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Development of Sand Court Training Program to Enhance Physical Fitness and Skills in Novice Badminton

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Abstract

Background and Aims: The creation of a sand court training program presents a special chance for inexperienced badminton players to improve their abilities and physical condition. Because sand offers resistance, players must move and footwork with more effort, which increases their agility and endurance. The uneven surface also forces players to hone their technique, which improves balance and coordination—two skills necessary for winning the game. Thus, this study aims to investigate the effects of sand court training programs on the physical fitness and skills of novice badminton students, particularly in comparison to traditional synthetic court training.

Methodology: The sample group consisted of 10 first-year students from Guangdong University of Business Studies, comprising 5 males and 5 females, all of whom had no prior experience in badminton training. Purposive sampling was employed to ensure participants had consistent backgrounds in badminton skill training. The primary tool utilized in this study was a sand court badminton training plan designed by experts, rather than questionnaire surveys. T-test statistical analysis was employed to analyze participants' physical fitness and skill test results before and after the training.

Results: After 8 weeks of sand court training, participants showed significant improvements in both physical fitness (including balance, endurance, explosiveness, flexibility, and speed) and badminton skills (including serving accuracy, smashing accuracy, blocking accuracy, footwork, and defense). In comparison to traditional synthetic court training, sand court training provided participants with more challenges and better training outcomes.

Conclusion: This study demonstrates that sand court training effectively enhances the physical fitness and badminton skills of beginners. Therefore, compared to traditional synthetic court training, sand court training offers superior training effects, providing a new perspective on badminton training methods and highlighting the potential value of incorporating sand court training into training programs.

Keywords: Sand Court Training; Badminton; Physical Fitness; Skills; Impact

Introduction

In modern society, with the acceleration of people's lifestyles and the enhancement of health awareness, sports have become an integral part of daily life. As Diao (2020) mentioned in the study "Research on Scientific Improvement of Physical Fitness in Badminton Training," badminton, as a globally popular sport, is favored for its relatively low requirements for court equipment, low entry barriers, and its ability to effectively enhance physical fitness and coordination. However, with the popularity and advancement of badminton, traditional training methods and environments have gradually failed to meet the increasing training needs of athletes and amateur enthusiasts, particularly in improving athletes' physical fitness, skills, and adaptability to different competition environments. Therefore, finding and validating new training methods and environments is of great significance for promoting the development of badminton.

In the study "Exploration of Strategies to Improve the Teaching Level of Youth Badminton" by Liu and Wang (2020), it was mentioned that in recent years, sand court training has been widely used as an emerging training method in beach sports such as soccer and volleyball, showing good training effects such as enhancing athletes' balance, strength, and endurance. However, research on the application of sand court training in badminton is relatively scarce, especially in my region, where this training method is hardly adopted by sports coaches and athletes. Considering the potential advantages of sand court training in other sports, this study aims to explore the application effects of sand court training in badminton, provide more diversified training programs for badminton training, and contribute to the development of sports in the region.

The significance of this study is first reflected in providing new perspectives and methods for badminton training. By exploring the impact of sand court training on improving the physical fitness and skills of badminton athletes, more scientific and effective training programs can be provided for coaches and athletes. Secondly, this study has a positive effect on promoting the popularity and competitive level of badminton sports in my region. By validating the effectiveness of sand court

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training, more people can be attracted to participate in badminton sports, while also enhancing the competitiveness of athletes in domestic and international competitions. Additionally, this study may have a positive impact on various fields such as sports science research, sports teaching, and sports training, promoting innovation and development in these areas.

With the development of sports and the increasing demand for quality of life, traditional badminton training methods have become inadequate to meet the needs of athletes and enthusiasts, especially in enhancing physical fitness, skills, and adaptability. Sand court training, as an emerging training method, has the potential to provide new solutions for badminton training.

Objectives

1. To develop a badminton training program for novice students to execute on sand court.
2. To investigate the effect of sand court training on the physical fitness and badminton skills of novice students.

Literature Review

This literature covers resources both domestically and internationally, broadly describing the potential of sand court training in the badminton field. We will delve into the current research status and trends of sand court training in enhancing the physical fitness and technical level of badminton beginners. The review will start from the basic theories of sand court training, analyze its impact on athletes' physical fitness and technical levels, and finally, discuss the application and challenges of sand court training in badminton beginner training, incorporating views from other scholars.

Basic Theories and Physiological Foundations of Sand Court Training: Sand court training, a unique method of sports training, is primarily conducted on soft and unstable sandy surfaces. Its core aim is to challenge athletes' physical responses in this atypical environment by overcoming the natural resistance and instability of the sand, thereby enhancing muscle strength, and improving coordination, and balance. This training method requires athletes to have not only good physical condition but also high adaptability and mental resilience. Girard et al. (2011) in their study "Changes in spring-mass model parameters and energy cost during treadmill running on dry sand" emphasized that sand training, through its unique training environment, significantly increases athletes' lower limb power and endurance. It also plays an indispensable role in enhancing cardiopulmonary function and athletes' proprioception and joint protection capabilities. This indicates that sand training can promote athletes' physical health and increase the body's adaptability to various physical stresses while improving their performance.

Impact of Sand Court Training on the Physical Quality of Badminton Beginners: Badminton is a sport that demands high physical qualities from athletes, including speed, strength, endurance, flexibility, and coordination. Against this backdrop, sand court training emerges as an effective way to enhance athletes' cardiopulmonary endurance, muscle strength, and coordination ability through its unique training environment - unstable and soft sand. This training method not only challenges the physical limits of athletes but also enhances their psychological adaptability and willpower.

Binnie et al. (2013) in their study "Effect of sand versus grass training surfaces during an 8-week pre-season conditioning program in team sport athletes" found that training on sand surfaces significantly improves athletes' physical qualities, especially explosiveness and endurance, compared to conventional hard surface training. The instability of the sand requires athletes to exert more effort and energy to maintain balance and complete training movements. This high-intensity training not only strengthens muscle power but also significantly enhances cardiopulmonary function. Moreover, the characteristics of sand training are also beneficial in improving athletes' coordination and reaction speed, enabling them to better handle the rapid changes in badminton matches. Thus, sand court training provides a comprehensive platform for enhancing the physical and technical skills of badminton beginners and advanced players alike, helping them reach new heights at competitive levels.

Impact of Sand Court Training on the Technical Level of Badminton: Sand court training has shown its unique value and importance. Conducting training on unstable sand, increases the difficulty for athletes in performing technical movements, forcing them to involve more muscle groups in each action to maintain balance and complete the technique. This high-intensity physical engagement not only accelerates the learning speed of skills but also significantly improves the accuracy and stability of movements.

Luo (2021) in "A study on the enhancement of core strength training in badminton" detailed how sand training effectively enhances badminton beginners' serving, footwork, and striking techniques, especially in improving the accuracy of strokes and flexibility of steps. This training

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method not only strengthens the athletes' core strength but also improves their balance and coordination, which are crucial technical elements in badminton. Furthermore, the high load characteristic of sand training can also enhance athletes' psychological qualities, strengthening their adaptability and mental resilience when facing unpredictable situations in matches. Thus, while improving technical levels, sand court training also lays a solid foundation for badminton beginners to face various challenges in competitions.

Application and Challenges: Despite the significant advantages of sand court training in enhancing the physical and technical levels of badminton beginners, its practical application is not without challenges. Xiang (2020) in "Research on training to improve basic techniques of badminton players" pointed out that the unique environment of sand training demands higher professional knowledge and experience from coaches to ensure the scientific nature and safety of training. Moreover, the high intensity and difficulty of sand training pose greater demands on athletes' physical condition, requiring them to have a good foundation in physical fitness and strong psychological endurance to adapt to the challenges encountered during training. Therefore, designing a training plan that can leverage the advantages of sand training while considering individual differences among athletes is a key issue for coaches in practice. From my perspective, despite these challenges, the potential of sand court training to enhance athletes' physical and technical aspects cannot be overlooked. To fully utilize the advantages of sand training, it is recommended that coaches conduct detailed individual assessments before designing training plans to ensure that each athlete can undergo training within their physical limits. Additionally, enhancing professional training for coaches in sand court training, improving their knowledge and practical skills, is crucial for ensuring training effectiveness. Moreover, gradually reducing the difficulty and intensity at the beginning of training, allowing athletes to adapt to the sand training environment, is an effective strategy to prevent sports injuries and enhance the sustainability of training.

In summary, as an effective training method, sand court training has unique advantages in improving the physical fitness and technical level of badminton beginners. Through a review of related literature, it is clear that sand court training plays a significant role in the comprehensive development of badminton beginners. Future research needs to explore further the optimal implementation plans for sand court training to maximize its application value in badminton training. Attention should also be paid to individual differences, adjusting training plans based on the actual conditions of athletes to ensure the effectiveness and safety of training.

Conceptual Framework

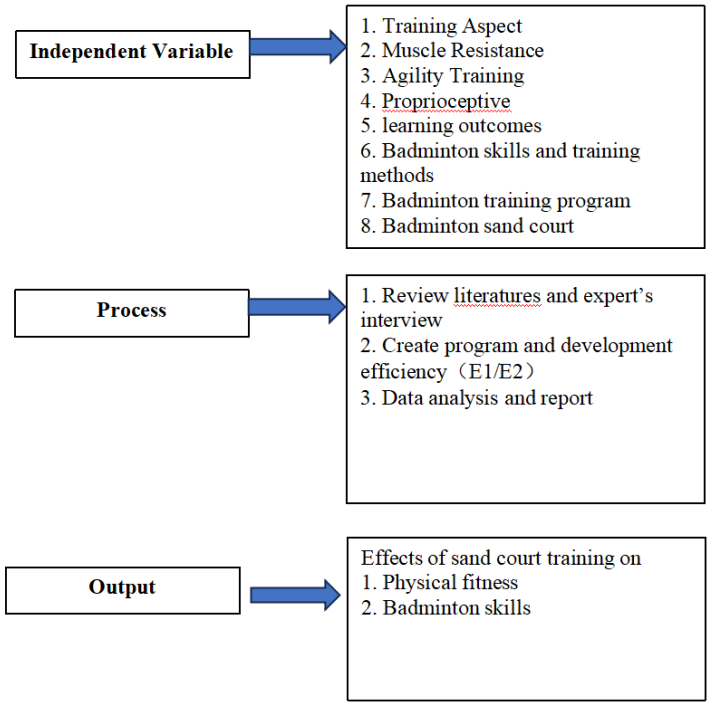

Figure 1 Conceptual Framework

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Methodology

The purpose of this study is to investigate the effects of sand court training programs on improving the physical fitness and skills of novice badminton students. To achieve this research goal, we adopted a quasi-experimental design, assessing the impact of sand court training on students' physical fitness and skills through a series of pre-tests and post-tests.

Study Population and Sample Group: In this study, we focused on 2000 students from the Badminton Club of Guangdong University of Business Studies, covering a wide range of skill levels from beginners to advanced players. To accurately assess the effects of sand court training on badminton skills and physical fitness, we meticulously selected a representative sample group based on a series of screening criteria. This sample group consisted of 10 first-year non-physical education major students, displaying good diversity in gender, age, and physical fitness status, aiming to ensure the broad applicability of the research results. Among the selected sample, there were an equal number of male and female students, totaling 5 males and 5 females. These students had not received any formal badminton training before joining the study, and their baseline levels were similar, providing a homogeneous baseline for the study, and ensuring the reliability and effectiveness of the research results.

Research Tools: The core research tool utilized in this study was a carefully designed and validated 8-week sand court training program. This program was developed collaboratively by a group of experts in the fields of badminton training and physical fitness training, ensuring the scientific and practical aspects of the training content through in-depth interviews and rigorous draft review processes. To achieve optimal training effects and data collection, the program stipulated two training sessions per week, each lasting 1.5 hours. The training content covered various aspects from basic physical fitness training to specialized badminton skill training. Particularly in the last training session of the 8-week program, we extended the duration to 2 hours specifically for a comprehensive match, allowing students to apply the learned skills in practice and providing an excellent opportunity for the research team to observe and analyze students' strategic use and demonstration of skills in real matches. This approach aimed to comprehensively evaluate the effects of sand court training on improving the physical fitness and skills of novice badminton students.

Creating and Finding Quality Tools: The sand court training program adopted in this study was meticulously designed based on in-depth sports science research and a comprehensive understanding of the skill development needs of badminton players. In the process of formulating the training program, we first conducted a comprehensive analysis of a large amount of relevant academic literature, extracting training principles and methods that significantly improve badminton skills and physical fitness. Subsequently, through in-depth interviews with a series of experts in the fields of badminton and physical fitness training, combined with their practical experience and scientific research findings, the training program was further optimized and adjusted. To ensure the scientific and practical nature of the training program, we also conducted pre-tests on a small group of target populations to assess the initial effects of the training content and adjusted the training program based on the test feedback. Additionally, the entire program underwent rigorous review by an expert team to ensure that each training activity effectively promoted the improvement of students' badminton skills and physical fitness.

Data Collection: To comprehensively assess the effects of the sand court training program on students' badminton skills and physical fitness, this study designed a detailed data collection plan covering multiple tests before and after the training. In terms of badminton skills, we carefully measured the accuracy of students in three basic skills: serving, smashing, and blocking, which are key indicators for assessing badminton technical proficiency. Simultaneously, students' footwork and defensive skills were evaluated to determine their ability to move on the court and respond to opponents' attacks. In terms of physical fitness tests, we focused on assessing balance, endurance, strength, agility, and speed, which directly impact the performance of badminton players. By conducting tests on these skills and physical fitness parameters before and after the training, we were able to accurately assess the effects of sand court training on improving the skills and physical fitness of novice badminton students, ensuring the scientific and practical nature of the research results.

Data Analysis: In this study, data analysis employed two main methods: descriptive statistics and inferential statistics, to explore the effects of the sand court training program on novice badminton students in depth. Through descriptive statistics, we initially outlined the basic characteristics of the

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participating students, including age, gender distribution, and their badminton skills and physical fitness levels before training, calculating the mean and standard deviation of these data to provide a foundation for subsequent analysis. Subsequently, inferential statistics, specifically t-tests, were used to compare the data before and after training, focusing on evaluating improvements in badminton skills such as serving accuracy, smashing accuracy, and blocking accuracy, as well as enhancements in physical fitness parameters including balance, endurance, strength, agility, and speed. These comparative results revealed the significance of the training program, providing scientific evidence for assessing the effectiveness of sand court training.

Results

The results of this study demonstrate that sand surface training is effective in enhancing physical fitness and badminton skills within badminton teaching programs. Here are the main contents translated into English: (1) Comparison of Physical Fitness Test Results (Pre-test and Post-test), (2) Comparison of Badminton Skills Test Results (Pre-test and Post-test), (3) Conclusion.

The research was experimental. The participant selection process, therefore, was not only pivotal in defining the study's scope but also in ensuring the robustness and relevance of its findings. The participant demographic for this study was carefully selected to ensure a representative sample of the adult population with varying degrees of physical capability. A total of 10 individuals participated, maintaining an equal distribution across genders, which allowed for a gender-neutral analysis of the training program's effects. The age range of participants was 18-25 years,

The symbols within the parentheses "$\bar{x}$" represent the sample mean, "SD" stands for standard deviation, "t" denotes the t-test statistic, and "p" represents the level of significance. An asterisk (*) indicates that the result is statistically significant at the given level of significance, meaning the difference is not due to chance.

Comparison of Physical Fitness Test Results (Pre-test and Post-test)

Table 1 The Comparison of physical fitness tests between the pretest and the post-test

No.	Tests	Pretest		Posttest		t	p
		$\bar{x}$	SD	$\bar{x}$	SD		
1	Balance:	64.80	3.85	69.21	3.03	-2.71	0.02*
2	Strength:	45.54	3.08	48.93	1.95	-2.70	0.02*
3	Endurance:	298.13	11.99	284.07	14.06	2.31	0.05*
4	Power:	201.84	12.12	210.49	9.07	-2.67	0.02*
5	Agility:	15.31	0.48	14.48	0.68	2.94	0.02*
6	Speed:	7.06	0.20	6.73	0.15	3.14	0.01*

*P< .05

Table 1 showed that the results of physical fitness tests on Balance, Strength, Endurance, power, agility, and speed at the posttest were higher than at the pretest at a .05 level of significance. This showed that sand surface training for badminton was effective to use for enhancing physical fitness for the badminton teaching program.

Comparison of Badminton Skills Test Results (Pre-test and Post-test)

Table 2 The Comparison of Badminton skills tests between the pretest and the posttest

No.	Tests	Pretest		Posttest		t	p
		$\bar{x}$	SD	$\bar{x}$	SD		
1	Serves:	58.70	4.83	65.49	4.52	-3.09	0.01*
2	Smash:	57.39	7.23	63.96	2.79	-2.84	0.02*
3	Drive:	52.03	3.67	57.48	6.57	-2.41	0.04*
4	Footwork:	19.78	1.09	18.34	0.87	2.84	0.02*
5	Defensive:	25.52	0.93	24.10	1.15	2.49	0.03*

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* P< .05

Table 2 shows that the results of badminton skills tests on Serve, Smash, Drive, Footwork, and Defensive at the posttest were higher than at the pretest at a .05 level of significance. This showed that sand surface training for badminton was effective to use for badminton skills for the badminton teaching program.

Conclusion

The research findings indicate that participants' post-test scores in physical fitness tests (including balance, strength, endurance, explosiveness, agility, and speed) were significantly higher than their pre-test scores after training on sandy surfaces, with statistical significance at the 0.05 level. This suggests that training on sandy surfaces is effective in enhancing physical adaptability in badminton teaching programs.

Additionally, the results of the badminton skills tests showed that scores for serving, hitting, pushing, footwork, and defensive skills in the post-test were higher than in the pre-test, with statistical significance at the 0.05 level. This demonstrates that training on sandy surfaces also effectively improves badminton skills, making it suitable for badminton teaching plans.

In summary, training on sandy surfaces not only effectively enhanced participants' physical adaptability but also significantly improved badminton skills, having a positive impact on the physical and technical training of badminton players. These findings provide scientific evidence for the application of sandy surface training in sports education and training.

Conclusion

In this study, we explored the effects of sand court training on physical fitness and skills improvement in novice badminton students. Through drafting and validating the effectiveness of the sand court training program via expert interviews, we implemented an 8-week training program, conducted twice a week for one and a half hours each session, for a group of college freshmen who had never received badminton training before. By comparing the results of badminton skill tests and physical fitness tests before and after the training, we found: (1) The training program's validity was highly verified, with a validity score of 0.91. (2) The physical fitness tests showed significant improvements in various parameters, including balance, strength, endurance, explosive power, agility, and speed, after the training. (3) The badminton skill test results indicated significant improvements in service accuracy, smash accuracy, drive accuracy, footwork, and defensive ability after the training.

Based on these findings, we conclude that sand court training can more effectively improve badminton skills and physical fitness compared to traditional synthetic court training. This research outcome not only validates the application value of sand court training in badminton but also provides a new perspective and method for future badminton training. Our study emphasizes the importance of innovative training environments for enhancing athletes' physical fitness and skills, offering valuable references for training in badminton and other sports.

Discussion

This study implemented an 8-week sand court training program to explore its effects on physical fitness and badminton skills in novice badminton students. The results indicate that sand court training is more effective in improving badminton skills and physical fitness compared to traditional synthetic court training, validating the application value of sand court training in badminton and offering new perspectives and methods for future training.

Summary of results

The research significantly revealed the positive impact of sand court training on novice badminton students. Through 8 weeks of systematic training on sand, students showed remarkable progress in multiple physical fitness tests, including but not limited to, balance, strength, endurance, explosive power, agility, and speed. Similarly, in the improvement of badminton skills, students also showed significant improvements in key skills such as service accuracy, smash accuracy, drive accuracy, footwork, and defensive abilities. These results not only prove that sand court training can effectively enhance students' physical quality but also highlight the significant effects of sand court training in improving specific sports skills. Therefore, sand court training can be considered an effective training method that can promote the comprehensive development of athletes' physical fitness and specifically improve the technical level of badminton sports, providing a new perspective for sports training.

Although the study's results point to benefits for beginning badminton players who train on sand courts, a number of methodological flaws call into question the validity of the conclusions reached. The

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inability to compare results with alternative training methods or to establish a control group makes it difficult to attribute improvements to sand court training alone (Deeks, Higgins, & Altman, 2021). Furthermore, the 8-week intervention period might not have captured the sustainability or long-term impacts of the noted improvements. It is difficult to determine whether the stated improvements in badminton skills and physical fitness endure over time in the absence of longitudinal data or follow-up evaluations (Schulz, Altman, & Moher, 2010).

Discuss the results

The effectiveness of sand court training is primarily due to its unique physical properties, where instability and greater resistance are core advantages. These features force participants to use more strength and concentrate more attention to adapt to the training environment, leading to more active and positive training participation. The soft texture of sand, compared to hard surfaces, can better absorb impact force and reduce the risk of sports injuries, providing athletes with a relatively safe environment for high-intensity training. However, sand court training has its limitations, such as specific requirements for the training venue and potential additional pressure on the participants' lower limb joints, especially in cases of long-term high-intensity training. Thus, while sand court training uniquely promotes physical fitness and skills, careful consideration and appropriate adjustments are needed to address its potential limitations in the implementation process.

Although the passage emphasizes the potential advantages of sand court training, it ignores some of the complexities involved in this training modality and does not provide any empirical evidence to back up its assertions. The claim that the instability and resistance of sand courts cause more positive and active training participation is speculative and lacks empirical support (Mujika, Halson, Burke, & Balagué, 2018). Furthermore, controlled studies evaluating injury rates and severity among athletes training on various surfaces are necessary to validate the notion that sand offers a safer training environment than hard surfaces (Panzarella et al., 2018). Furthermore, the passage acknowledges the drawbacks of sand court training, such as venue requirements and possible joint pressure, but it offers no specific suggestions or solutions to address these problems, making it less useful in sports training environments.

Recommendation

Based on the research findings, the following four recommendations are made:

1. Future badminton training could appropriately integrate elements of sand court training to improve athletes' physical fitness and technical levels.
2. It is recommended that students undergo sufficient warm-up and adaptability training before training to reduce the risk of injury.
3. For students with specific health issues or unstable lower limb joints, sand court training should be chosen cautiously and conducted under the guidance of a coach.
4. Further research is encouraged to explore the application value of sand court training in other sports projects and how to optimize sand court training to meet the needs of different athletes.

Based on the findings of this study, which demonstrated that sand court training significantly enhances the physical fitness and badminton skills of novice badminton students, we propose the following recommendations:

Recommendations for Applying Research Findings

1. Integrate Sand Court Training into Badminton Training Programs: Given the significant effects of sand court training on improving physical fitness and skills, it is recommended that coaches and training institutions incorporate sand court training as part of the badminton training regimen, especially for enhancing athletes' balance, strength, endurance, explosive power, agility, and speed. This can not only improve athletes' overall performance but also add diversity and fun to training.
2. Safety and Adaptability Training: As sand court training may exert additional pressure on the lower limb joints, it is advised to provide athletes with sufficient warm-up and adaptability training before engaging in sand court training, as well as to emphasize recovery and rest during the training period to ensure safety.
3. Personalized Training Plans: Considering the different physical conditions and skill levels of athletes, it is suggested to develop personalized sand court training plans. For students with specific health issues or unstable lower limb joints, extra caution should be exercised, possibly requiring adjustments to the training intensity and frequency, or conducting training under the guidance of a coach.

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Recommendations for Future Research

1. Diversity Studies: Encourage research on the effects of sand court training among athletes of different ages and skill levels to better understand the applicability and effects of sand court training more comprehensively.

2. Long-term Effect Studies: It is recommended to conduct long-term studies to assess the sustained impact of sand court training on athletes' physical fitness and skills improvement, as well as its long-term effect on sports injury prevention.

3. Comparative Studies: Future research could explore comparisons between sand court training and other training methods (such as aquatic training, strength training, etc.) to determine the most effective combination of training methods.

4. Mechanism Studies: Further research into the physiological and psychological mechanisms behind the enhancement of physical fitness and skills through sand court training will help optimize training methods and improve training efficiency.

By adopting these recommendations, we can better leverage the potential of sand court training in badminton and other sports training, providing athletes with a safer and more effective training environment.

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