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Comparing agility and shadow training with core stability at riau specialized sports school

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ABSTRACT

This study aims to determine the effect of agility training incorporating core stability and shadow training incorporating core stability on the improvement of badminton footwork at the Riau Specialised Sports School (SKO). This is a quasi-experimental study, employing a "two-groups pre-test-post-test design". The population for this study comprised 26 athletes from the Riau SKO, with the sample selected using purposive sampling: male athletes who were still active at the Riau SKO and had chosen badminton as their sport, totalling 12 male athletes aged 16-18 years. The instrument used in this study was a 30-second badminton footwork test. The data analysis techniques for hypothesis testing utilised the Paired Sample Test and the Independent Sample Test. The results of the study indicate: Firstly, there is a significant effect of agility training combined with core stability on the improvement of footwork in badminton at SKO Riau, with a significance level (2-tailed) of 0.000 < 0.05. Secondly, there was a significant effect of shadow training combined with core stability on the improvement of footwork in badminton at SKO Riau, with a significance level (two-tailed) of 0.003 < 0.05. Thirdly, there was no difference in the mean effect between the agility training with core stability group and the shadow training with core stability group on the improvement of footwork in badminton at SKO Riau, with a significance value (two-tailed) of 0.277 > 0.05.

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Introduction

Badminton is a game and a sport in which Indonesia excels (Apriantono et al., 2021). Indonesia has produced athletes who are ready to compete and represent the country on the international stage. To achieve excellence in badminton, coordination, speed, mastery of movement and agility are required. Good physical fitness is a key factor in practising this sport, which is the second most physically demanding after football (Ihsan et al., 2023). Bompa (Bafirman, 2013) states that the basic components of physical fitness include endurance, strength, power, speed, flexibility, agility, balance and coordination. Athletes need to master these to achieve peak physical performance.

Badminton is a sport that demands speed, agility and precision of movement (At Tanzil et al., 2025). Agility in badminton referred to as footwork agility is one of the physiological characteristics that badminton players must possess (Pratama et al., 2024). The techniques that need to be mastered in badminton include how to hold the racket, footwork, and basic stroke techniques (Riza Agustian et al., 2022). Footwork is one of the basic

techniques in badminton that athletes must master. This study focuses on the physical aspect of agility to improve the badminton footwork skills of athletes at the Riau Special Sports School. Athletes' performance is influenced by several factors, such as physical, technical, tactical and mental aspects (Candra et al., 2022).

Subarjah states that footwork consists of active foot movements that adjust the body's position so that the shuttlecock can be struck from an ideal position (Hidayat Suharto, 2019). In badminton, these footwork movements must be practised in order to achieve perfect footwork. Khairuddin argues that suboptimal footwork will affect the shots that are struck (Edmizal et al., 2020). In this regard, several exercises are believed to improve footwork in badminton, such as shadow boxing, skipping, shuttle runs, zig-zags and sprints (Rahmawati & Adityatama, 2025).

In badminton training, particularly when it comes to improving footwork, there are numerous exercises that coaches can use to enhance players' footwork. Shadow drills, for example, are often believed to improve badminton footwork agility. However, coaches should at least provide other types of exercises to prevent athletes from becoming bored or disengaged. One such example is agility training, such as shuttle runs and zig-zag drills, which are believed to have a positive effect on badminton footwork. Thus, there are numerous variations of exercises available to improve badminton footwork. As noted by Rahmawati & Adityatama (2025), "Exercises such as shadow drills, skipping, shuttle runs, zig-zags and sprints can improve badminton footwork". Some of these exercises involve rapid movements, making them suitable for improving badminton footwork (Kardani & Rustiawan, 2020). These movements are also beneficial as they combine elements of speed, straight-line movement, and zig-zag movement (Azhariat Malasari, 2019).

The problem identified at the Riau Specialised Sports School, based on observations by the researcher and the coach, was that athletes were often slow to reach the shuttlecock hit by their opponent. In line with other findings, footwork is one of the challenges frequently faced by badminton athletes (Apriani & Arifai, 2025). This is thought to be because some athletes do not yet possess effective and efficient footwork they are unable to change direction quickly, resulting in them being too late to reach the shuttlecock. Consequently, this study was conducted to compare different types of training exercises that can improve footwork in badminton.

In badminton training, particularly when focusing on improving footwork, core stability exercises are often not integrated into the training programme. In badminton, footwork movements include stepping, jumping, running and changing direction quickly. Such movements naturally require balance and body stability to prevent falls or injuries. Core stability training is designed to strengthen the core muscles surrounding the spine and abdomen (Azzahra et al., 2024). Core stability plays a role not only in injury rehabilitation but has also been increasingly incorporated into sport since the 1990s (Liu, 2025). Core stability exercises are postural muscle exercises designed to maintain stabilisation of the pelvic and lower limb muscles, enabling them to contract and coordinate effectively so that the body remains in a balanced position (Anjasmara et al., 2021). Core stability training is essentially aimed at maximising an athlete's ability to control the position and movement of the trunk, thereby enabling optimal and efficient movement (Khotijah Rahma, 2023). An unstable or weak core can impair an athlete's performance and increase vulnerability to injuries to the knees and ankles (A'isyah Nurhayati et al., 2023). It is therefore vital for coaches to incorporate this training programme.

A number of studies have shown that core stability exercises can maintain body balance and control in athletes. However, research specifically combining agility training with core stability and shadow drills with core stability and comparing the two in terms of their impact on improving badminton footwork remains relatively limited, particularly in the context of athlete development at Specialised Sports Schools. This situation highlights a research gap that warrants further investigation.

Based on the above, there is a need for a study that systematically examines the effect of agility training combined with core stability and shadow drills combined with core stability on the improvement of badminton footwork skills. This research is important in order to obtain empirical evidence regarding which type of training is more effective and efficient for improving the footwork of badminton athletes, particularly at the Riau Specialised Sports School (SKO Riau). The results of this study are expected to provide a scientific basis for coaches in designing more targeted training programmes to maximise performance.

Method

The method used in this study was a quasi-experimental method with a 'two-group pre-test post-test' design. Each training group agility with core stability and shadow boxing with core stability received treatment for 6 weeks, comprising 16 sessions at a frequency of three times a week. Sugiyono stated that the formation of the training groups utilised the ordinal pairing technique, which was employed to ensure similarity and evenly balanced abilities (Ramadhan et al., 2024). Group formation initially involved a pre-test using a 30-second

footwork test. Groups were then determined using the ordinal pairing technique. The ordinal pairing design was used to divide participants into two groups: test results were ranked from highest to lowest, then participants were divided into Group A and Group B and paired using the formula A-B-A-B (Festiawan, 2020). Group A was given a shadow training programme incorporating core stability, whilst Group B was given an agility training programme incorporating core stability. Following 16 training sessions, a post-test was conducted. The training provided consisted of exercise carried out systematically, progressively and individually over an extended period to influence human physiological and psychological functions and achieve predetermined objectives (Halbatullah et al., 2019).

The study population comprised 26 athletes aged 16-18 years at SKO Riau, with the sample selected using purposive sampling. Purposive sampling is the selection of a sample based on specific criteria or objectives set by the researcher (Try Andreas Putra, 2025). The sample comprised badminton athletes aged 16-18 years who were still active at the Riau Specialised Sports School, competing in badminton, and who were healthy and not currently suffering from any injuries. This sample was selected in accordance with the criteria of the study to be conducted.

The test instrument to be used is the footwork test, designed to measure badminton footwork agility through movements involving stepping forwards, sideways and backwards to the right and left during a 30-second badminton game (Rahmawati & Adityatama, 2025).

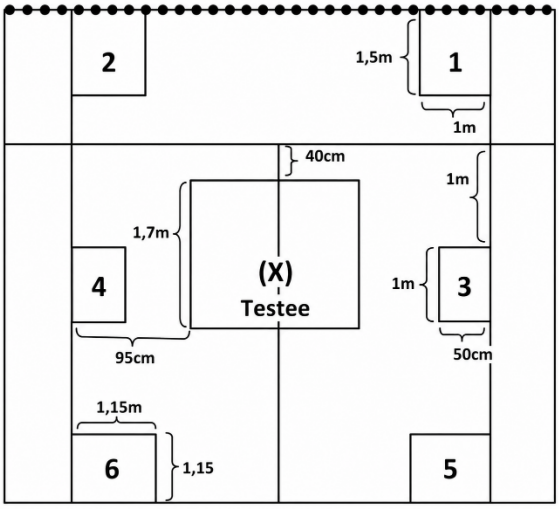

Figure 1. Badminton Footwork Test
Source: Tohar (Rahmawati & Adityatama, 2025)

The data analysis technique used was the paired-samples t-test to determine the improvement in footwork agility before and after the intervention in each training group. An independent-samples t-test was then used to determine the difference in the mean effects between the agility training group with core stability and the shadow training group with core stability.

Results and Discussions

In this study, the data description used to characterize each variable consisted of: agility with core stability (X1), shadow with core stability (X2), and footwork (Y) at the Riau Special Sports School (SKO).

Table 1. Descriptive Statistics

Variable	N	Range	Minimum	Maximum	Mean	Std. Deviation
Pre-test Agility	6	3	14	17	15.83	1.169
Post-test Agility	6	3	17	20	18.67	1.211
Pre-test Shadow	6	4	14	18	16.33	1.366
Post-test Shadow	6	5	18	23	19.67	1.751
Valid N (listwise)	6					

This analysis (Table 1) was conducted on a sample of 6 participants for each training method. The mean score on the pre-test for agility with core stability was 15.83 (SD 1.169), with a minimum score of 14 and a

maximum score of 17. In the post-test for agility with core stability, the mean score was 18.67 (SD 1.211), with the lowest score being 17 and the highest being 20. In the pre-test for shadow with core stability, the mean score was 16.33 (SD 1.366), with a minimum score of 14 and a maximum score of 18. In the post-test for shadow with core stability, the mean score was 19.67 (SD 1.751), with a minimum score of 18 and a maximum score of 23.

Table 2. Normality Test

Variable	Group	Shapiro–Wilk Statistic	df	Sig.
Result	Pre-test Agility	0.908	6	0.421
Result	Post-test Agility	0.907	6	0.415
Result	Pre-test Shadow	0.927	6	0.554
Result	Post-test Shadow	0.797	6	0.055

The results (Table 2) were obtained using the Shapiro-Wilk test. The data from each pre-test and post-test for the agility training method with core stability and the shadow training method with core stability showed a significance level (sig) > α = 0.05. This indicates that the data are normally distributed.

Table 3. Homogenity Test

Variable	Levene Statistic	df1	df2	Sig.
Footwork (Based on Mean)	0.018	1	22	0.896

Based on the homogeneity Table 3, a significance value of 0.896 was obtained. According to the decision criteria for the homogeneity test, if sig > 0.05, the data is considered homogeneous. A significance value of 0.896 indicates that 0.896 > 0.05. Therefore, it is concluded that the agility training method group with core stability and the shadow group with core stability are deemed to share common elements or are homogeneous.

Table 4. Within Group Effect Test (Agility with Core Stability)

Pair	Paired Differences (Mean)	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pre-Test vs. Post-Test (Agility Training)	-2.833	0.753	0.307	-3.623	-2.043	-9.220	5	0.000

Based on the Table 4 which compares the pre-test and post-test results for agility training with core stability the significance value (two-tailed) is 0.000 < 0.05 therefore, H_0 is rejected and H_1 is accepted. Thus, agility training with core stability has a positive effect on improving footwork in badminton at SKO Riau.

Table 5. Within Group Effect Test (Shadow with Core Stability)

Pair	Paired Differences (Mean)	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pre-Test vs. Post-Test (Shadow Training)	-3.333	1.506	0.615	-4.913	-1.753	-5.423	5	0.003

Based on the Table 5 which compares pre-test shadow drills with core stability to post-test shadow drills with core stability the significance value (two-tailed) is 0.003 < 0.05 therefore, H_0 is rejected and H_1 is accepted. Thus, shadow drills with core stability have a positive effect on improving the footwork skills of badminton athletes at SKO Riau.

Table 6. Test for Differences Between Groups (Independent Samples Test)

Variable	Levene's Test (F)	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower	95% CI Upper
Footwork (Equal variances assumed)	0.192	0.670	-1.150	10	0.277	-1.000	0.869	-2.937	0.937

Based on the Table 6, it can be seen that under the assumption of equal variances, the significance level (two-tailed) is 0.277 > 0.05; therefore, it can be concluded that there is no significant difference in the mean footwork test scores between the agility training group with core stability and the shadow training group with core stability regarding improvements in footwork in badminton at SKO Riau.

To determine the magnitude of the difference in means between the two training methods, this study used effect size in its calculations. Effect size indicates the effectiveness of a study and explains the magnitude of the effectiveness of the two training methods (Dao Samo et al., 2023).

Table 7. Effect Size Assessment Standards

No.	Cohen's d Score	Category
1	$0.2 \leq d < 0.5$	Low
2	$0.5 \leq d < 0.8$	Medium
3	$d \geq 0.8$	High

Calculations using Cohen's d yielded a value of 0.644. This means that since $d = 0.644 < 0.8$, the result falls into the moderate category. The difference in mean scores between agility training with core stability and shadow drills with core stability regarding improvements in footwork in badminton at SKO Riau falls into the moderate category (Table 7).

Agility training combined with core stability training has a positive effect on improving the footwork skills of badminton athletes at SKO Riau.

Agility training refers to the body's ability to change direction of movement in specific positions without losing balance (Soffan Hadi et al., 2016). The principles of agility training for achieving optimal results are overload, pre-pressure and periodisation (Pratama et al., 2024). Agility training in badminton is extremely useful for gaining control of the court. This is linked to the fast-paced nature of the game, which involves constant movement to every side of the court. To move with agility, one must, of course, train properly and correctly.

An individual's agility can be influenced by several factors, such as age, gender, height and body weight (Nurpratiwi et al., 2021). In this case, the age of the SKO children ranges from 16 to 18 years. As they approach adulthood, if trained with a well-designed training programme, this can have a positive impact on the athletes' badminton footwork.

In this study, the agility exercises used were the shuttle run and the zig-zag. The shuttle run is an agility exercise that involves changing the direction of movement whilst moving in a straight line. The movement elements in this exercise involve running at speed and then changing the body's position and direction (Maryansyah Indra Fahlevi et al., 2021). Meanwhile, the zig-zag exercise involves changing the direction of movement in a winding pattern (Candra Dwi Satriaputra & Widodo, 2019). Harsono states that an agile person is someone who is able to change the direction of their body quickly and accurately whilst maintaining their balance (Ade Prayoga et al., 2022). In badminton technique, footwork requires varied changes of direction, such as moving from the front right to the front left, or from the right side to the left side. These changes in direction align with this agility training, which involves changing direction both in a straight line and whilst moving in a zig-zag pattern.

Both of these exercises have an impact on athletes' ability to improve their badminton footwork at SKO Riau. This study demonstrates a positive effect of agility training combined with core stability on badminton footwork at SKO Riau. This study is also supported by other research indicating that shuttle run exercises can improve footwork in badminton (Rinto Prasetyo et al., 2025).

Badminton shadow drills combined with core stability exercises have a positive effect on improving the footwork skills of badminton athletes at SKO Riau.

Shadow drills are a type of badminton training in which the athlete simulates hitting the shuttlecock anywhere on the court they wish, according to Tahir Djide in (Tri Denatara et al., 2023). This exercise involves moving to retrieve the shuttlecock and placing it at the edges of the court. According to Kardjono in (Ayu Tri Widhiyanti et al., 2022), shadow training involves footwork movements carried out to retrieve and place the shuttlecock at each of the six corners of the court. Badminton shadow drills are a form of training carried out by visualising oneself in a match (Sholeh et al., 2024). In this study, the shadow drills used were shadow shuttlecock retrieval and shadow badminton. Shadow badminton is a shadow training method carried out by moving the racket to the six corners of the court.

Shadow drills are frequently used by badminton coaches to improve badminton footwork. This study found that shadow drills can improve badminton footwork at SKO Riau. This is also supported by another study by Ayu Tri Widhiyanti et al (2022), which found that shadow drills can enhance agility in badminton footwork.

The Relationship Between Core Stability in Both Training Methods and Improvements in Badminton Footwork at SKO Riau.

The focus of this study is core stability training. Core stability refers to the interaction between the passive spinal structure and the active spinal muscles, along with the neural control system; when combined, these elements maintain the range of intervertebral motion within safe limits. This core stability training method was originally designed for the rehabilitation of injuries and lower limb conditions (Nugroho et al., 2018). This method is used to provide a body foundation for the lower and upper limbs, thereby ensuring a stable base for the body. The fast-paced, dynamic nature of badminton requires strong core muscles to ensure a stable and effective body foundation, as well as to optimise the strength of the leg muscles during movement. The targets for core stability training are the pelvis and lower limbs, including the rectus abdominis, erector spinae, gluteus medius, gluteus maximus, hamstrings, quadriceps, gastrocnemius, biceps femoris, and abductor pollicis longus (Prabaningtyas, 2021). These core muscles stabilise the movements of the upper and lower limbs. Strong core muscles enable efficient movement of the upper and lower body. Core muscles are essential for every badminton player. They serve to stabilise the body, generate force and act as a kinetic chain for energy transfer. The core muscles are used during dynamic activities to support the chest and pelvis and to generate internal pressure for the expulsion of material. Performing core stability exercises can help reduce and prevent problems with the knee joints and the lower body (Sm et al., 2025). Therefore, agility and shadow drills combined with core stability exercises help to control body position during rapid movements and changes of direction. According to research conducted by Nugroho (2018), footwork exercises combined with core stability exercises are more effective than footwork exercises alone.

There was no significant difference in the average effect between agility training with core stability and shadow training with core stability on improving the footwork skills of badminton athletes at SKO Riau.

Agility training with core stability and shadow boxing with core stability can both improve footwork. The training programmes for agility with core stability and shadow boxing with core stability each comprised 16 sessions. Based on the research findings from the Independent Samples t-test, assuming equal variances, the significance value (2-tailed) was $0.277 > 0.05$; it can therefore be concluded that there was no difference in the mean effect of the agility training with core stability and shadow training with core stability groups on the improvement of footwork in badminton at the Riau Special Sports School.

This study utilised an effect size calculation to determine the magnitude of the difference in means between the agility training group with core stability and the shadow training group with core stability, yielding a Cohen's d value of 0.644. This indicates that the difference in means between the agility training group with core stability and the shadow training group with core stability regarding improvements in footwork falls within the moderate category.

This study indicates that there is no significant difference between agility training combined with core stability and shadow training combined with core stability in terms of improving badminton footwork at the Riau Specialised Sports School. These findings differ from those of Tri Denatara et al (2023), who found that the shuttle run method is more effective for improving badminton footwork. This discrepancy is thought to be influenced by several characteristics, such as the fact that the sample used in this study was aged 16-18 years, the test instrument employed a 30-second footwork test, and the design of the training programme provided. The difference in results may also be influenced by the relatively small sample size, meaning that the variation in results may differ from previous findings. These findings indicate that agility training methods incorporating core stability, alongside shadow drills incorporating core stability, both demonstrate a positive influence on the improvement of badminton footwork at the Riau Specialised Sports School, meaning both approaches enhance badminton footwork. Consequently, based on these findings, coaches can incorporate a variety of training exercises designed to improve badminton footwork.

Conclusions

The findings indicate that both agility training combined with core stability and shadow training combined with core stability significantly improve badminton footwork performance among athletes at the Riau Special Sports School (SKO). However, no significant difference was found between the two training approaches, suggesting that both methods are equally effective for enhancing footwork performance. These findings provide practical evidence that coaches may adopt either training program as an effective alternative for improving badminton footwork while considering athletes' needs and training objectives.

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