Jurnal Pendidikan Jasmani (JPJ)
Vol.5, No.1, July 2024
ISSN: 2723-2816 (Online)

Effectiveness of High Intensity Interval Training (HIIT) in Improving Athlete Performance: A Literature Review

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Abstract
This study aims to determine effectiveness of high intensity interval training (HIIT) in improving athlete performance using a literature review approach. PRISMA standards for systematic reviews and meta-analyses were followed in this review investigation. Studies had to be published from 2022 to June 2024. In the search procedure, the following keywords were used: (1) HITT; (2) athlete performance. Scopus search engine was used in the data source of this study. Seventeen articles were created from the 121 search results in the database that were modified to meet the requirements. Research shows that HIIT can lead to significant improvements in various aspects of physical fitness, such as maximal oxygen uptake (VO2max), functional physical performance, fitness indices, and agility.
Keywords: *HITT, Athlete Performance*

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INTRODUCTION

Athlete performance is a multifaceted concept that encompasses optimal physical, mental, and social well-being essential for sporting success (Smyth et al., 2022). To improve performance, regular evaluations are conducted, with the vertical jump being a popular movement to assess lower extremity strength and power, utilizing computer vision techniques for cost-effective analysis (Gerard, 2022; Roygaga et al., 2022). Nutrition plays an important role in optimizing athletic performance, with recommendations emphasizing energy and macronutrient requirements, hydration, and careful use of supplements (Mohiuddin, 2019). Personalized nutrition tailored to an individual's genetic profile is increasingly recognized as beneficial to athletes, given the variation in requirements based on sport, position, and training schedule (Roygaga et al., 2022). Overall, achieving athlete performance health involves addressing multiple domains such as leadership, skilled personnel, performance health culture, operational effectiveness, and integrated strategies within a high-performance sport system.

To improve athlete performance, a combination of strategies involving nutrition, supplementation and training is essential. Sports nutrition plays an important role in optimizing performance and overall health, especially for adolescent athletes, by ensuring proper growth and development (Hamidie & Masuda, 2017). In addition, new oral compositions have been formulated to reduce fatigue, enhance recovery, improve muscle performance, and contribute to overall health, making them beneficial for athletes at various levels (Berg, 2019). Furthermore, the use of specific compositions containing sulforaphane and curcumin has been associated with improved sports performance, recovery, and physiological adaptation following physical activity, exercise, or sports, suggesting potential benefits of these active ingredients in athletic settings (Spriet, 2018). Additionally, research suggests that polyphenols such as curcumin may activate pathways involved in mitochondrial biogenesis, potentially improving muscle adaptation and performance in athletes (Mazzeo, 2019). By combining proper nutrition, supplementation, and targeted training, athletes can strive to improve performance and overall well-being.

High-Intensity Interval Training (HIIT) exercise programs have been shown to be effective in improving anthropomorphic variables, reducing cardiometabolic risk in overweight and obese schoolchildren [(Espinoza Silva et al., 2023), improving aerobic and anaerobic performance, and influencing body tissue composition (Florian & Hurych, 2022). In addition, short-term HIIT programs have shown significant improvements in body composition, cardiovascular fitness, psychological well-being, and executive function in overweight female young adults (Guo et al., 2023). While HIIT programs offer time efficiency and positive health benefits to sedentary individuals and athletes, further research is needed to fully understand their effects on brain-derived neurotrophic factor (BDNF) levels and cardiovascular health, especially in populations with metabolic or cardiovascular disease (Bayrakdaroğlu et al., 2022). Integrating adolescent HIIT programs into existing opportunities, with a focus on developing physical literacy, engaging delivery, and a supportive implementation framework could lead to significant population health impacts (Lubans et al., 2022). This study can be used to build training plans that are tailored to the specific demands of the sport. As a result, this research is crucial for determining training programs. The study's objective is to offer suggestions to the audience based on its findings.

METHOD

A systematic literature review involves a rigorous and structured approach to summarize the existing knowledge on a particular topic, identify gaps in the literature, and suggest areas for future research (Arogundade et al., 2023). It requires careful planning, detailed data collection, and analysis to provide an objective picture of the current state of knowledge in a particular field (Islam & Uddin, 2023). For example, studies have used systematic literature reviews to evaluate correlated storage siting problems, categorizing solution methods into heuristic, meta-heuristic, and data mining approaches (Karo-Karo et al., 2023; Pradana et al., 2023). Such reviews not only inform evidence-based decision-making but also guide the direction of future research by systematizing and synthesizing recent work (Agus Hendriyanto et al., 2023).

Articles published in international journals indexed by the highly respected Scopus database constituted the study population. Articles having H-Index and published in international journals with Elsevier homepage between 2022 and June 2024 are the selected sample. Primary and secondary data sources are the two categories of research data sources used in this study. A data coding sheet was the tool used in this study. This information was helpful in explaining why some studies were not included in the synthesis in addition to acting as an internal audit.

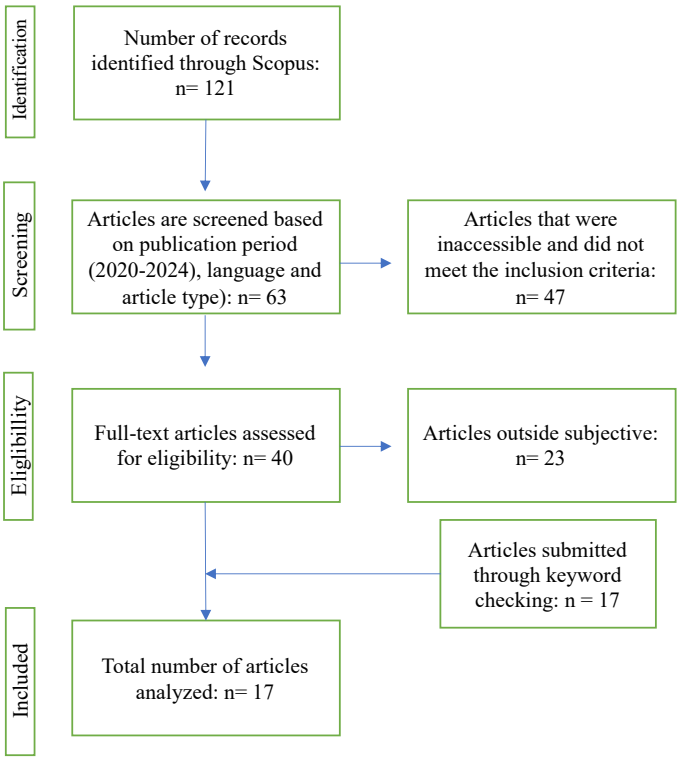

Figure 1. Flow diagram used to select articles.

The keywords “HITT" and "athlete performance" were searched for articles published in Scopus from 2022 to June 2024. As seen in the flow diagram (Figure 1), a total sample of 17 articles from a total of 121 articles was obtained by adhering to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines (Moher et al., 2016) during the identification, screening phase, conformity, and inclusion.

The literature review considered the following variables: (a) the annual trend of articles published between 2022 and June 2024; (b) the distribution of publications at the first author's institution; (c) the number of authors; (d) the field of study (HITT, athlete performance); (e) the type of study (experimental, descriptive, correlational, other); and (f) the average number of citations per article publication.

In order to establish a core collection of papers that might be utilized and subsequently examined, article titles, abstracts, and keywords were reduced. The review authors only included open access publications in their review study because they did not want to leave out anyone who could not access their research. The following inclusion and exclusion criteria were used to select only relevant studies that addressed a certain issue exclusively.

RESULTS AND DISCUSSION

Result

The total number of publications for the chosen time period and the publication year are displayed in the table below.

Table 1. Evolution Of The Number Of Publication At Year

No	Year	Number of Article
1	2022	10
2	2023	7
3	2024	0

Table 2. Review Of Research Results

No	Author and Years	Findings
1	(Dahiya & Kumar, 2023)	HIIT is an effective method for improving athletic performance through its ability to accelerate metabolism, increase calorie expenditure, enhance aerobic resistance, and improve VO2max.
2	(Atakan et al., 2022)	HIIT and SIT increase fat oxidation during exercise, with greater effects seen in longer training regimens and overweight individuals.
3	(Rajar et al., 2023)	HIIT is an efficient and effective exercise for reducing the risk of cardiovascular diseases.
4	(Zaid et al., 2023)	HIIT (High-Intensity Interval Training) can improve health status similar to traditional exercise within a two-week period, and various HIIT protocols such as P90X, Tabata, and Spinning offer benefits.
5	(Gripp et al., 2022)	The real-world HIIT protocol "bip training" significantly improves VO2 max, surpassing traditional MICT in enhancing cardiorespiratory fitness.
6	(Joisten et al., 2022)	HIIT is effective for improving athlete performance.
7	(Rhibi et al., 2022)	HIIT at 110% MAV is more efficient in improving performance, and there is a significant positive correlation between MAV and muscle damage markers.
8	(Fernandes et al., 2023)	HIIT is an effective exercise method for women of all fitness levels and ages, as it significantly improves their body composition both aesthetically and functionally.
9	(Ön, 2022)	The study found that HIIT does not improve agility performance in soccer and volleyball players, but it is effective in enhancing agility recovery post-training.
10	(MS & M, 2022)	HIIT, specifically the Tabata Interval Workout, is an effective method for improving aerobic capacity and speed in amateur tennis players.
11	(Bayrakdaroğlu et al., 2022)	HIIT improves cardiovascular health and performance benefits in athletes.
12	(D'Isanto et al., 2022)	HIIT has been found to improve both the quantitative and qualitative aspects of young soccer players, confirming its effectiveness in enhancing soccer performance.
13	(Westmacott et al., 2022)	HIIT in hypoxia increased VO2max more than HIIT in normoxia.
14	(Haller et al., 2022)	High-intensity interval training (HIIT) leads to an increase in VİO2max in elite athletes.
15	(Wang & Zhang, 2023)	HIIT significantly improves the fitness and agility of soccer players, while also reducing sports injuries and enhancing physical endurance in athletes.
16	(Xueqian & Jiechun, 2023)	HIIT improves athletes' functional physical performance effectively.
17	(Magalhães et al., 2023)	HIIT is an effective method for boosting metabolism, calorie expenditure, aerobic endurance, and VO2max. It is also beneficial for enhancing athletic performance in multiple ways.

Research shows that HIIT can lead to significant improvements in various aspects of physical fitness, such as maximal oxygen uptake (VO2max), functional physical performance, fitness indices, and agility.

Discussion

High Intensity Interval Training (HIIT) has been shown to be highly effective in improving the performance of athletes across a range of sporting disciplines. Studies have shown that HIIT can lead to significant improvements in physical performance, including vital capacity, fitness index, FMS index, VO2max, upper and lower limb explosive strength, and anaerobic power (Chang et al., 2022; Haller et al., 2022; Magalhães et al., 2023; Wang & Zhang, 2023; Xueqian & Jiechun, 2023). The benefits of HIIT stem from its ability to speed up metabolism, increase caloric expenditure, improve aerobic resistance, and improve overall health and well-being. Studies have highlighted that HIIT is particularly beneficial for elite athletes, leading to notable improvements in maximal oxygen uptake and functional physical performance, making it a valuable tool for improving athletic ability efficiently and effectively.

Research from various studies supports the idea that High Intensity Interval Training (HIIT) can indeed produce significant improvements in functional physical performance. Research has shown that HIIT can effectively increase vital capacity (Xueqian & Jiechun, 2023), develop cardiorespiratory fitness, strength, aerobic endurance, and VO2peak (Schlegel et al., 2022), promote improved functional movement in older adults (Stern et al., 2023), improve acceleration, agility, and repeated sprint ability in youth soccer players (Michailidis et al., 2023), and elicit multifaceted improvements in measures of strength, power, and endurance in untrained adolescents (Gavanda et al., 2022). These findings collectively demonstrate the effectiveness of HIIT across a range of age groups and fitness levels, highlighting its potential as a valuable training method to improve various aspects of physical performance.

Research from various studies supports the idea that High-Intensity Interval Training (HIIT) can indeed lead to significant improvements in fitness indices. Studies have shown that HIIT interventions result in improvements in various health-related parameters, including cardiovascular fitness, body composition, and psychological well-being (Domaradzki et al., 2022; Guo et al., 2023; Leahy et al., 2022). Specifically, a study comparing HIIT to traditional moderate-intensity continuous training found that HIIT was more efficacious in improving Fitness Fatness Index (FFI), a predictor of cardiovascular disease risk, with a greater proportion of participants

achieving clinically significant changes in FFI following HIIT (Sharma & Yadav, 2023). In addition, studies in adolescents have shown that HIIT positively impacts cardiorespiratory fitness, especially in boys, emphasizing the effectiveness of HIIT in improving fitness levels across different age groups and populations (Jurić et al., 2023). These findings collectively highlight the effectiveness of HIIT in improving fitness indices and overall health outcomes.

Research from various studies supports the idea that High Intensity Interval Training (HIIT) can indeed produce important improvements in agility performance. The study by Michailidis and Metaxas showed that a short-term HIIT program can improve acceleration, agility and repeated sprint ability in soccer players under 17 years old (Michailidis et al., 2023). Similarly, research by Wibowo showed that HIIT training methods can lead to significant improvements in agility, speed, and cardiovascular endurance in basketball players (Munandar, 2022). Furthermore, Ön's study on male soccer and volleyball players showed that although HIIT may not directly improve agility times, it can help with post-exercise agility recovery (Ön, 2022). These findings collectively highlight the effectiveness of HIIT in improving agility, making it a valuable training method for athletes aiming to improve their performance in sports that require rapid changes in direction and speed.

CONCLUSION

Based on the analysis of the effectiveness of high intensity interval training (HIIT) in improving athlete performance: a literature review, it can be concluded that High Intensity Interval Training (HIIT) has been extensively studied to determine its effectiveness in improving athlete performance. Research shows that HIIT can produce significant improvements in various aspects of physical fitness, such as maximal oxygen uptake (VO2max), functional physical performance, fitness indices, and agility.

ACKNOWLEDGMENT

We are grateful for the contribution of Sekolah Tinggi Olahraga dan Kesehatan Bina Guna to this study.

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