

## Can Plyometric Training Improve Badminton Players' Smash Jumps? A Literature Review

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### ABSTRACT:

**Background:** The jumping smash is a crucial attacking technique in badminton that requires leg muscle strength and high explosive power. The performance of this technique is highly dependent on the athlete's explosive ability, so effective and scientifically-based training methods are needed. Plyometric training has been widely used to increase explosive power, but scientific evidence specifically examining its effect on the jumping smash performance of badminton players is still limited and scattered.

**Objectives:** This study aims to critically analyze scientific evidence regarding the effectiveness of plyometric training in improving the jumping smash ability of badminton players.

**Methods:** This study used a systematic literature review method with reference to the PRISMA guidelines. Articles were searched for in the Scopus and Google Scholar databases using the keywords "plyometric exercise" AND "jumping smash" AND "badminton performance." Articles published in the last five years, available in full text, and relevant to plyometric interventions in badminton athletes were analyzed in depth.

**Results:** Of the 677 articles identified, seven studies met the inclusion criteria. The results of the analysis showed that plyometric training consistently improved jump height, lower limb muscle power, and jumping smash performance, including accuracy and effectiveness of the hit. These improvements were closely related to the optimization of the stretch-shortening cycle and neuromuscular adaptation.

**Conclusion:** Plyometric training has been proven to be effective and significant in improving the jumping smash ability of badminton players. This training needs to be integrated systematically, progressively, and specifically into the training program to achieve optimal and sustainable performance improvement.

**KEYWORDS:** plyometric training, jumping smash, badminton

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### I. INTRODUCTION

Badminton is a sport that requires a combination of speed, strength, agility, and explosive power, especially in the jumping smash, which is one of the most effective attacking techniques in a match [1]. The ability to perform an optimal jumping smash is greatly influenced by leg muscle strength and explosive power, so training methods that can significantly improve both aspects are needed [2]. One training method widely used to increase explosive power is plyometric training, which has been proven effective in various sports, including badminton [3].

Various studies show that plyometric training can improve vertical jump ability, leg muscle strength, and explosive performance in athletes [4], [5], [6]. In badminton athletes, plyometric training is applied to increase jump height and reaction speed when performing jumping smashes [7]. These studies generally report a significant improvement in jumping performance and muscle strength after undergoing a plyometric program for several weeks [8]. However, most studies still focus on general aspects of explosive power and have not specifically examined its effect on the jumping smash technique in badminton players.

Although empirical evidence regarding the benefits of plyometrics on explosive power improvement is quite strong [9], There is a gap in research related to the specific application of this exercise on the performance of jumping smashes in badminton. Some studies only assess improvements in vertical jump ability without directly linking it to the effectiveness of the jumping smash

## Can Plyometric Training Improve Badminton Players' Smash Jumps? A Literature Review

[2]. In addition, variations in research design, intervention duration, and subject characteristics have resulted in findings that are not entirely consistent, limiting the generalizability of the findings.

This gap highlights the need for more focused research on the relationship between plyometric training and improved jumping smash performance in badminton players. This research is important to provide a strong scientific basis for coaches and athletes in designing effective and measurable training programs. In addition, the results of this research are expected to enrich the scientific literature and make a real contribution to the development of sports coaching science, especially badminton.

The main objective of this literature review is to critically analyze scientific evidence regarding the effectiveness of plyometric training in improving the jumping smash ability of badminton players. Therefore, this study aims to answer the main question: "Can plyometric training improve the jump smash ability of badminton players?" and identify areas that still require further research. This literature review will also discuss the limitations of previous studies and offer new directions for the development of more effective and efficient training methods.

## II. RESEARCH METHOD

### Search Strategy

The search strategy was conducted systematically using the Scopus and Google Scholar databases, which are considered to be among the leading citation indexing systems [10]. These sources are frequently visited by researchers around the world. The search strategy includes a combination of variations of the keywords "plyometric exercise" AND "jumping smash" AND "badminton performance." The search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [11]. The search is limited to articles published in the last five years (2021–2025) in English and Indonesian. The search process is carried out by combining keywords using Boolean operators (AND, OR) to obtain relevant results.

### Exclusion Criteria

The exclusion criteria in this study included:

- 1) Articles that were not available in full text.
- 2) Studies that did not involve plyometric interventions in badminton players.
- 3) Studies that did not measure jumping smash performance as one of the outcomes.
- 4) Studies involving subjects other than badminton athletes.

### Procedure

The author used the Google Scholar and Scopus databases. The author found 677 articles. In addition, a number of screening procedures based on inclusion and exclusion criteria were used to process and analyze the articles found by the author. After meeting the criteria, there were 7 articles that were suitable. Most of the articles were not used because they did not discuss Plyometric Training in Improving Badminton Players' Jumping Smashes. All articles were extracted from their sources and analyzed using Mendeley to eliminate duplication.

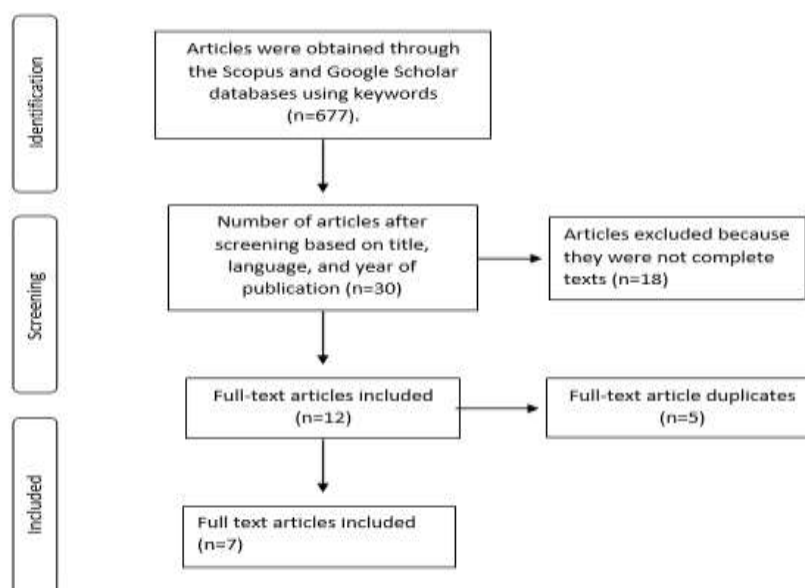


Figure 1. PRISMA Research Flowchart

## Can Plyometric Training Improve Badminton Players' Smash Jumps? A Literature Review

### III. RESULTS

The search results showed that of the 677 articles initially identified through searches of the Scopus and Google Scholar databases. At the screening stage based on year, title, and language, there were 30 articles that were suitable. 18 articles were excluded because they were not text. In addition, 5 articles that were duplicates were removed, leaving 7 articles that met the criteria for further analysis in this study. Below, Table 1 presents a summary of the publications considered in this systematic review.

**Table 1. Article Summary**

Author and Year	Research Methods and Types	Research Objective	Research Results
[12]	Experimental research with pre-test and post-test control group design	To assess the effectiveness of lateral box shuffle plyometric exercises on increasing leg muscle power in badminton athletes	Significant improvement in leg muscle power in the treatment group compared to the control group ( $p < 0.05$ ).
[13]	Experimental research with a 2x2 factorial design	To compare the effects of plyometric and circuit training on badminton jumping smash ability and leg muscle power	Plyometric training showed better results in improving badminton jumping smash skills than circuit training.
[14]	Experimental design with pre-post testing	To evaluate the effects of plyometric and electromyostimulation training on badminton players' performance	Significant improvements in sprint time and vertical jump height for plyometric training, while EMS improved jumping ability.
[2]	Randomized controlled trial	To compare the effects of plyometric training and electromyostimulation on agility, sprint, explosive power, and jumping ability in badminton players	Plyometric training significantly improved sprint time and jumping ability; electromyostimulation improved only jumping ability.
[15]	Randomized controlled trial with experimental and control groups	To investigate the effects of plyometric depth jump training on badminton smash accuracy and lower body power	Significant improvements in smash accuracy and vertical jump height for the experimental group.
[16]	Static-group pretest-posttest design	To assess the effect of plyometric depth jump training on students' jumping smash ability in badminton	Significant improvement in jump height and explosive leg power, contributing to improved jumping smash performance.
[17]	Experimental design with pre-test and post-test control groups	To assess the effectiveness of plyometric training on jumping performance and agility in badminton players	Significant improvement in jumping performance and agility after plyometric training

### IV. DISCUSSION

This literature review consistently shows that plyometric training has a significant effect on improving the jumping smash ability of badminton players. These findings confirm that the explosive component of the legs, which is the main determinant of a successful jumping smash, can be effectively improved through training stimuli that emphasize the stretch-shortening cycle, which is a key characteristic of plyometric training [4], [7].

Biomechanically, jumping smashes require a combination of maximum strength, muscle contraction speed, neuromuscular coordination, and precise timing. Plyometric training has been proven to improve efficiency by increasing tendon stiffness, activating myotatic reflexes, and increasing the recruitment of high-frequency motor units [7], [9]. This mechanism

## Can Plyometric Training Improve Badminton Players' Smash Jumps? A Literature Review

explains why almost all of the studies analyzed reported significant increases in jump height, leg muscle power, and smash-specific performance after plyometric intervention [12], [15], [16].

Findings [15] provides strong evidence that plyometric training not only improves general physical capacity, but also has a direct impact on the technical performance of jumping smashes, including stroke accuracy. This shows that improving leg explosive power through plyometrics can be functionally translated into specific sports skills, rather than simply improving isolated physical variables. In other words, plyometrics have a high transfer of training to competitive badminton performance.

However, this study also identified several important limitations in the existing literature. First, most studies still focus on physical variables such as jump height and muscle power, while measurements of jumping smash performance often do not include comprehensive biomechanical analysis, such as take-off angle, joint angular velocity, or shuttlecock velocity. Second, variations in intervention duration, training intensity, and subject characteristics (age, competition level, and training experience) lead to heterogeneity in findings, which limits the generalizability of research results [4].

In addition, the majority of studies used short-term designs (4–8 weeks), so the long-term effects of plyometric training on jumping smash performance and injury risk have not been fully answered. In fact, plyometric training has high mechanical demands and has the potential to increase the risk of injury if it is not designed progressively and in a controlled manner [3]. Therefore, further research with a longitudinal design and stricter exercise load control is urgently needed.

Practically speaking, the findings in this review have important implications for badminton coaches and practitioners. Plyometric training should be systematically integrated into training programs, taking into account the principles of specificity, progressivity, and individualization of athletes. The combination of plyometric training with jumping smash technique training is expected to produce more optimal adaptations than the separate application of these training methods.

## V. CONCLUSION

Based on a critical synthesis of seven relevant studies, it can be concluded that plyometric training is consistently and significantly effective in improving the jumping smash ability of badminton players through increased leg muscle power, jump height, and the transfer of physical adaptations to specific technical performance such as smash accuracy and effectiveness. The neuromuscular mechanisms resulting from plyometric training, particularly the optimization of the stretch-shortening cycle, have been shown to contribute significantly to the biomechanical requirements of the jumping smash, which demands explosive strength, coordination, and precise timing. However, existing scientific evidence is still dominated by short-term designs and measurements of general physical variables, necessitating further research with a longitudinal approach, more comprehensive biomechanical analysis, and strict training load control to strengthen the generalization of findings. Practically, the results of this review confirm that plyometric training is not merely a supplement, but a strategic component that must be systematically, progressively, and specifically integrated into badminton training programs to optimize jumping

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## Can Plyometric Training Improve Badminton Players' Smash Jumps? A Literature Review

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