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JOURNAL OF APPLIED MOVEMENT AND SPORT SCIENCE

Efforts to improve speed in non-professional athletes: An application of plyometric training in badminton

Research Article

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Abstract.

Background Speed is one of the most important physical components in badminton as it determines an athlete's ability to respond to attacks and return the shuttlecock to areas that are difficult for opponents to reach. Athletes with optimal speed can control the game's tempo and increase their chances of winning. One effective method to improve speed is plyometric training, which utilizes explosive muscle contractions to optimize strength and power.

Objectives This study aimed to examine the effect of plyometric training on improving the speed of non-professional badminton athletes.

Methods A pre-experimental design with a one-group pretest–posttest approach was employed. The participants were 15 non-professional female athletes aged 20–25 years, all with normal blood pressure and resting heart rates. The training program consisted of box jump, box shuffle, and squat jump, conducted three times per week for six weeks (a total of 18 sessions). Speed was measured before and after the intervention using the 30-meter running test. Data were analyzed using a paired-sample t-test with a 5% significance level.

Results The results showed a significant improvement in mean speed from 4.49 ± 0.17 seconds to 4.14 ± 0.21 seconds ($p \leq 0.001$). It is concluded that a structured plyometric training program effectively increases the speed of non-professional badminton athletes.

Conclusion The contribution of this study is to provide empirical evidence for coaches and athletes that plyometric training can be integrated into physical conditioning programs as a strategy to optimize on-court performance.

Keywords: speed, plyometric training, athletes, physical performance

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INTRODUCTION

Sports are a form of physical activity that play a strategic role in enhancing physical fitness, maintaining health, improving mood, and supporting work productivity. Beyond maintaining physical condition, sports serve as an essential instrument for preserving overall health, both physically and mentally (Corbin & Le Masurier, 2014). In addition, sports function as a competitive platform that can drive individual achievement. According to Zensari & Irawan (2019), sports not only promote physical well-being but also serve as a medium for identifying and developing talent across various disciplines. One competitive sport that demands high levels of physical ability, technical skills, and tactical intelligence is badminton.

Badminton is a highly popular sport in many countries, including Indonesia, and requires a combination of technical skills, game strategies, and optimal physical capabilities. To achieve peak performance, athletes must be adequately prepared in physical, technical, tactical, and mental aspects (Błach et al., 2021). Among these, physical preparation forms the foundation, as without good physical conditioning, mastery of techniques and strategies cannot be applied effectively during matches (Lorenz & Morrison, 2015). One of the most crucial biomotor components in badminton is speed, which directly determines an athlete's ability to chase the shuttlecock, anticipate the opponent's shots, and control the pace of play. Short-term acceleration is especially critical in increasing an athlete's chances of winning rallies and dominating matches (Sahin, 2014).

Various training methods can be used to improve speed, one of which is plyometric training. This form of exercise utilizes explosive muscle contractions to enhance strength, power, and neuromuscular responsiveness. Common plyometric exercises include box jumps, box shuffles, and squat jumps. Box jumps have been shown to positively influence lower limb muscle strength (Putera et al., 2023) through physiological adaptations in which heavier jump loads trigger strong muscle contractions, thereby improving contractile capacity (Sabillah et al., 2022). Moreover, box jumps effectively enhance lower limb explosive power (Hamonangan & Wellis, 2020) and hip power (Al Hafidz et al., 2020), both of which are essential for rapid and explosive movements in badminton.

Squat jumps involve jumping and landing in a squat position, engaging the calf and thigh muscles while also improving coordination and body stability. Meanwhile, box shuffles help train lateral speed and foot coordination, which are highly relevant to the dynamic movement patterns in badminton. The combination of box jumps, box shuffles, and squat jumps therefore has the potential to serve as an effective training strategy to improve both speed and agility in athletes.

While many studies have examined the benefits of plyometric training on strength and explosive power, research specifically investigating the combined effects of these three exercises on the speed performance of non-professional badminton players remains scarce. This is noteworthy, as non-professional athletes constitute the majority of players participating in local and regional competitions, making such findings highly relevant for practical application.

The novelty of this study lies in implementing a structured six-week training program that combines box jumps, box shuffles, and squat jumps for non-professional badminton athletes, with a primary focus on improving short-distance sprint speed as a direct indicator of on-court responsiveness. The findings are expected to provide empirical evidence and practical recommendations for designing more effective and applicable physical conditioning programs tailored to the demands of badminton.

METHOD

Participants

This research was conducted at Gor Janti Field in Yogyakarta. This study involved 15 male non-professional badminton athletes aged 20–25 years, all of whom had normal blood pressure and resting heart rate. Participants were recruited using a purposive sampling technique, with inclusion criteria specifically tailored to the research objectives. All participants met the eligibility requirements before the commencement of the intervention.

Research Design

This research employed a pre-experimental design with a one-group pretest–posttest approach. The intervention consisted of a plyometric training program comprising three types of exercises: box jumps, box shuffles, and squat jumps. Training sessions were conducted three times per week over a period of six weeks, totaling 18 sessions. The study was conducted at two venues: This research was conducted at Gor Janti Field in Yogyakarta. Speed performance was assessed before and after the six-week intervention using the 30-meter running test (Putera et al., 2023).

Data Analysis

Statistical analyses were performed using IBM SPSS Statistics version 25. Data normality was evaluated using the Shapiro–Wilk test. Hypothesis testing was conducted using the paired-sample t-test, with a significance level set at $p \leq 0.05$.

RESULTS AND DISCUSSION

Results

The descriptive statistical analysis of mean speed performance between the pretest and posttest is presented in Figure 1. The results indicate an improvement in mean speed from the pretest value of 4.49 ± 0.17 seconds to the posttest value of 4.14 ± 0.21 seconds. The minimum recorded time during the pretest was 4.04 seconds, while the maximum was 4.71 seconds. In contrast, the posttest recorded a minimum time of 3.76 seconds and a maximum of 4.42 seconds.

Table 1. Speed performance (seconds) in pretest and posttest

Statistic	Pretest	Posttest
Mean ± SD	4.49 ± 0.17	4.14 ± 0.21
Maximum	4.71	4.42
Minimum	4.04	3.76

Normality testing using the Shapiro–Wilk test revealed that both pretest ($p = 0.070$) and posttest ($p = 0.096$) data were normally distributed ($p > 0.05$).

Table 2. Normality test results

Speed (seconds)	Sig.	Description
Pretest	0.070	Normal
Posttest	0.096	Normal

The paired-sample t-test analysis demonstrated a statistically significant improvement in mean speed between pretest and posttest measurements ($t = 7.866$, $df = 14$, $p \leq 0.001$), indicating that the plyometric training program effectively enhanced sprint performance.

Table 3. Hypothesis testing results

Group	*t*	df	Sig.
Pretest–Posttest	7.866	14	0.000

Discussion

Speed is one of the most crucial aspects in badminton, as it determines an athlete's ability to reach and return the shuttlecock to areas that are difficult for the opponent to access. Athletes with optimal speed can control the game's tempo, shorten reaction times, and increase their chances of scoring points. Bompa & Haff (2019) define speed as the ability to cover a distance in the shortest possible time, whereas Jeffreys (2013) describes it as the time taken to cover a specific distance. In essence, speed refers to the ability to move body parts quickly and is an essential physical component for badminton athletes.

A well-structured training program plays a significant role in improving athletes' physical condition. Budiwanto (2012) emphasizes that training should meet both psychological and physiological demands and be implemented progressively over time. Adi et al. (2020) recommend a frequency of 3–5 training sessions per week for 6–8 weeks to achieve optimal physiological adaptation. The present study's findings align with these recommendations, showing that box jumps, box shuffles, and squat jumps performed three times per week for six weeks significantly improved speed in non-professional badminton athletes.

These results are consistent with those of Baro & Sonowal (2014), who reported improvements in speed and agility following a six-week plyometric program involving various jump types. Similarly, Primadinata (2015) found significant enhancements in both speed and muscular power after box jump training. Perikles et al. (2016) also reported a significant effect of jump to box, front box jump, and depth jump on speed improvement. Likewise, Sugiarto (2019) observed a 4.144% increase in sprint speed after squat jump training.

Physiologically, this improvement is likely due to muscle adaptations induced by plyometric exercises, such as an increase in the number of myofibrils within muscle fibers, which leads to faster muscle contractions (Womsiwor & Sandi, 2014). Faster contraction speed, in turn, enhances overall movement speed (Santoso, 2016). Therefore, this study confirms that the combination of box jumps, box shuffles, and squat jumps is effective in improving the speed of non-professional badminton athletes and can be recommended as part of physical conditioning programs.

The limitations of this study include a relatively small sample size and the inclusion of only male non-professional athletes, limiting the generalizability of the findings to professional or female athletes. Moreover, external factors such as diet, additional physical activities outside the program, and psychological conditions were not controlled and may have influenced performance outcomes. The

relatively short six-week duration also does not allow conclusions regarding the long-term sustainability of the observed improvements.

CONCLUSION

This study demonstrates that plyometric exercises—specifically box jump, box shuffle, and squat jump—performed three times per week over a six-week period significantly improve speed in non-professional badminton athletes. This improvement confirms the effectiveness of plyometric training as a method for developing physical abilities, particularly speed, which is a crucial factor in badminton performance. These findings can be applied by coaches and athletes as part of regular training programs, especially during the physical preparation phase. Incorporating structured and consistent plyometric exercises can help athletes move faster, more efficiently, and more accurately during matches. This study contributes to the scientific literature by providing empirical evidence that a combination of three simple plyometric exercises can have a significant impact on improving speed, even in non-professional athletes. It offers the potential for developing practical training models that are easy to implement across various athletic levels. Future studies are recommended to include larger samples, involving athletes of different skill levels and genders, as well as to extend the training duration to assess long-term effects. Additionally, further research should explore the impact of combining plyometric training with other training methods on different performance aspects such as agility, strength, and endurance.

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AUTHOR CONTRIBUTION STATEMENT

ZZ designed the study, collected data, and performed statistical analysis. PK provided input and revised the draft.

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