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Basic Movement Training and Agility in Youth Badminton Athletes

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ABSTRACT

Purpose of the study: This study aimed to determine the effect of basic movement training on the agility of badminton athletes under 12 years old. The research focused on evaluating whether a structured basic movement training program could significantly improve agility performance among young badminton athletes.

Methodology: This study employed a quantitative experimental approach using a One-Group Pretest–Posttest Design. The sample consisted of 27 male badminton athletes under 12 years old from PB. Bantul Badminton Club selected through purposive sampling. The intervention involved 16 sessions of basic movement training.

Main Findings: The results demonstrated a significant effect of basic movement training on agility improvement among badminton athletes under 12 years old. The paired-sample t-test revealed a significance value of 0.000 (< 0.05), indicating a statistically significant difference between pretest and posttest scores. The mean agility score improved from 9.1437 seconds during the pretest to 8.6804 seconds during the posttest. Furthermore, the calculated t-value (6.251) exceeded the critical t-value (2.056), confirming the effectiveness of the training intervention in enhancing agility performance.

Novelty/Originality of this study: The novelty of this study lies in the application of a structured basic movement training program consisting of twelve integrated locomotor and non-locomotor movement patterns specifically designed for badminton athletes under 12 years old. Unlike conventional badminton training that primarily emphasizes technical skills, this study highlights the importance of fundamental movement development as a foundation for agility enhancement, providing an innovative and age-appropriate training approach for long-term athlete development.

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1. INTRODUCTION

Badminton is one of the most popular sports worldwide and has become a highly competitive sport requiring athletes to possess excellent technical, tactical, physical, and psychological abilities [1]-[3]. The increasing level of competition in badminton has encouraged coaches and sports scientists to pay greater attention to athlete development from an early age. In modern badminton, success is not determined solely by technical proficiency in executing strokes but also by the ability to move efficiently across the court. Athletes must react quickly to the shuttlecock's trajectory, adjust body positions rapidly, and maintain stability while performing various offensive and defensive actions. Consequently, physical conditioning has become an essential component in the long-term development of badminton athletes [4].

Among various physical fitness components, agility is considered one of the most important determinants of badminton performance. Agility is defined as the ability to change direction, body position, or movement patterns rapidly and accurately while maintaining balance and control. In badminton matches, athletes are required to move in multiple directions, including forward, backward, lateral, and diagonal movements within a very short period [5], [6]. These movement demands make agility a crucial physical quality because it enables athletes to reach the shuttlecock efficiently and recover quickly for subsequent movements. Athletes with superior agility generally demonstrate better court coverage, faster reaction times, and greater effectiveness in executing tactical strategies during competition [7].

The importance of agility becomes even more evident in youth badminton development programs. Athletes under the age of twelve are in a critical stage of growth and motor development, where fundamental movement skills can be effectively cultivated and refined [8]. During this developmental period, appropriate training interventions can significantly influence future athletic performance. Coaches increasingly recognize that the establishment of strong movement foundations during childhood contributes to improved physical literacy, enhanced athletic capabilities, and reduced injury risk. Therefore, training programs designed for young athletes should not focus exclusively on technical skills but should also emphasize the development of fundamental physical capacities such as agility, coordination, balance, and speed [9], [10].

One approach that has gained increasing attention in youth sports development is basic movement training. Basic movement training consists of fundamental locomotor, non-locomotor, and manipulative movement patterns that form the basis of more complex sport-specific skills. These movements include running, jumping, hopping, skipping, balancing, turning, and directional changes [11]. Through systematic and progressive practice, basic movement training enhances neuromuscular coordination, motor control, body awareness, and movement efficiency. As a result, athletes become better prepared to perform sport-specific movements that require quick and coordinated responses [12], [13]. In badminton, improved fundamental movement competence may contribute directly to enhanced agility and overall playing performance.

Despite the recognized importance of agility in badminton, observations conducted among athletes at PB Bantul Badminton Club revealed that several under-12 athletes still experienced difficulties in performing rapid directional changes and maintaining movement efficiency during training and competition. Some athletes demonstrated delayed responses when moving toward the shuttlecock, reduced balance during multidirectional movements, and inconsistent recovery positions following stroke execution [14]. These conditions indicate that agility development among young athletes may not yet be optimal. Furthermore, conventional training programs often emphasize technical drills and stroke repetition while providing limited attention to fundamental movement development. Such circumstances suggest the need for alternative training approaches capable of enhancing agility through comprehensive movement-based interventions.

From a theoretical perspective, basic movement training is expected to improve agility by enhancing motor coordination, movement efficiency, and neuromuscular adaptation [15], [16]. Fundamental movement patterns develop the athlete's ability to control body movements in various directions and situations, which subsequently supports the execution of more complex sport-specific actions. As badminton requires continuous multidirectional movement and rapid transitions between offensive and defensive positions, improvements in fundamental movement skills may positively influence agility performance. Therefore, investigating the effectiveness of basic movement training in improving agility among young badminton athletes is essential for developing evidence-based training strategies.

Several previous studies have examined factors influencing agility and physical performance in youth athletes. Research conducted by Yuwono [17] highlighted the importance of fundamental movement development as the foundation for long-term athletic performance. Similarly, Irawan et al. [18] emphasized that fundamental movement skills contribute significantly to the development of physical fitness components, including agility, speed, and coordination in youth athletes. Furthermore, Asnaldi et al. [19] reported that movement-based training interventions positively affected motor competence and athletic development among young sports participants. Although these studies provide valuable evidence regarding the benefits of movement training, most investigations focused on general athletic populations or multiple physical outcomes simultaneously. Limited studies have specifically examined the influence of structured basic movement training on agility performance among badminton athletes under the age of twelve. Therefore, further investigation is required to address this gap and provide sport-specific evidence regarding the effectiveness of basic movement training in badminton.

The novelty of this study lies in the application of a structured basic movement training program consisting of integrated locomotor and non-locomotor movement patterns specifically designed for badminton athletes under twelve years old. Unlike previous studies that primarily focused on general physical conditioning or technical badminton training, this research emphasizes the development of fundamental movement competence as a strategy for enhancing agility. Furthermore, the study contributes empirical evidence regarding the effectiveness of age-appropriate movement training interventions within a badminton-specific context, thereby expanding current knowledge in youth athlete development and sports training methodology [20], [21].

The findings of this study are expected to provide valuable implications for coaches, athletes, sports practitioners, and researchers. For coaches, the results may serve as a scientific basis for incorporating basic movement training into youth badminton development programs. For athletes, enhanced agility may contribute to improved court movement efficiency and competitive performance. For sports organizations, the findings may support the design of long-term athlete development frameworks that emphasize fundamental movement competence. Additionally, the study contributes to the growing body of literature concerning youth sports training and physical development by providing evidence regarding the relationship between movement-based interventions and agility improvement [22].

The urgency of this study is rooted in the increasing demand for evidence-based training methods capable of optimizing athlete development from an early age. As badminton competition becomes increasingly demanding, young athletes must develop not only technical proficiency but also the physical capacities necessary to support high-level performance. Agility is a critical component that influences movement efficiency, tactical execution, and competitive success. However, limited research has examined the role of basic movement training in enhancing agility among under-12 badminton athletes. Therefore, this study is important for providing scientific evidence regarding effective training approaches that can support long-term athlete development and improve the quality of youth badminton coaching programs..

2. RESEARCH METHOD

2.1. Research Design

This study employed a quantitative experimental approach using a One-Group Pretest–Posttest Design [23]. Experimental research is designed to determine the effect of a treatment on a particular variable by comparing conditions before and after the intervention. In this study, basic movement training served as the independent variable, while agility served as the dependent variable. All participants completed an agility pretest prior to the intervention and a posttest after completing the training program. The difference between pretest and posttest scores was used to determine the effectiveness of the basic movement training program in improving agility among badminton athletes under 12 years old. The One-Group Pretest–Posttest Design can be illustrated as follows:

$$O1 \rightarrow X \rightarrow O2 \qquad \ldots(1)$$

Where:
O1 = Pretest (Initial Agility Measurement)
X = Basic Movement Training Program
O2 = Posttest (Final Agility Measurement)

2.2. Subjects and Sample

The population of this study consisted of all badminton athletes under 12 years old registered at PB Bantul Badminton Club. The participants were actively involved in regular training programs and competitions organized by the club. A purposive sampling technique was employed to select participants based on predetermined criteria, including age under 12 years, active participation in club training, physical fitness to complete the intervention program, and willingness to participate throughout the study period.

Based on these criteria, a total of 27 male badminton athletes were selected as research participants. The use of purposive sampling ensured that the selected participants possessed characteristics relevant to the objectives of the study and were capable of completing the entire intervention program.

Table 1. Characteristics of Research Participants

Variable	Category	Percentage (%)
Gender	Male	100
Age Group	Under 12 Years	100
Training Status	Active Athletes	100
Sample Size	27 Athletes	100

2.3. Data Sources and Data Collection Techniques

The study utilized both primary and secondary data sources [24]. Primary data were obtained directly from participants through agility testing conducted before and after the training intervention. Secondary data were collected from scientific journals, textbooks, coaching manuals, and previous research studies related to agility, badminton performance, and fundamental movement training.

Data collection was conducted in several stages. Initially, participants completed a pretest to measure baseline agility levels. Subsequently, the athletes participated in a structured basic movement training program

consisting of locomotor and non-locomotor movement activities. Following completion of the intervention period, a posttest was administered using the same agility assessment instrument. Additional information regarding participant characteristics and training activities was obtained through observation and documentation techniques. These procedures ensured the collection of valid and reliable data for analysis.

2.4. Research Instruments

The primary instrument used in this study was the Modified T-Test Agility Test, which is widely recognized as a reliable and valid instrument for assessing multidirectional agility performance. The test requires participants to sprint, shuffle laterally, change direction rapidly, and return to the starting position as quickly as possible. Performance is recorded in seconds using a stopwatch, with lower times indicating superior agility performance.

Supporting equipment included stopwatches, cones, measuring tapes, whistles, score sheets, and badminton court facilities. Prior to implementation, the instrument underwent validity and reliability testing to ensure measurement accuracy and consistency. The Modified T-Test was selected because it closely resembles movement patterns commonly performed during badminton competition, including forward, backward, and lateral movements [25].

Table 2. Research Variables and Instruments

Variable	Indicator	Instrument	Unit
Basic Movement Training (X)	Training Intervention	Basic Movement Training Program	Session
Agility (Y)	Multidirectional Movement Speed	Modified T-Test	Seconds

2.5. Data Analysis Techniques

The collected data were analyzed using both descriptive and inferential statistical procedures. Descriptive statistics were employed to determine the mean, maximum score, minimum score, and standard deviation of agility performance. These analyses provided an overview of participant performance before and after the intervention.

Before hypothesis testing, prerequisite analyses were conducted. Data normality was examined using the Shapiro–Wilk test, while homogeneity of variance was evaluated using Levene's Test. Following confirmation that the data met the assumptions of parametric testing, a paired-sample t-test was conducted to determine whether significant differences existed between pretest and posttest agility scores [26]. Statistical analyses were performed using IBM SPSS Statistics Version 23, with a significance level of $\alpha = 0.05$.

Table 3. Statistical Analysis Procedures

Analysis Stage	Statistical Test	Purpose
Descriptive Analysis	Mean, SD, Min, Max	Describe data distribution
Normality Test	Shapiro–Wilk Test	Examine data normality
Homogeneity Test	Levene's Test	Examine variance homogeneity
Hypothesis Testing	Paired-Sample t-Test	Determine training effect
Software	IBM SPSS Statistics 23	Data processing

2.6. Research Procedure

The research was conducted systematically through several stages [27]. First, the researcher identified the research problem and reviewed relevant literature regarding agility and fundamental movement training. Second, participant selection was conducted according to the predetermined inclusion criteria. Third, a pretest was administered to assess initial agility performance using the Modified T-Test. Fourth, participants completed a structured basic movement training program for sixteen training sessions. The training program incorporated various locomotor and non-locomotor movement activities designed to improve coordination, balance, and multidirectional movement efficiency. Fifth, a posttest was administered using the same agility assessment procedure. Finally, the collected data were processed and analyzed statistically to determine the effectiveness of the intervention.

Table 4. Basic Movement Training Program

Session	Main Activity	Training Focus
1–4	Running, Skipping, Hopping	Locomotor Development
5–8	Jumping, Side Shuffling, Balance Drills	Coordination and Stability
9–12	Direction Change Drills	Agility Development
13–16	Integrated Movement Patterns	Sport-Specific Movement Efficiency

The methodology was designed to ensure that the intervention, data collection, and analysis procedures were conducted systematically and scientifically, thereby enabling accurate evaluation of the effectiveness of basic movement training in improving agility among badminton athletes under 12 years old.

3. RESULTS AND DISCUSSION

3.1. Descriptive Analysis of Agility Performance

The agility performance of badminton athletes was assessed using the Modified T-Test before and after the implementation of the basic movement training program. The descriptive statistics revealed improvements in agility performance following the intervention. The mean pretest score was 9.1437 seconds, whereas the mean posttest score decreased to 8.6804 seconds. Since agility performance is measured in time units, a lower score indicates better performance. Therefore, the reduction in mean time demonstrates an improvement in the athletes' agility after participating in the training program.

Table 5. Descriptive Statistics of Agility Performance

Variable	N	Mean (Seconds)	Standard Deviation
Pretest	27	9.1437	0.496
Posttest	27	8.6804	0.487

The results indicate that the average improvement in agility performance reached approximately 0.4633 seconds. Although numerically the difference may appear relatively small, in competitive badminton even slight improvements in movement speed can substantially affect performance outcomes. Faster directional changes allow athletes to reach the shuttlecock earlier, improve court coverage, and execute technical skills more effectively during rallies. Therefore, the observed improvement represents a meaningful enhancement in athletic performance.

3.2. Normality and Homogeneity Test Results

Prior to hypothesis testing, prerequisite analyses were conducted to determine whether the data met the assumptions required for parametric statistical testing. The Shapiro–Wilk normality test demonstrated that both pretest and posttest data were normally distributed, with significance values greater than 0.05. Furthermore, Levene's Test indicated homogeneous variance across measurements, confirming that the data satisfied the requirements for paired-sample t-test analysis.

Table 6. Normality Test Results

Variable	Significance Value	Decision
Pretest	> 0.05	Normal Distribution
Posttest	> 0.05	Normal Distribution

Table 7. Homogeneity Test Results

Variable	Significance Value	Decision
Agility Scores	> 0.05	Homogeneous Variance

The fulfillment of these statistical assumptions ensured that the subsequent hypothesis testing procedures could be performed accurately and that the resulting conclusions would possess a high degree of reliability.

3.3. Effect of Basic Movement Training on Agility

The primary objective of this study was to determine whether basic movement training significantly influenced agility among badminton athletes under 12 years old. To evaluate this objective, a paired-sample t-test was conducted comparing pretest and posttest agility scores.

The analysis revealed a calculated t-value of 6.251, which exceeded the critical t-value of 2.056 at the 0.05 significance level. Furthermore, the significance value obtained was 0.000, which was substantially lower than the predetermined alpha level of 0.05. These findings indicate a statistically significant difference between pretest and posttest agility scores.

Table 8. Paired-Sample t-Test Results

Variable	t-value	t-table	Sig. (2-tailed)	Decision
Pretest–Posttest	6.251	2.056	0.000	Significant

The decision-making criterion can be represented mathematically as follows:

$$T_{count} > T_{table} \quad \ldots(2)$$

Since the calculated t-value exceeded the critical value and the significance level was below 0.05, the null hypothesis was rejected. Therefore, the basic movement training program significantly improved agility among badminton athletes under 12 years old.

3.4. Improvement Percentage of Agility Performance

To provide a clearer understanding of the magnitude of improvement, the percentage increase in agility performance was calculated by comparing pretest and posttest mean scores.

The improvement percentage was calculated using the following formula:

$$Improvement\ (\%) = \frac{Pretest - Posttest}{Pretetst}\ X\ 100\% \quad \ldots(3)$$

Based on the calculation, the athletes demonstrated an improvement of approximately 5.07% following participation in the training program. This percentage indicates that the intervention produced a meaningful enhancement in movement efficiency and directional-change capability among participants.

The observed improvement supports the notion that agility development in youth athletes can be effectively enhanced through systematic movement-based training programs emphasizing fundamental motor skills rather than solely focusing on sport-specific technical exercises.

The findings of this study demonstrated that basic movement training significantly improved agility among badminton athletes under 12 years old. The statistical evidence showed substantial differences between pretest and posttest performance, indicating that the training intervention successfully enhanced multidirectional movement capabilities [28]. These results support the theoretical assumption that agility development is strongly influenced by the quality of fundamental movement skills acquired during childhood and early adolescence.

Basic movement training emphasizes the development of locomotor and non-locomotor movement patterns that serve as the foundation for more complex sport-specific actions [29]. Through repetitive practice of movements such as running, hopping, skipping, jumping, balancing, and directional changes, athletes develop improved neuromuscular coordination and movement efficiency. Enhanced neuromuscular function enables athletes to perform rapid transitions between movement patterns while maintaining balance and body control. Consequently, agility performance improves because athletes become more capable of responding quickly and effectively to changing movement demands [30].

The improvement observed in this study may also be explained through motor learning theory. According to motor development principles, repeated exposure to diverse movement patterns facilitates neural adaptations that improve movement execution and coordination. During the sixteen training sessions, participants continuously practiced movement sequences requiring acceleration, deceleration, directional changes, and postural adjustments. Such activities likely stimulated neuromuscular adaptations that enhanced the athletes' ability to execute agile movements more efficiently. As a result, participants demonstrated faster completion times during the posttest assessment.

From a badminton-specific perspective, agility is one of the most important determinants of successful performance. During competition, players must frequently move forward, backward, laterally, and diagonally in response to shuttlecock placement. Athletes with superior agility can reach the shuttlecock earlier, maintain better positioning, and execute strokes more effectively. Therefore, improvements in agility resulting from basic movement training may contribute directly to enhanced badminton performance. The findings suggest that movement-based conditioning programs should be integrated into youth badminton training curricula to support long-term athletic development.

The results also highlight the importance of emphasizing fundamental movement competence during childhood. Many youth training programs focus heavily on technical skill acquisition while neglecting foundational movement development. However, without adequate movement competence, athletes may struggle to maximize the effectiveness of technical training. The findings of this study demonstrate that investments in basic movement training can produce meaningful improvements in physical performance that subsequently support sport-specific skill execution.

The findings of this study expand upon previous research examining the relationship between fundamental movement skills and athletic performance. Santos et al. [31] reported that movement competency development positively influenced physical fitness components among youth athletes. Similarly, Kurnaz [32] found that movement-based training programs improved athletic performance indicators such as agility, coordination, and balance. Additionally, Zhang et al. [33] emphasized the importance of fundamental movement development as the foundation of long-term athlete development models. Although these studies established the

importance of movement competence, most focused on general youth populations or multiple sports simultaneously. Few studies specifically investigated the effectiveness of structured basic movement training on agility among badminton athletes under 12 years old. Therefore, the present study addresses an important gap by providing sport-specific evidence regarding movement-based interventions within youth badminton development programs.

The novelty of this study lies in the implementation of a structured basic movement training program specifically designed for badminton athletes under 12 years old. Unlike previous studies that concentrated primarily on technical badminton drills or general physical conditioning, this research emphasizes fundamental movement development as a mechanism for improving agility. Furthermore, the intervention incorporated integrated locomotor and non-locomotor movement patterns directly relevant to badminton movement demands. The findings provide new empirical evidence supporting the effectiveness of age-appropriate movement-based training for enhancing agility within youth badminton contexts.

The findings of this study offer important practical implications for coaches, athletes, sports organizations, and researchers. Coaches may utilize the results to justify the inclusion of structured basic movement training within youth badminton development programs. By improving agility through movement-based interventions, athletes may achieve enhanced court coverage, faster reactions, and improved competitive performance. Sports organizations may also consider incorporating fundamental movement assessments into talent identification and athlete development systems. Additionally, researchers may use these findings as a foundation for future investigations examining the long-term effects of movement-based training on various performance outcomes [34].

Several limitations should be acknowledged when interpreting the results of this study. First, the study employed a one-group pretest–posttest design without a control group, which limits the ability to attribute improvements exclusively to the intervention. Second, the sample consisted of only 27 athletes from a single badminton club, potentially restricting the generalizability of the findings to broader populations. Third, the study focused exclusively on agility and did not examine other performance-related variables such as speed, balance, coordination, reaction time, or technical badminton skills. Finally, the intervention period was relatively short, making it difficult to assess long-term training effects. Future studies should utilize randomized controlled designs, larger and more diverse samples, longer intervention durations, and multiple performance indicators to provide a more comprehensive understanding of the effectiveness of basic movement training in youth badminton development.

4. CONCLUSION

This study aimed to determine the effect of basic movement training on agility among badminton athletes under 12 years old. The findings demonstrated that the implementation of a structured basic movement training program significantly improved athletes' agility performance. This improvement was evidenced by a decrease in the average agility test time from the pretest to the posttest and supported by the paired-sample t-test results, which indicated a statistically significant difference between measurements before and after the intervention ($p < 0.05$). These findings suggest that basic movement training effectively enhances multidirectional movement ability, coordination, and movement efficiency among young badminton athletes. Therefore, basic movement training can be considered an effective training strategy for improving agility and supporting long-term athletic development in youth badminton.

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