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Effects of High-intensity Interval Training Towards Agility and Vertical Jump Among Female Volleyball Athletes: A Conceptual Study



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Abstract | This narrative review investigates the effects of high-intensity interval training (HIIT) on agility and vertical jump performance among female volleyball athletes. While HIIT is widely recognized for its ability to enhance cardiovascular endurance and overall muscular strength, its specific impact on agility and vertical jump performance remains underexplored. The review synthesizes existing literature, revealing mixed results across various studies. Some research indicates potential benefits of HIIT in improving general physical fitness, which may indirectly support agility and jumping ability. However, other studies show that HIIT alone may not be sufficient to significantly enhance these specific performance metrics. The findings suggest that while HIIT can be an effective component of a broader training regimen, it may need to be combined with sport-specific drills, such as targeted agility exercises and plyometrics, to optimize performance outcomes in female volleyball players. This review highlights the need for further research, particularly studies that focus on gender-specific adaptations to HIIT, to better understand its efficacy in improving agility and vertical jump performance in female athletes. The review reveals that while HIIT is effective in enhancing overall cardiovascular and muscular endurance, its specific impact on agility and vertical jump performance in female volleyball players remains inconclusive, with mixed results across the studies reviewed. The evidence suggests that while HIIT may contribute to general fitness improvements that could indirectly benefit agility and jumping ability, it may not be sufficient as a standalone training approach for optimizing these specific skills.

Keywords: *Volleyball, high intensity interval training, HIIT, vertical jump, agility, female, physical performance.*

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I. INTRODUCTION

Volleyball, introduced by Professor William G. Morgan in 1895, originated as “mintonette,” a game inspired by the Italian sport “Faustball” [1]. As the sport grew in popularity, research has increasingly focused on optimizing training for improved performance, particularly for female athletes, where muscle strength and technical skills are critical [2] [3].

High-intensity interval training (HIIT) targets both aerobic and anaerobic systems [4] and is recognized for improving cardiovascular endurance and overall strength [5]. It involves alternating short, intense exercise intervals with brief recovery periods, making it a highly effective training strategy [6] [7].

Agility and jump performance are critical for success in volleyball [8], as they enable quick directional changes and explosive power, which are essential for executing complex movements and directly impact overall performance [8].

Recent studies highlight vertical jump performance as a key indicator of lower-body power [9] and overall explosive strength, crucial for both offensive and defensive actions in volleyball, such as spiking and blocking [10]. While various training methods target jump height, integrating HIIT offers a unique approach to enhancing explosive power and agility, essential for quick transitions on the court. Existing research demonstrates that HIIT can significantly improve jump performance, as seen in studies with young female handball players [11] and amateur wushu sanda athletes [12], who exhibited notable gains in countermovement and horizontal jump measures.

Agility involves rapid directional changes, while maintaining control and balance is equally vital in volleyball [13]. Quick responses to the dynamic nature of the game significantly impact player effectiveness. Existing literature on HIIT’s impact on agility in other sports suggests promising outcomes. For instance, studies on youth soccer players [14] and taekwondo athletes [15] demonstrated significant improvements in agility metrics following HIIT interventions. Additionally, research on female basketball players [16] indicated that HIIT is as effective as traditional plyometric training in enhancing agility.

Research done by [14], demonstrated that a short-term HIIT program significantly improved agility, as shown by better performance in the Illinois agility test. While [12] further support these findings by demonstrating the benefits of HIIT in enhancing neuromuscular capabilities, particularly vertical jump performance. In their study, amateur wushu sanda athletes underwent a 4-week HIIT protocol incorporated into their regular training. The results revealed significant improvements in the countermovement jump (CMJ), with athletes achieving greater jump height and enhanced explosive power.

Existing research on the effects between HIIT and athletic performance predominantly focuses on general fitness improvements or male athletes, leaving a gap in understanding its effects on female volleyball players [17]. This included emphasizing the need for more studies specifically examining the effects of HIIT on female athletes, particularly in volleyball, as much of the existing literature focuses on male athletes or mixed-gender groups [18].

A. *Effect of HIIT towards agility and vertical jump in volleyball*

This conceptual study investigated the effects of HIIT on agility and vertical jump performance among volleyball athletes by synthesizing existing literature.

The literature suggests that while HIIT improves cardiovascular endurance and overall strength [4], its impact on agility and vertical jump performance is inconsistent with mixed results across the studies

reviewed. Some studies show potential benefits, but others, such as [19], found no significant agility improvements, illustrating the complexity of this skill. The 4-week HIIT practice did not affect agility performance in volleyball players, indicating that while HIIT may lead to short-term improvements in agility, it does not result in long-term enhancements.

Regarding jump performance, no direct evidence of significant improvements following HIIT in volleyball players was found. As reported by [20], suggest that HIIT might contribute to better jump performance from the comparison between the groups shown more significant effects on the experimental group rather than control group. Moreover, the results indicate that the HIIT discussed more effectively enhances athletes' physical coordination compared to traditional volleyball physical training. The experimental group showed a significantly greater improvement than the control group, demonstrating the superiority of the HIIT method for physical coordination.

II. METHODS

This study utilizes a randomized pre-test and post-test design to evaluate the effects of a 6-week training program on female volleyball athletes. A sample of 36 participants, aged 18 to 25, who meet specific inclusion criteria (four years of experience, injury-free for six months, and amateur-level status), are randomly allocated to either a HIIT group or a control group. The HIIT protocol, as adopted from [16], was performed twice per week with progressively increasing intensity over the 6-week period, while the control group continued their regular volleyball training routine. Agility is assessed using the T-test drill, with performance measured by a timing gate system ($r = 0.73$), and jump performance is evaluated through the vertical jump test, utilizing the MyJump 2 application to capture metrics such as jump height, flight time, and power ($r = 0.93$).

The study is conducted over five sessions. In Session 1, athletes are familiarized with the testing procedures to ensure their comfort and safety. Session 2 involves screening, which includes anthropometric measurements (height, weight, and body fat percentage). Sessions 3 is the pre-test phase, where agility and vertical jump tests are administered. In Session 4, participants undergo the 6-week intervention. Session 5 concludes the study with post-testing, where the agility and vertical jump assessments are repeated to determine the training's impact.

III. CONCLUSIONS

In conclusion, the objective of this conceptual study is to examine the effects of HIIT on agility and vertical jump performance among female volleyball athletes by synthesizing existing literature. The evidence suggests that although HIIT may contribute to general fitness improvements that could indirectly benefit agility and jumping ability, it may not be sufficient as a standalone training approach for optimizing these specific skills, which may need to be combined with more sport-specific training interventions [21] to achieve significant improvements in physical performance. The findings from this study may assist coaches and trainers in improving their athletes' performance. Additionally, it provides valuable insights for both coaches and researchers, contributing to the broader field of sports science.

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