



## **Improving Smash Accuracy in Badminton Athletes: A Systematic Literature Review**

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### **Abstract**

Smash accuracy is one of the key factors in badminton performance. To analyze and evaluate the effectiveness of various training methods in improving smash accuracy among badminton athletes. A systematic literature review was conducted using the PICO framework and PRISMA guidelines with predetermined inclusion and exclusion criteria. Article searches were performed on Google Scholar using keywords related to training methods and badminton smash accuracy. After the screening process, 11 articles met the inclusion and exclusion criteria. Among the 11 reviewed articles, drill training methods demonstrated the highest consistency in improving smash accuracy in badminton athletes. Eight articles explicitly showed that drill methods had positive and significant effects on smash accuracy. Variations of drill methods such as V-Drill technique, drills with specific targets, and integrated training models also proved effective. Comparative analysis between methods revealed that more focused and targeted approaches (such as directional smash training and drilling methods compared to target games) tended to be more effective than complex methods. Drill training methods represent the gold standard for improving smash accuracy in badminton athletes, with consistent effectiveness across various age groups and skill levels. Future research should investigate the effectiveness of these methods on elite athletes and conduct longitudinal studies to understand long-term skill retention.

**Keywords:** *Training Methods, Smash Accuracy, Badminton, Systematic Literature Review.*

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## **INTRODUCTION**

Badminton is one of Indonesia's premier sports that is not only popular among the general population but also frequently serves as a source of achievement at regional and international levels. To achieve optimal performance, maturity involving physical, technical, tactical, and mental factors is required (Dipoyanti et al., 2023). In badminton competition, an athlete's success is largely determined by mastery of fundamental techniques, one of which is the smash stroke (Hadi & Mashud, 2025). Accurate and sharp smashes can serve as decisive weapons in scoring points, particularly when facing opponents with strong defensive capabilities (Edmizal et al., 2024). Smash accuracy is a complex skill that requires coordination between technique, timing, and precision (Hadi & Mashud, 2025).

However, several studies indicate that many athletes still experience difficulties in achieving consistent smash accuracy. Studies conducted by Dezon et al. (2025) and Nanggro (2024) on junior athletes showed that smash accuracy levels remained below optimal standards.

Research by Haekal & Basri (2021) and Prasetya et al. (2025) on training methods demonstrated that the use of technology in training can yield better results compared to conventional methods. Studies by Hartanto & Dewi (2024) and Hafidz et al. (2025) also concluded that training methods with immediate feedback provide significant improvements. Despite the existence of various research on effective training methods, many coaches in practice still employ conventional training approaches.

These limitations are caused by several interconnected factors, including limited access to information about current training methods, facility constraints, insufficient funding for advanced training equipment, and the habit of using familiar training methods that may not reflect current best practices. Additionally, the translation of research findings into practical coaching applications often presents challenges, as academic research may not always align with real-world training contexts (Coutts, 2020). This situation creates a significant gap between research findings and field implementation, potentially hindering the development of athletes' technical capabilities and limiting their competitive potential.

Based on the above discussion, several critical problems need to be addressed to advance badminton training practices. First, currently employed training methods are not yet optimal in improving smash accuracy, often lacking evidence-based foundations and failing to incorporate modern understanding of motor learning principles. Second, information about effective training methods remains scattered across various publications and has not been well synthesized into actionable guidance for practitioners. Third, coaches require practical guidance on training methods that are proven effective based on scientific evidence, presented in formats that facilitate implementation in diverse training environments. Fourth, there is a need for systematic evaluation of training methods to determine which approaches yield the most consistent and sustainable improvements in smash accuracy across different athlete populations.

To address these issues, this study employed a Systematic Literature Review (SLR) approach aimed at analyzing and evaluating various training methods that have been proven effective in improving badminton smash accuracy. SLR was chosen because it can provide a comprehensive synthesis of various research findings that have been conducted previously,

offering a robust methodology for identifying, evaluating, and synthesizing evidence from multiple studies. This approach allows for the identification of patterns, trends, and gaps in current research while providing a foundation for evidence-based practice recommendations (Rother, 2007). Through this systematic review, it is expected that a clear picture of which training methods are most effective for improving smash accuracy can be obtained, along with insights into the mechanisms underlying successful interventions and factors that may influence training effectiveness.

This study is expected to contribute significantly to the field of badminton training by providing: (1) a comprehensive summary of effective training methods based on scientific evidence, organized and evaluated according to rigorous criteria, (2) practical recommendations for coaches in designing smash training programs that can be adapted to various training contexts and athlete populations, and (3) identification of research areas that require further development, including gaps in current knowledge and opportunities for future investigation. Additionally, this review aims to bridge the gap between research and practice by presenting findings in a format that is accessible and actionable for coaches, athletes, and sports scientists working in badminton development programs.

## **METHOD**

Data collection was supported by the Google Scholar database. Based on this database, the authors collected relevant articles using specified keywords. The authors also employed the PICO method, which was used to discover new findings (Kuettel & Larsen, 2020). The PICO method details can be seen in Table 1 as follows:

**Table 1.** PICO Method

<b>PICO</b>	<b>Description</b>
<b>P (Problem/Population)</b>	Junior badminton athletes who require improvement in smash accuracy
<b>I (Intervention)</b>	Training methods for improving smash accuracy
<b>C (Comparison)</b>	Training methods without specific intervention
<b>O (Outcome)</b>	Improvement in smash accuracy

The application of the PICO method in this research helped the authors find articles relevant to the research variables as supporting data. For example, searches were conducted using keywords such as "Atlet Bulutangkis" AND "Metode Latihan" AND "Smash" AND "Ketepatan" or "Badminton Athletes" AND "Training Methods" AND "Smash" AND

"Accuracy". These keywords were entered into the Google Scholar database, which collected data from search results relevant to the keywords used. The next step involved data extraction using inclusion and exclusion criteria to make the data more specific to the existing research variables (Ratih & Susanna, 2018). The following description of the use of inclusion and exclusion criteria can be seen in Table 2.

**Table 2.** Inclusion and Exclusion Criteria

Type	Inclusion	Exclusion
Article Type	Research articles	Research reports (theses, dissertations, seminars, proceedings) and books
Publication Year	Last 5 years (2020-2025)	Below 5 years (<2020)
Participants	Badminton athletes	General students (school students) and university students
Research Variables	Analyzing training methods and smash accuracy	Not discussing training methods or not related to smash accuracy
Scope	Indonesian badminton clubs or academies	General schools, campus organizations, or non-professional communities
Validity	Has DOI and registered in SINTA	No DOI and not registered in SINTA
Outcome	Provides data or information about improvement in smash accuracy/precision	Does not explicitly mention smash accuracy outcomes

## RESULTS AND DISCUSSION

### Result

The search results through the Google Scholar database revealed 371 articles from Google Scholar that matched the search keywords. The articles found were then processed and analyzed through several filtering stages based on inclusion and exclusion criteria methods. Based on the results of the article selection stage, the researchers found 11 articles that met the requirements as research samples and reviewed their entire content as research data. For clearer details regarding the article filtering process up to the final stage, it can be seen in the PRISMA flow diagram according to reporting items (Moher et al., 2009) which is preferred for

systematic review and meta-analysis guidelines, an evidence-based checklist used by authors when reporting systematic reviews and meta-analyses.

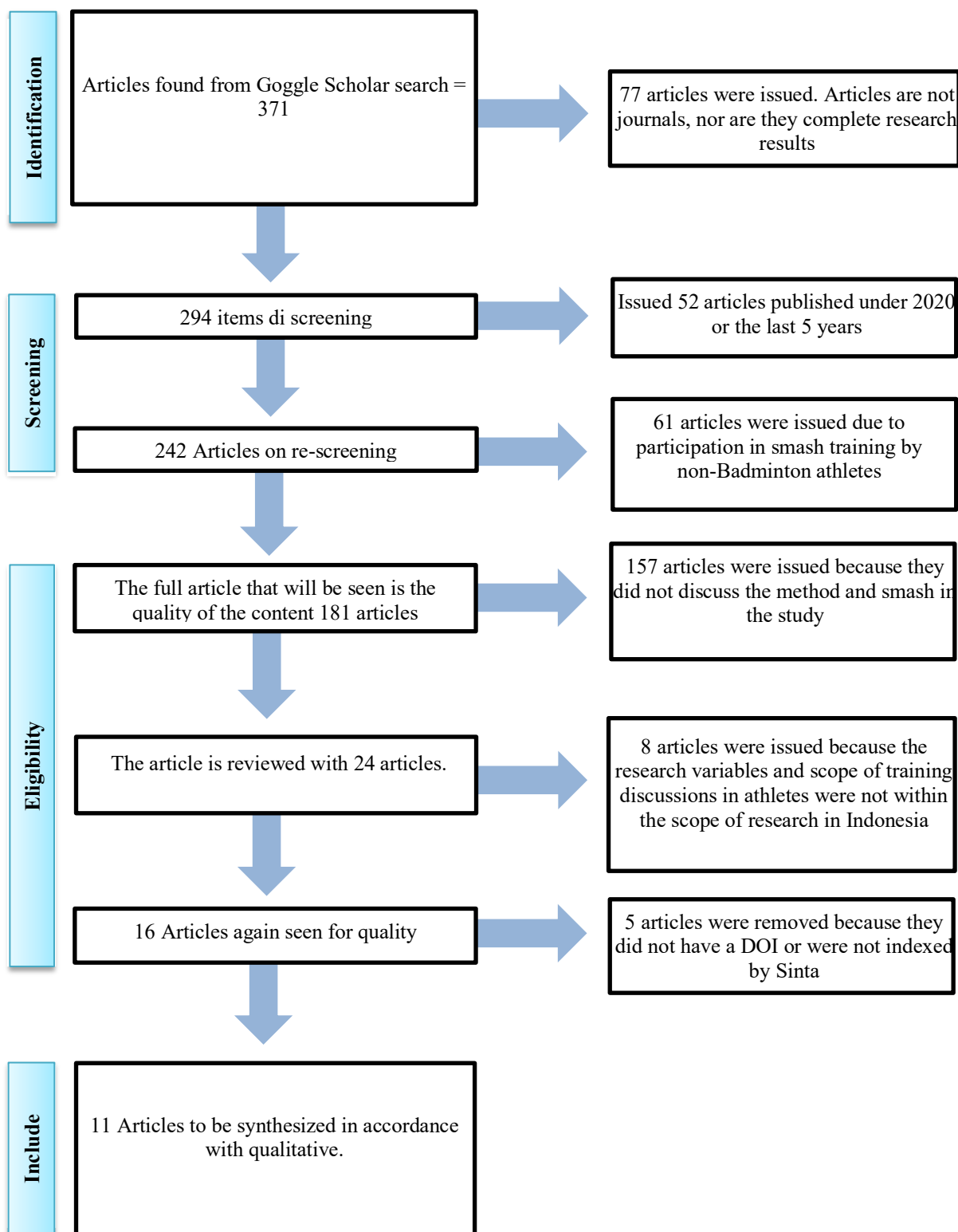


Figure 1. PRISMA Flowchart

Based on the results of the selection and filtering process through stages that refer to the inclusion and exclusion methods that have been previously established, it was concluded that there were 11 articles that met the criteria according to the provisions. The review description of the 11 articles obtained is outlined in Table 3.

**Table 3.** Review of Training Method Articles for Improving Smash Accuracy in Badminton Athletes

No	Author and Year	Research Design	Sample	Research Focus	Research Results
1	(Baihaqi & Hadi, 2022)	Experimental research method with two groups pre-test-post-test design.	PB athletes. Krisna Demak Age 10-12 Total 27 people.	The Effectiveness of Drill Practice Methods and Stroke Patterns on the Accuracy of Badminton Athletes' Smash	<ul style="list-style-type: none"> <li>• Drill drills have a positive effect on smash accuracy, with a significant improvement.</li> <li>• The punch pattern training method also has an effect on the accuracy of the smash, although the increase is not as large as the drill exercise.</li> <li>• The drill training method is more effective than the punch pattern method in improving the accuracy of smash of male badminton athletes aged 10–12 years at PB Krisna Demak</li> </ul>
2	(Denatara, 2024)	This research is research and development (R&D) using the Borg and Gall models.	PP PBSI Jaya Raya athletes aged 13 and 15 totaled 30 people.	Forehand Smash Badminton Training Models For U-13 And U-15 Athletes	1. There are three types of training models developed: footwork and shadow smash, plyometric and drill training models, as well as game patterns and situation models using

					<p>the Denatara BISA Integrated Accuracy Smash Training Model.</p> <ul style="list-style-type: none"> <li>• Research shows that smash training using the Denatara BISA method can have an effect on improving the quality of badminton forehand smash, so that this training can be used as a form of training variation, especially for U-13 and U-15 athletes.</li> </ul>
3	(Endrawan et al., 2024)	Experimental research method with a pretest-posttest design in one group.	Junior Eternal Badminton Union athletes totaled 15 people.	Badminton Smashing Punch Training Method Junior High School Athletes Eternal Badminton Association	<ul style="list-style-type: none"> <li>• The results of the study show that the drill method can improve the accuracy of badminton shots of junior athletes from the PB Abadi Badminton Association.</li> </ul>
4	(Febrisyah et al., 2022)	Experimental research method with a Pretest Posttest One Group design.	PB athletes. Kiber Sambas Ages 11-12 totaled 12 people.	The Effect of Drill Drills on the Accuracy of Badminton Smash Athletes Pb. Kiber Sambas	<ul style="list-style-type: none"> <li>• The conclusion that drill practice has a positive effect on improving the accuracy of smash of badminton athletes at PB Kiber Sambas.</li> </ul>
5	(Hutomono & Eksani, 2023)	Experimental research method with two groups pre-test-post-test design.	PB Ngemplak Junior Athletes totaled 30 people.	Differences in the Influence of Target Game Training Methods and Drilling Smash on the Accuracy	<ul style="list-style-type: none"> <li>• The results showed that there was a significant difference in the influence between the target game method and the drilling smash method on the accuracy</li> </ul>

				of Badminton Smash in PB Ngeemplak Athletes	of smash in badminton in PB Ngeemplak athletes. <ul style="list-style-type: none"> <li>The smash drilling method has been proven to have a better influence than the target game method in increasing the accuracy of the smash.</li> </ul>
6	(Ichsan et al., 2023)	Experimental research method with one group pre-test and post-test design	PB Mitra Jaya Tenganan Junior Athletes totaled 30 people.	V-Drill Technique to Improve Forehand Smash Athletes PB Mitra Jaya Tenganan	<ul style="list-style-type: none"> <li>The provision of the V-Drill variation technique has a significant influence on the forehand smash skills of badminton players.</li> </ul>
7	(Prabowo, 2023)	The research method of pseudo-experimental research with two groups pre-test-post-test design.	PB Sukowati Sragen Junior Athletes amounted to 30 people.	The Difference in the Effect of the Depth Jump and Side to Side Box Shuffle Training Methods on Jumping Smash Skills in Badminton Games in Male Athletes Aged 14–16 Years PB Sukowati Sragen	<ul style="list-style-type: none"> <li>There was a significant difference in influence between using the depth jump method and side to side box shuffle on the skill of jumping jumping smash in badminton in PB Sukowati Sragen athletes.</li> <li>The depth jump method has a better effect than the side to side box shuffle method on the jumping smash skill in badminton in PB Sukowati Sragen athletes.</li> </ul>

8	(Syaiuddin & Indardi, 2023)	The experimental research method is with the Quasi Exsperiment One Groups Pretest-Posttest Design.	PB Ksatria Demak athletes aged 11-12 years total 14 people.	The Effect of the Drill Smash Practice Method on the Accuracy of Smash of PB Ksatria Demak Men's Badminton Athletes	<ul style="list-style-type: none"> <li>The conclusion of the study stated that the drill smash training method had a significant positive effect on the accuracy/accuracy of smash of male badminton athletes aged 11-12 years at PB Ksatria Demak.</li> </ul>
9	(Taufik & Hulfian, 2024)	The experimental research method with a two-group design uses a pretest and posttest approach.	PB Pelangi Mataram Junior Athletes totaled 20 people.	The Contribution of One-Way Smash Training and Two-Way Smash Training to the Accuracy of Badminton Smash	<ul style="list-style-type: none"> <li>Research shows that both one-way and two-way smash exercises affect the accuracy of PB Pelangi Mataram players' smash. However, there is a difference in influence between the two, and one-way smash exercises have proven to be more effective in improving smash accuracy.</li> </ul>
10	(Wardani et al., 2022)	Experimental research method with one group pretest posttest design.	PB Mutiarausia athletes are 10-14 years old.	The Effect of the Drill Method with the Shuttlecock Cardboard Target in Improving the Smash Accuracy of Men's Badminton Players	<ul style="list-style-type: none"> <li>The results of the study can be concluded that there is an increase in smash accuracy in using the smash drill training method using shuttlecock cardboard targets in male players aged 10-14 years.</li> </ul>

11 (Zainuddin et al., 2024)	The research method uses a quantitative descriptive approach.	PB Junior Athlete. Jhonlin numbered 10 people.	The Effect of the Punch Training Method on the Ability of Badminton Smash in PB Jhonlin Badminton Club Junior Athletes	<ul style="list-style-type: none"> <li>The conclusion of this study shows that drill practice has a positive effect on the smash accuracy of junior athletes at PB Jhonlin Badminton Club.</li> </ul>
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### Thematic Improves the Accuracy of Smash Punches in Badminton Athletes

**Table 4. Thematic Synthesis**

Theme Findings	Number of Studies	Summary of Findings	General Implications
Effectiveness of the Drill Method	10 studies	The drill practice method has consistently shown a positive and significant influence on improving the accuracy of badminton smash	The drill method is the main recommended approach
Comparison of Exercise Methods	3 studies	The drill method has been proven to be more effective than the punch pattern and target play method	Implementation priorities in the drill method
Supporting Physical Components	2 Studies	Physical exercises such as depth jump and plyometric support improved smash skills	Integration of physical exercise with technique is required

### Findings Synthesis of Similarities and Differences Findings Improve Smash Hitting Accuracy in Badminton Athletes

#### A. Similarities of Findings

The selected studies demonstrated consistent trends in the following aspects:

1. Drill training methods consistently provided positive effects on smash accuracy across all research utilizing these approaches.
2. The use of pretest-posttest experimental designs became the standard methodology employed in the majority of studies.
3. Research focus on junior athletes demonstrated consistency in target population selection.

4. The implementation of specific targets or objectives in training enhanced the effectiveness of smash accuracy training.

## **B. Differences in Findings**

However, variations in results were observed in several aspects:

1. Several studies showed varying effectiveness between different types of drills (unidirectional vs. bidirectional drills, V-drill vs. conventional drill).
2. Differences in training duration and intensity affected the magnitude of smash accuracy improvement.
3. Studies integrating physical components demonstrated different results compared to studies focusing solely on technique.
4. Variations in accuracy measurement methods (target accuracy, test scores, subjective assessment) resulted in diverse improvement levels.

**Table 5.** Synthesis of Similarities and Differences of Findings

<b>Aspects</b>	<b>Consistent Studies</b>	<b>Different Studies</b>	<b>Divergence Explanation</b>
Drill Effectiveness	<ol style="list-style-type: none"> <li>1. (Febrisyah et al., 2022)</li> <li>2. (Syaiuddin &amp; Indardi, 2023)</li> <li>3. (Endrawan et al., 2024)</li> <li>4. (Zainuddin et al., 2024)</li> </ol>	<ol style="list-style-type: none"> <li>1. (Ichsan et al., 2023)</li> <li>2. (Taufik &amp; Hulfian, 2024)</li> <li>3. (Wardani et al., 2022)</li> </ol>	<p>Ichsan et al's research used the V-Drill variation technique while another study used drill exercises.</p> <p>Taufik &amp; Hulfian's research focuses on one-way and two-way drills.</p> <p>Wardani et al's research used a drill with a focus on the target of the cardboard target.</p>
Comparison of Exercise Methods	<ol style="list-style-type: none"> <li>1. (Baihaqi &amp; Hadi, 2022)</li> <li>2. (Zainuddin et al., 2024)</li> </ol>	<ol style="list-style-type: none"> <li>1. (Hutomono &amp; Eksani, 2023)</li> </ol>	<p>The research of Baihaqi &amp; hadi, and Zainuddin et al used the Drill Drill Method with a Stroke Pattern, while Hutomono &amp; Eksani use drills with target play.</p>
Physical Component Integration	<ol style="list-style-type: none"> <li>1. (Prabowo, 2023)</li> <li>2. (Denatara, 2024)</li> </ol>	Other studies	<p>The majority of studies focus on engineering without explicitly considering the physical aspects</p>
Duration and Follow-up	No longitudinal studies yet	All studies	<p>The majority of studies only measured short-term effects with no follow-up</p>

## **Summary of Systematic Literature Review Findings on Improving Smash Accuracy in Badminton Athletes**

### **Research Question Responses:**

Based on the systematic literature review of 11 articles that met the inclusion and exclusion criteria, the following conclusions can be drawn:

1. **Drill training methods represent the most effective approach** for improving smash accuracy in badminton athletes, demonstrating high consistency of results across different studies.
2. **Variations in drill implementation** (V-drill, target-based drill, integrated drill) provide flexibility in training programs while maintaining effectiveness.
3. **Integration of physical components** such as plyometric and jumping exercises can enhance the effectiveness of smash accuracy training programs.
4. **Drill methods are superior** to conventional methods such as stroke patterns and target games in improving smash accuracy.
5. **The primary target population** of research is junior athletes, indicating the importance of developing smash accuracy at an early age.

These findings provide an evidence-based foundation for coaches and badminton practitioners in designing effective training programs to improve smash accuracy in badminton athletes.

## **Discussion**

### **1. Main Findings**

Based on the results of the systematic literature review of 11 articles that met the criteria, there is strong consistency regarding the effectiveness of drill training methods in improving smash accuracy in badminton athletes. This is evident from research by Baihaqi & Hadi (2022), Endrawan et al. (2024), Febrisyah et al. (2022), Syaiuddin & Indardi (2023), Wardani et al. (2022), and Zainuddin et al. (2024), which consistently demonstrate that drill training methods have positive and significant effects on improving smash accuracy in badminton athletes.

The study by Baihaqi & Hadi (2022) provides empirical evidence that drill training methods are more effective than stroke pattern methods in improving smash accuracy in male badminton athletes aged 10-12 years. This finding is reinforced by the results of research by Hutomono & Eksani (2023), which showed that smash drilling methods have

better effects compared to target game methods in improving smash accuracy in PB Ngemplak athletes.

## **2. Training Method Variations and Their Effectiveness**

This systematic review identified various training method variations that can improve badminton smash accuracy. Denatara (2024) developed a comprehensive training model with three types of approaches: footwork and shadow smash, plyometric and drill training models, and game patterns and situational models using the Denatara BISA Integrated Smash Accuracy Training Model. This research demonstrates that integrated approaches can provide positive impacts on improving badminton forehand smash quality, particularly for U-13 and U-15 athletes.

The V-Drill technique investigated by Ichsan et al. (2023) also proved to have a significant influence on forehand smash skills. This indicates that variations in drill methods can provide different stimuli while remaining effective in improving smash accuracy.

## **3. Comparison of Specific Training Methods**

The research conducted by Taufik & Hulfian (2024) provides significant insights regarding the comparative effectiveness of unidirectional versus bidirectional smash training. The findings demonstrate that while both methods positively influence smash accuracy, unidirectional smash training proved more effective in improving smash accuracy among PB Pelangi Mataram players. These findings indicate that focus and consistency in stroke direction during training can yield more optimal results compared to overly complex directional variations.

## **4. Physical and Technical Aspects in Smash Accuracy Enhancement**

Prabowo (2023) examined the physical aspects supporting smash accuracy through a comparative analysis of depth jump and side-to-side box shuffle training methods on jumping smash skills. This research demonstrated that the depth jump method had superior effects compared to the side-to-side box shuffle method in enhancing jumping smash skills among male athletes aged 14-16 years. This indicates that the power and coordination components developed through depth jump training are more relevant to the requirements of effective smash technique.

## **5. Innovation in Training Targets and Media**

Wardani et al. (2022) introduced innovation in drill methodology by utilizing shuttlecock cardboard targets. This research showed that the use of specific targets in drill training can improve smash accuracy in male players aged 10-14 years. The implementation of specific and measurable training media provides clearer feedback for athletes in developing stroke accuracy.

## **6. Methodological Consistency in Research**

The majority of studies in this review employed experimental methods with pretest-posttest designs, utilizing both one-group and two-group designs. This methodological consistency demonstrates that experimental approaches constitute appropriate methods for measuring the effectiveness of various training methods on badminton smash accuracy. The implementation of quasi-experimental and true experimental designs across various studies provides robust validity to the generated findings.

## **7. Implications for Training Program Development**

Based on the findings from this systematic review, it can be concluded that drill training methods represent the most consistent and effective approach for improving smash stroke accuracy in badminton athletes. However, variations in drill implementation, encompassing technical aspects, targets, and physical components developed, can provide different and complementary stimuli.

Badminton coaches can integrate these proven effective methods into systematic and progressive training programs. The utilization of specific targets, drill technique variations, and reinforcement of supporting physical components can be combined to optimize athletes' smash accuracy improvement.

## **8. Limitations and Recommendations for Future Research**

Although these findings provide consistent insights regarding the effectiveness of various training methods, most studies were conducted on junior age groups and club-level athletes. Future research should examine the effectiveness of these methods on elite and senior athletes to provide broader generalization.

Furthermore, longitudinal studies examining skill retention and transfer learning from various training methods would provide more comprehensive understanding of the

long-term effectiveness of the training methods reviewed in this systematic review. Such investigations would contribute to the development of evidence-based training protocols that can be implemented across different competitive levels and age groups in badminton.

## **CONCLUSION**

Based on the systematic literature review of 11 articles that met the inclusion and exclusion criteria, it can be concluded that regarding training methods for improving smash stroke accuracy in badminton athletes, drill training methods have proven to be the most consistent and effective approach for enhancing smash stroke accuracy in badminton athletes. Of the 11 articles reviewed, 8 articles explicitly demonstrated that drill methods provide positive and significant effects on improving smash accuracy among badminton athletes across various age groups and skill levels. V-Drill techniques, drills with specific targets (shuttlecock cardboard), and integrated training models (Denatara BISA) all showed positive results in improving smash accuracy, indicating that adaptations and innovations in drill methods can be implemented without compromising their effectiveness.

For badminton coaches and practitioners, these findings provide clear guidance that smash accuracy training programs should focus on drill methods as the primary component, with variations adapted to athlete characteristics and training phases. The use of specific targets and measurable training media can enhance training program effectiveness. Physical components such as power and coordination developed through plyometric training (depth jump) need to be integrated to support technical smash skills, particularly for jumping smash.

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