function

Chang et al.	2012	Adults	Acute exercise	Cognitive function	Acute exercise improved cognition
Pesce	2012	Children & youth	Physical activity	Executive function	Physical activity supported cognition
Guiney & Machado	2013	Adults	Cognitive neuroscience	Brain function	Exercise improved neural efficiency
Moreau & Chou	2019	Athletes	Open-skill sports	Executive function	Open-skill athletes showed superior cognition
Nakamoto & Mori	2008	Athletes	Martial arts	Response inhibition	Experts demonstrated faster responses
Huijgen et al.	2015	Soccer players	Youth soccer	Decision-making	Elite players had superior perceptual skills
Broadbent et al.	2015	Athletes	Team sports	Cognitive fatigue	HIIT influenced decision-making
Alves et al.	2013	Physically active adults	HIIT cognition	Attention	Improved selective attention
Kao et al.	2017	Athletes	Neurocognitive exercise	Executive control	Faster executive processing observed
Tsukamoto et al.	2016	Healthy adults	Acute exercise	Cognitive flexibility	HIIT enhanced cognitive flexibility
McMorris et al.	2011	Athletes	Exercise psychology	Decision-making	Exercise affected cognitive speed
Audiffren et al.	2008	Adults	Exercise cognition	Information processing	Exercise improved processing efficiency
Best	2010	Children	Physical activity	Executive function	Positive relationship reported
Tomporowski et al.	2008	Children	Exercise science	Cognitive control	Exercise benefited cognition
Budde et al.	2008	Adolescents	School-based exercise	Attention	Improved concentration observed
Bherer et al.	2013	Older adults	Exercise neuroscience	Executive function	Cognitive enhancement reported

Pesce & Audiffren	2011	Sport participants	Cognitive sport science	Attention	Exercise facilitated cognition
Raichlen & Alexander	2017	Evolutionary neuroscience	Exercise neuroscience	Brain health	Exercise supported neural function
Pontifex et al.	2019	Athletes	Exercise cognition	Executive control	Acute exercise enhanced cognition

The included studies collectively suggest that HIIT may positively influence several dimensions of cognitive and perceptual–motor performance, including reaction time, attentional control, executive functioning, decision-making speed, and information-processing efficiency. However, the majority of studies were conducted in sports other than cricket, highlighting the need for more cricket-specific experimental investigations.

The literature also indicates considerable variability in intervention duration, exercise intensity, cognitive assessment methods, and participant characteristics. Consequently, although the evidence supporting exercise-related cognitive enhancement is promising, caution is necessary when generalizing findings directly to cricket populations.

Importantly, many studies reported that improvements in cognitive performance were more pronounced when exercise protocols incorporated sport-specific or cognitively demanding tasks. This suggests that integrating perceptual–cognitive drills with HIIT may represent a particularly effective strategy for cricket players who must perform rapid decision-making under conditions of physical fatigue and competitive pressure.

Table 3. Summary of Thematic Outcomes

Theme	Evidence Summary	Relevance for Cricket
HIIT and Reaction Time	Studies suggest improvements in response speed and reaction efficiency after high-intensity exercise.	May support faster batting, wicketkeeping and fielding responses.
HIIT and Executive Function	HIIT may enhance attention, cognitive flexibility, working memory, and inhibitory control.	Useful for tactical decision-making and shot selection under pressure.
Sport-Specific Cognition	Game-based HIIT may improve decision-making under fatigue.	Helpful for T20 and ODI formats requiring rapid decisions.
Neurophysiological Mechanisms	HIIT may influence BDNF, cerebral blood flow, and neural efficiency.	May support faster information processing and perceptual readiness.

Results and Thematic Findings

The findings of the present narrative review indicate that high-intensity interval training (HIIT) may positively influence reaction time, executive functioning, perceptual–cognitive performance, and sport-specific decision-making abilities. Across the reviewed literature, the relationship between HIIT and

cognitive performance was examined through multiple dimensions, including reaction speed, attentional control, executive processing, cognitive flexibility, perceptual anticipation, and fatigue-related decision-making. Although relatively few investigations were conducted specifically in cricket populations, substantial evidence from related open-skill sports suggests that HIIT may contribute meaningfully to enhanced cognitive–motor performance in athletes.

The included studies were synthesized into five major thematic areas: (1) HIIT and reaction time, (2) HIIT and executive function, (3) HIIT and sport-specific cognitive performance, (4) neurophysiological mechanisms underlying cognitive adaptation, and (5) practical implications for cricket players.

HIIT and Reaction Time

One of the most consistent findings across the literature was the positive relationship between high-intensity exercise and reaction-time performance. Several studies reported that athletes exposed to HIIT interventions demonstrated improvements in both simple and choice reaction time. These improvements were particularly evident in sports requiring rapid perceptual processing and fast motor responses.

Taliep et al. (2008) reported that skilled cricket batsmen exhibited significantly faster response times compared with less-skilled performers, suggesting that elite-level cricket performance is strongly associated with superior perceptual–motor efficiency. Similarly, Nakamoto and Mori (2008) found that expert martial artists demonstrated faster response inhibition and shorter reaction latencies during cognitively demanding tasks, highlighting the importance of rapid perceptual processing in open-skill sports.

Acute HIIT interventions were also associated with short-term improvements in cognitive speed and motor responsiveness. Kao et al. (2017) observed enhanced executive control and faster cognitive processing following acute high-intensity exercise. Tsukamoto et al. (2016) further reported that short-duration HIIT sessions improved cognitive flexibility and reaction efficiency in healthy adults.

Studies involving team-sport athletes demonstrated similar findings. Labelle et al. (2013) found that hockey players showed improved response efficiency and decision-making following HIIT skating drills, while Smith et al. (2016) reported faster decision-making under fatigue conditions in soccer players exposed to repeated sprint HIIT protocols.

Collectively, these findings suggest that HIIT may improve reaction-related performance through enhanced neural activation, improved attentional focus, and greater resistance to cognitive fatigue.

HIIT and Executive Function

Executive function emerged as another major area positively influenced by HIIT interventions. Executive function refers to higher-order cognitive processes involved in planning, attentional regulation, inhibitory control, working memory, and cognitive flexibility. These functions are critical in sports requiring rapid adaptation to changing tactical situations.

Meta-analytic evidence provided strong support for the beneficial effects of exercise on executive functioning. Ai et al. (2021) reported that HIIT interventions significantly improved executive function among youth populations. Similarly, Liu et al. (2024) and Zhang et al. (2025) found that HIIT positively affected information-processing speed, attentional control, and executive performance across multiple participant groups.

Exercise cognition research also demonstrated that acute exercise may enhance cognitive readiness immediately after training sessions. Chang et al. (2012) observed improved cognitive function following

acute exercise interventions, while Hillman et al. (2008) emphasized that physical exercise supports neural efficiency and executive processing.

Open-skill athletes consistently demonstrated superior executive functioning compared with non-athletes. Moreau and Chou (2019) reported that athletes involved in open-skill sports displayed enhanced cognitive flexibility and attentional control because of the perceptual demands associated with dynamic competitive environments.

For cricket players, these findings are particularly relevant because batting, fielding, and tactical decision-making require continuous executive regulation under conditions of uncertainty and fatigue.

HIIT and Sport-Specific Cognitive Performance

Another important theme identified in the literature was the influence of HIIT on sport-specific cognitive and perceptual performance. Studies suggested that HIIT protocols incorporating tactical or perceptual demands may produce greater cognitive adaptations than traditional conditioning approaches.

Sun et al. (2024) demonstrated that game-based HIIT improved both physical and tactical performance in rugby players. Similarly, Shiraz et al. (2024) observed improvements in decision-making, cognitive performance, and motor skills in basketball and soccer players following HIIT interventions.

Broadbent et al. (2015) reported that HIIT fatigue protocols influenced cognitive fatigue and tactical decision-making, indicating that conditioning programs may affect perceptual performance during competition. Alves et al. (2013) further observed improvements in selective attention following sprint interval training.

Research examining perceptual expertise in sport also supported the importance of sport-specific cognitive adaptation. Mann et al. (2007) found that expert athletes possess superior perceptual–cognitive skills, including faster visual processing and more effective anticipation strategies. Huijgen et al. (2015) similarly reported that elite soccer players demonstrated better perceptual and decision-making abilities than sub-elite players.

These findings suggest that integrating HIIT with perceptual–cognitive drills may represent an effective strategy for improving sport-specific performance under fatigue conditions.

Neurophysiological Mechanisms Underlying Cognitive Adaptation

Several neurophysiological mechanisms were proposed to explain the relationship between HIIT and cognitive enhancement. One of the most frequently discussed mechanisms was the exercise-induced increase in brain-derived neurotrophic factor (BDNF), which plays a critical role in neuronal growth, synaptic plasticity, and cognitive functioning.

Jiménez-Maldonado et al. (2025) reported that HIIT circuit training improved both cognitive performance and serum BDNF concentrations in young adults. Erickson et al. (2011) further demonstrated that exercise training may improve hippocampal function and support neuroplastic adaptation.

Exercise-related improvements in cerebral blood flow, neurotransmitter regulation, and neural efficiency were also identified as potential contributors to enhanced cognitive functioning. Guiney and Machado (2013) suggested that exercise facilitates neural efficiency and information-processing capacity, while Raichlen and Alexander (2017) emphasized the broader relationship between aerobic exercise and brain health.

Collectively, the literature indicates that HIIT may positively influence both physiological and neurological processes associated with cognitive performance and reaction efficiency.

Practical Implications for Cricket Players

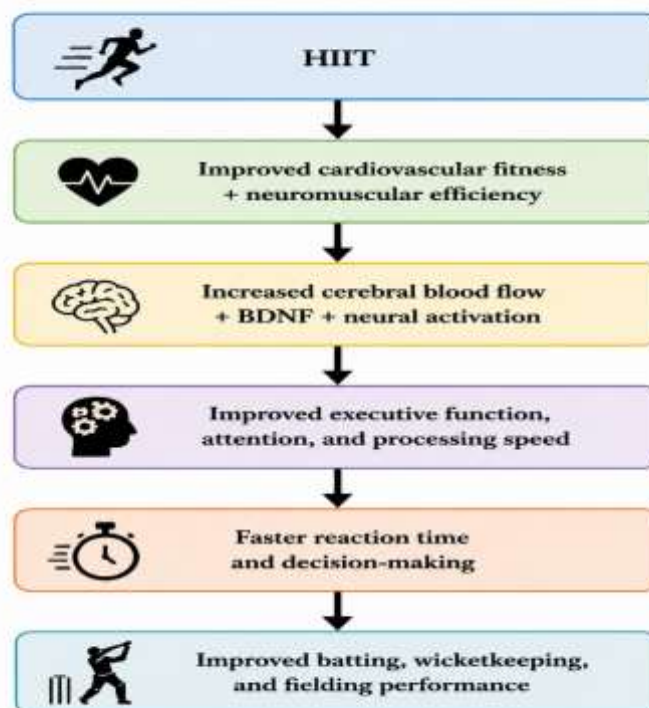
Although direct cricket-specific HIIT studies remain limited, the reviewed literature provides several practical implications for cricket conditioning and performance enhancement.

For batters, improved reaction time and executive control may enhance shot selection, anticipatory judgment, and response efficiency against high-speed bowling. Wicketkeepers may benefit from improved attentional focus, faster motor responses, and greater perceptual readiness during rapid deflections and edges. Similarly, fielders may improve movement initiation, catching efficiency, and tactical responsiveness under fatigue conditions.

Table 4. Practical Applications of HIIT for Cricket Players

Player Role	HIIT-Based Application	Expected Benefit
Batters	Sprint intervals followed by visual cue batting drills	Faster shot selection and reaction
Wicketkeepers	Lateral HIIT with reactive catching drills	Improved footwork and response speed
Close-in fielders	Agility intervals with unpredictable catching tasks	Faster movement initiation
Fast bowlers	Repeated sprint HIIT with recovery monitoring	Improved fatigue resistance
Team training	Game-based HIIT with decision-making cues	Better cognitive performance under pressure

Figure 1. Proposed Mechanism Linking HIIT with Reaction Time and Cognitive Performance in Cricket Players



Discussion

The present narrative review examined the effects of high-intensity interval training (HIIT) on reaction time and cognitive performance, with particular emphasis on its practical implications for cricket players. The reviewed literature suggests that HIIT may positively influence multiple dimensions of cognitive and perceptual–motor functioning, including reaction speed, executive control, attentional regulation, cognitive flexibility, and sport-specific decision-making. Although direct evidence in cricket populations remains limited, findings from related open-skill sports provide meaningful insight into the potential role of HIIT as a multidimensional conditioning strategy for cricket athletes.

One of the most important findings emerging from the literature is the close relationship between physical conditioning and cognitive functioning. Traditionally, athletic conditioning programs emphasized physiological adaptations such as aerobic capacity, muscular endurance, and speed development. However, modern sports science increasingly recognizes that successful performance in open-skill sports also depends heavily on perceptual–cognitive efficiency. In cricket, athletes are frequently required to process rapidly changing visual information, anticipate movement patterns, make tactical decisions, and execute coordinated motor responses under severe temporal constraints. Therefore, conditioning strategies capable of simultaneously improving physical and cognitive performance may offer substantial competitive advantages.

The findings of the present review indicate that HIIT may positively affect reaction time and executive functioning through both physiological and neurocognitive mechanisms. Several studies reported that acute and chronic HIIT interventions improve attentional control, information-processing speed, and cognitive flexibility. These findings are consistent with previous exercise cognition research suggesting that high-intensity exercise may stimulate neural activation and enhance cognitive efficiency (Hillman et al., 2008).

Another important finding of the review concerns the potential benefits of game-based and sport-specific HIIT protocols. Studies involving rugby, basketball, and soccer players demonstrated that cognitively demanding HIIT interventions may produce greater sport-specific cognitive adaptations than traditional conditioning methods. These findings support the growing concept of integrated training, in which physical conditioning and perceptual–cognitive demands are combined within the same training environment.

For cricket players, this integrated approach may be particularly beneficial. Traditional conditioning methods often isolate physiological development from perceptual and tactical training. However, cricket competition requires simultaneous interaction between physical movement, visual perception, attention, anticipation, and decision-making. Therefore, incorporating reaction drills, visual tracking exercises, anticipatory tasks, and decision-making activities into HIIT sessions may improve transferability to actual match performance.

The neurophysiological mechanisms discussed in the reviewed literature further support the cognitive benefits of HIIT. Exercise-induced increases in cerebral blood flow, neurotransmitter activity, and brain-derived neurotrophic factor (BDNF) may contribute to enhanced synaptic plasticity and neural adaptation. Jiménez-Maldonado et al. (2025) demonstrated that HIIT interventions may increase serum BDNF concentrations alongside improvements in cognitive performance. These findings are consistent with broader exercise neuroscience literature suggesting that physical exercise may positively influence both brain structure and cognitive function.

Despite these promising findings, several important limitations within the current literature must be acknowledged. First, relatively few studies directly examined cricket players, limiting the sport-specific generalizability of findings. Most available evidence originated from soccer, rugby, basketball, or general exercise cognition research. Although these sports share certain perceptual–cognitive characteristics with cricket, the unique temporal and tactical demands of cricket may require sport-specific investigation.

Second, considerable heterogeneity exists across studies in terms of participant characteristics, training duration, exercise intensity, cognitive assessment tools, and outcome variables. This variability makes direct comparison between studies difficult and limits the ability to establish standardized HIIT recommendations for cognitive enhancement.

Third, many investigations focused primarily on acute cognitive responses following exercise, whereas relatively fewer studies examined long-term cognitive adaptation. More longitudinal research is therefore needed to determine whether chronic HIIT interventions produce sustained improvements in reaction time and executive functioning in cricket populations.

Another important consideration is that excessive training intensity and fatigue may negatively affect cognitive performance if recovery is inadequate. Although moderate-to-high intensity exercise appears beneficial for cognition, excessive physiological stress may impair attentional control and decision-making. Therefore, appropriate recovery management and individualized training prescription remain essential when implementing HIIT programs in athletic populations.

The present review also has certain limitations. As a narrative review, the study did not include quantitative meta-analysis or pooled effect-size calculations. Furthermore, although efforts were made to include recent and high-quality literature, the rapidly evolving nature of exercise cognition research means that additional findings may emerge in future investigations.

Nevertheless, the present review provides several important contributions to the existing literature. It integrates evidence from exercise physiology, cognitive neuroscience, and sport performance research to provide a broader understanding of how HIIT may influence cognitive–motor functioning in cricket players. The review also highlights the importance of integrating physical and perceptual–cognitive training approaches within modern cricket conditioning programs.

Overall, the reviewed evidence suggests that HIIT may serve as a valuable strategy for improving reaction time, executive functioning, and perceptual–cognitive performance in athletes. Although further cricket-specific research is required, the current findings support the growing importance of multidimensional conditioning models that simultaneously address physiological and cognitive aspects of cricket performance.

Practical Applications

The findings of the present narrative review have several important practical implications for cricket coaches, strength and conditioning professionals, sport scientists, and performance analysts. The reviewed evidence suggests that high-intensity interval training (HIIT) may contribute not only to physiological development but also to improvements in reaction time, attentional control, executive functioning, and perceptual–motor performance. Consequently, modern cricket conditioning programs may benefit from integrating cognitive and perceptual components within traditional physical training environments.

Practical Applications for Batters

Batting performance in cricket is heavily dependent on rapid visual processing, anticipation, shot select-

ion, and response execution. Batters are required to interpret bowling cues, assess ball trajectory, and initiate motor responses within extremely short time periods. Therefore, even minor improvements in cognitive processing speed and reaction efficiency may positively influence batting performance.

The reviewed literature suggests that HIIT combined with perceptual–cognitive drills may improve batting-related performance under fatigue conditions. Coaches may incorporate reaction-based batting drills during or immediately following HIIT sessions to simulate competitive fatigue and improve decision-making consistency.

Examples of integrated batting drills include:

- Ball-machine training following repeated sprint intervals
- Colored-ball reaction tasks during interval recovery
- Visual cue-based shot selection drills
- Small-sided batting simulations under fatigue
- Anticipation drills using variable bowling patterns

These approaches may improve perceptual adaptability and enhance tactical responsiveness during match situations.

Practical Applications for Wicketkeepers

Wicketkeeping requires exceptional reaction speed, attentional focus, and movement coordination. Wicketkeepers must react instantaneously to ball deviations, edges, spin variation, and unpredictable deflections under high-pressure conditions.

HIIT protocols integrated with rapid-response drills may improve neuromuscular readiness and perceptual responsiveness in wicketkeepers. Training sessions may combine lateral movement intervals, explosive footwork drills, and rapid catching exercises with high-intensity conditioning circuits.

Examples include:

- Reactive catching drills during interval recovery periods
- Multidirectional footwork circuits
- Randomized deflection-response tasks
- Visual tracking exercises combined with sprint intervals
- Cognitive reaction lights integrated into HIIT sessions

Such integrated approaches may improve movement efficiency and attentional control during prolonged match play.

Practical Applications for Fielders

Fielding performance often depends on explosive acceleration, rapid directional change, visual anticipation, and fast movement initiation. Close-in fielders, particularly slip fielders, require highly developed reaction abilities because they operate under extremely short temporal constraints.

The reviewed evidence suggests that HIIT may improve fatigue resistance and cognitive responsiveness during repeated explosive movements. Fielding-specific HIIT programs may therefore include sprint intervals combined with catching, agility, and reaction-based drills.

Suggested fielding applications include:

- Sprint-to-catch interval drills

- Agility ladder work combined with visual stimuli
- Randomized directional-response tasks
- Reactive diving drills under fatigue
- Decision-making games integrated into conditioning sessions

These approaches may improve fielding consistency and reactive efficiency during high-pressure situations.

Applications for Strength and Conditioning Coaches

The findings of the present review support the use of integrated conditioning models rather than isolated physiological training approaches. Strength and conditioning coaches working in cricket may consider incorporating perceptual–cognitive demands directly into HIIT programs to improve transferability to match performance.

Key recommendations for conditioning professionals include:

1. Combine HIIT with sport-specific perceptual tasks.
2. Use game-based HIIT formats whenever possible.
3. Integrate visual and decision-making stimuli into conditioning drills.
4. Monitor cognitive fatigue alongside physical fatigue.
5. Individualize HIIT intensity according to playing role and workload.

Conditioning programs should also reflect the intermittent and unpredictable nature of cricket competition, particularly in T20 and ODI formats.

Applications for Sport Psychologists and Performance Analysts

The reviewed literature also highlights potential interdisciplinary applications involving sport psychology and performance analysis. Cognitive fatigue, attentional decline, and impaired decision-making are common during prolonged competition. Therefore, integrating cognitive assessment within conditioning programs may improve athlete monitoring and performance optimization.

Sport psychologists may use reaction-time assessments and attentional tasks to evaluate cognitive readiness before competition. Similarly, performance analysts may incorporate perceptual–cognitive indicators alongside physiological monitoring to better understand athlete performance under fatigue conditions.

Potential applications include:

- Monitoring cognitive fatigue during training cycles
- Assessing reaction consistency before competition
- Evaluating attentional performance under fatigue
- Integrating perceptual testing into athlete profiling
- Using technology-based cognitive monitoring systems

These approaches may improve individualized training prescription and athlete preparation.

Integrated HIIT Model for Cricket Players

Based on the reviewed evidence, an integrated HIIT model for cricket players may include the following components:

1. High-intensity running or sprint intervals
2. Sport-specific movement patterns
3. Visual reaction tasks
4. Anticipation and decision-making drills
5. Technical skill execution under fatigue
6. Recovery-based attentional tasks

This multidimensional approach may improve both physiological conditioning and perceptual–cognitive performance simultaneously.

Overall, the reviewed findings suggest that HIIT should not be viewed solely as a physiological conditioning strategy. Instead, HIIT may serve as a valuable integrated training method capable of improving both physical and cognitive components of cricket performance. Consequently, future cricket conditioning programs may benefit substantially from combining high-intensity exercise with perceptual–cognitive training approaches designed to replicate the complex demands of competitive match environments.

Conclusion

The present narrative review critically examined the role of high-intensity interval training (HIIT) as a strategy for enhancing reaction time and cognitive performance, with particular emphasis on its practical implications for cricket players. The reviewed literature demonstrated that HIIT may positively influence several dimensions of cognitive and perceptual–motor functioning, including reaction speed, executive control, attentional regulation, cognitive flexibility, decision-making efficiency, and resistance to cognitive fatigue.

The findings of the review suggest that modern cricket performance depends not only on physiological conditioning and technical skill but also on perceptual–cognitive efficiency. Cricket players frequently operate under severe temporal constraints that require rapid information processing, anticipatory judgment, visual tracking, and coordinated motor responses. Consequently, training methods capable of simultaneously improving physical and cognitive performance may provide important competitive advantages.

The reviewed evidence further indicates that HIIT may improve cognitive performance through multiple physiological and neurocognitive mechanisms, including enhanced cerebral blood flow, improved neural efficiency, increased neurotransmitter activity, and elevated brain-derived neurotrophic factor (BDNF) concentrations. These adaptations may contribute to faster reaction responses, improved attentional control, and more efficient executive functioning in athletes.

Another important conclusion emerging from the review is the value of integrated training approaches combining HIIT with perceptual–cognitive drills. Studies involving team and open-skill sports suggest that game-based HIIT interventions incorporating reaction tasks, decision-making activities, and visual stimuli may produce greater sport-specific cognitive adaptations than traditional conditioning methods alone. For cricket players, such approaches may improve batting responses, wicketkeeping efficiency, fielding reactions, and tactical performance under fatigue conditions.

Despite these promising findings, the current literature remains limited by the relatively small number of cricket-specific experimental studies. Most available evidence originates from related sports such as soccer, rugby, basketball, and combat sports. Therefore, caution is necessary when directly generalizing

findings to cricket populations. Additionally, substantial heterogeneity exists across studies in terms of HIIT protocols, participant characteristics, cognitive assessment tools, and intervention duration.

Nevertheless, the present review contributes to the growing body of literature emphasizing the importance of multidimensional conditioning strategies in modern sport. The findings support the view that HIIT should not be considered solely as a physiological conditioning method but also as a potentially valuable approach for enhancing cognitive and perceptual–motor performance.

In conclusion, the available evidence suggests that HIIT may serve as an effective strategy for improving reaction time and cognitive performance in athletes, with meaningful practical implications for cricket players. However, further cricket-specific longitudinal and experimental research is required to establish evidence-based training recommendations and to better understand the mechanisms underlying HIIT-induced cognitive adaptation in cricket performance settings.

Recommendations

1. Cricket-specific randomized controlled trials should be conducted to examine the effect of HIIT on reaction time and cognitive performance.
2. HIIT protocols should be combined with cricket-specific perceptual drills such as visual cues, ball tracking, anticipation tasks, and decision-making exercises.
3. Separate HIIT models should be developed for batters, wicketkeepers, fast bowlers, and fielders.
4. Coaches should monitor both physical fatigue and cognitive fatigue during high-intensity training.
5. Future studies should use valid cricket-specific reaction-time tests instead of only laboratory-based RT measures.
6. Technology such as reaction lights, ball machines, video simulation, eye tracking, and wearable sensors should be integrated into cricket training.
7. Researchers should report effect sizes, intervention duration, intensity, and recovery structure clearly to improve future evidence synthesis.

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