Impact of five-cone and ladder drill training on agility among U15 football athletes

Pupuh Harya Prembanyu[1*,A-F], Agus Wiyanto[1,A,E,F], Setiyawan[1,C,E,F]

[1] Department of Physical Education, Health and Recreation, Faculty of Social Sciences and Sports Education, Universitas PGRI Semarang, Jl. Sidodadi Timur No. 24, Semarang 50232, Indonesia

***Corresponding author:** Pupuh Harya Prembanyu; Universitas PGRI Semarang, Jl. Sidodadi Timur No. 24, Semarang 50232, Indonesia; email: pupuhharyap1222@gmail.com

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ABSTRACT

Background: Although it may seem simple, soccer has complex characteristics, which is why many children are attracted to training at soccer schools. Agility is a crucial aspect of the game, as it enables a player to move quickly, evade opponents, and control the ball effectively. At the Pemalang Regency Bina Talenta Soccer School (SSB), agility training is not conducted optimally and has not been implemented systematically with effective methods. Therefore, exercises such as the five-cone and ladder drills need to be implemented to improve player agility more effectively.

Objectives: This study aims to examine the impact of five-cone and ladder drill training on the agility of U15 football athletes.

Methods: This study used a quantitative descriptive method with a quasi-experimental approach. The experimental design was a pretest-posttest in two groups. The sampling technique used was purposive sampling with 20 players participating in a four-week training program. The instrument to measure agility was the Illinois Agility Test, with a validity level of r = 0.87. The measurement data were analyzed using a difference test with the help of SPSS software version 29.0.

Results: The five-cone drill and the ladder drill had a significant effect on agility, as both exercises had a significance value of <0.05. The five-cone drill was more effective than the ladder drill. This was due to the difference in scores between the five-cone drill, which increased by 1.04, and the ladder drill, which increased by 0.84.

Conclusions: Both training methods are effective in improving agility and can be integrated into school-based football training programs. Furthermore, the results of implementing these methods can enhance player performance and provide a valuable source of new knowledge for future researchers on agility in SSB players.

Keywords: agility, five cone drills, football, ladder drills.

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INTRODUCTION

Sport is a physical training activity to enrich and improve abilities, fundamental movement skills, and advanced movement skills (specific to each Sport). According to Bangun (2016), Idels (2025), and Petersen et al. (2024), Sport generally involves physical and mental activity aimed at training the body. In practice, Sport serves not only to maintain physical health but also as a means of education, recreation, achievement development, character building, and social cooperation. In Indonesia, there are many types of sports, one of which is football.

Football is one of the most popular sports worldwide (Fadhli & others, 2023; Joannou & Candlish, 2018; Lane et al., 2020). With a large number of players and fans, it is not surprising that football is such an important sport in society. Generally, this game is played by two teams, with the goal being to score goals against the opposing team. Each team consists of 11 players and is led by a coach. The game begins with a 45-minute first half. If the score remains tied after both halves, the game proceeds to extra time or a penalty shootout. Although it seems simple, this game actually has very complex characteristics and nature, so it is not uncommon for many children to participate in training sessions, commonly called Football Schools, "SSB". SSB is an institution that focuses explicitly on football with the primary goal of developing the talents and abilities of young athletes. SSB Bina Talenta Pemalang Regency is a regional football school that fosters young players to develop their talents and potential. To achieve high levels of achievement in soccer, coaching must begin early to achieve optimal results. This coaching aims to develop young talent as the nation's next generation of leaders. The beauty of soccer is clearly visible when players master technique. Therefore, technique is the primary foundation for a player's ability to play well. Technique is also a crucial element for every player to develop effectively. Basic soccer techniques include passing, dribbling, shooting, and heading. In addition to technique, agility is equally important in this game.

Activities at the Pemalang Bina Talenta Football School (SSB) are not only a means of recreation and character building, but also play an important role as a medium to foster achievement and develop the physical potential of players, especially in the aspect of agility. Based on the results of initial observations, a maximum score of 19.40 was obtained with an average score of 17.70, which indicates that the level of agility of SSB Bina Talenta players is still in the "Sufficient" category. Based on the observations, five players fall into the "Good" category, seven players into the "Sufficient" category, three players into the "Poor" category, and five players are classified as "Very Poor". These results indicate that most players have not yet reached the optimal agility category and require more focused physical training, particularly in exercises that improve agility. These assessment criteria are based on sources Waskito (2021), which state that the Ilinios agility run test <15.2 is categorized as very good, 15.2 - 16.1 is categorized as good, 16.1 - 18.1 is categorized as sufficient, 18.2 - 19.3 is categorized as less, and >19.3 is categorized as significantly less.

Research that has been done previously by Ramdhan et al. (2024) focuses on dribbling techniques at the age of 10-12 years using ladder drills and cone drills, while this study focuses on the agility of U15 players and the comparison of the effectiveness of five cone drills and ladder drills, research (Santoso et al., 2023) stated that there was no significant difference between the two methods, but this study found that five cone drills were more effective than ladder drills, research Yohanes &

Komaini (2021) discusses the influence of ladder drill variations in general, while this study directly compares the two methods in the context of SSB Bina Talenta, research Haryono et al. (2021) comparing other exercises such as shuttle runs with ladder drills, while this study only focuses on five cone drills and ladder drills, research Neviantoko et al. (2020) found ladder drills to be more influential, in contrast to this study which confirmed that five cone drills were more influential.

Although both types of training have been widely used, research directly comparing their effectiveness, especially among young athletes in Football Schools (SSB), is still very limited. Therefore, this study aims to analyze the effect of five cone drills and ladder drills on the agility of U15 players at SSB Bina Talenta Pemalang Regency. The results are expected to provide scientific input for the development of sports development programs at SSB and contribute to optimizing youth player training. Although the benefits of agility training have been proven in various sporting contexts, a lack of research remains in directly comparing the effectiveness of five-cone drills and ladder drills for young football players in SSB environments. Previous studies have generally focused on a single training method or different sporting populations, thus not providing an adequate picture of which method is most effective for developing player agility at the school level. This study addresses this gap by directly comparing the two training methods, while also providing practical insights for coaches and educators on developing more effective training programs. The novelty of this study provides new insights into the effectiveness of five cone drills compared to ladder drills, specifically for U15 players at SSB Bina Talenta. The novelty lies in the implementation of a structured and systematic training method that has not been widely explored, as well as the analytical data supporting the significant improvement in agility.

The urgency of this research stems from the importance of agility, a key motor skill in football, particularly for young players. Implementing the proven-effective five-cone drills and ladder drills is expected to significantly improve player performance and support the development of talent and potential among young players at SSB Bina Talenta. The research findings can also serve as a reference for coaches and football institutions to optimize training programs.

The result of this study aims to analyze the effect of five cone drills and ladder drills on the agility of U15 players at SSB Bina Talenta, Pemalang Regency. Five-cone drills and ladder drills have proven effective and can be used as standard methods in SSB training to improve performance and motor skills. Furthermore, the results of this study can serve as a valuable reference for coaches and researchers in developing evidence-based training programs for youth football.

METHODS

Study Design and Participants

This study employed a quasi-experimental research design with a two-group pretest-posttest design, aiming to analyze the effect of five cone drills and ladder drills on the agility of U15 players at SSB Bina Talenta, Pemalang Regency. The population in this study consisted of all U15 players at SSB Bina Talenta, Pemalang Regency. The research sample was selected using a purposive sampling technique based on the following inclusion criteria: players who actively participate in regular training, have no history of disturbing injuries over the last three months, and are willing to participate in the entire series of training during the study. A total of 20

players were selected and divided equally into two experimental groups, each consisting of 10 players who will undergo the Five Cone Drills and Ladder Drills training methods to measure the effect of both methods on improving player agility.

Based on references from several studies related to five-cone drills and ladder drills, training is generally conducted three times a week for four weeks. Each training session lasts approximately 30 to 45 minutes, focusing on movement patterns that improve agility through changes of direction, speed, and coordination. For example, research at a football school in SSB showed that a three-times-a-week training protocol for four weeks was effective in improving players' agility and speed (Adhi & Wismanadi, 2018; Hadi et al., 2016; Morita et al., 2022).This duration and frequency are considered optimal to provide sufficient stimulus for improving the physical performance of young players without the risk of excessive fatigue.

Ethical approval statement

This research has received approval from the Ethics Committee of the Faculty of Social Sciences and Sports Education (FPIPSKR) of Universitas PGRI Semarang, with approval number 266/AM/FPIPSKR-UPGRIS/VII/2025. All participants received a detailed explanation of the study's purpose, including its potential benefits and risks.

Research Instruments

This study used the Illinois Agility Test as the primary instrument to measure the players' agility levels. This test is an international standard commonly used in sports to evaluate athletes' ability to change direction quickly, accurately, and in a controlled manner. This test was chosen due to its high reliability and widespread application in various scientific studies. The test involves several pieces of equipment, including a stopwatch, cones (or pylons), a tape measure, and a flat field measuring at least 10 x 5 meters. Participants start in a prone position and then run along a predetermined zigzag path, using cones as markers. The time from start to finish is recorded as a measurement result. Data collection was conducted twice: before the training program (pre-test) and after the training program (post-test). Both groups, those undergoing five-cone drills and ladder drills, followed the same procedure. The data obtained from these tests were used to assess the effectiveness of each training method in improving the agility of U15 players at SSB Bina Talenta Pemalang.

Data Analysis

The collected data were then analyzed using quantitative statistical techniques. Before hypothesis testing, the data were tested for normality using the Shapiro-Wilk test to verify normal distribution. After analyzing the data, they were tested using a t-test or paired-sample t-test. The basis for decision-making was that a sig (2-tailed) value <0.05 indicates a significant effect. However, a sig (2-tailed) value >0.05 indicates no significant effect. All data analyses were performed using IBM SPSS Statistics version 29.0.

RESULTS

This study examined the effect of five cone drills and ladder drills on the agility of U-15 SSB Bina Talenta players in Pemalang Regency. The collected data underwent statistical analysis using paired-sample t-tests within each experimental group. Table

1 presents the mean scores and standard deviations (SD) of the five cone drills and ladder drills measurements from both the pre-test and post-test phases.

Table 1. Mean and Standard Deviation Values for the Experimental Group in the Pretest and Posttest

Group	Phase	Mean	SD
Five cone drills	Pre-test	17.27	1.56
Five cone drills	Post-test	16.23	1.85
Ladder drills	Pre-test	18.13	1.28
Ladder drills	Post-test	17.29	1.48

Based on Table 1, the descriptive analysis indicates a clear improvement in agility performance for both training groups. Players who completed the five-cone drill showed better post-test outcomes compared to their pre-test results, demonstrating the effectiveness of this drill in enhancing agility. Similarly, the ladder drill group also exhibited noticeable improvements from pre-test to post-test, confirming that ladder-based training contributed positively to agility development. Overall, both training methods produced meaningful gains in agility among the U15 athletes.

Table 2. Normality Test Results

Group	Phase	Shapiro-Wilk		
		Statistic	Df	Sig.
Five cone drills	Pretest	.856	10	.069
Five cone drills	Postest	.903	10	.236
Ladder drills	Pretest	.883	10	.142
Ladder drills	Postest	.886	10	.152

The normality test results presented in Table 2, using the Shapiro–Wilk method, indicate that all pretest and posttest scores in both the five-cone drill group and the ladder drill group met the normality assumption, as all significance values exceeded 0.05. These findings confirm that the data were normally distributed, fulfilling a key requirement for conducting parametric analyses. Given that the assumption of normality was satisfied, the hypothesis testing was performed using paired-sample and independent-sample t-tests, as summarized in Table 3.

Table 3. Paired Samples T-Test

Group	N	Means	Std. Deviation	Std. Eror Means	Significance
Five cone drills	10	1.038	.391	.123	.001
Ladder drills	10	.838	.325	.102	.001

The paired-sample t-test was conducted to compare the pretest and posttest scores within each training group, following the decision rule that a significance value (2-tailed) below 0.05 indicates a meaningful difference between the two measurements.

As shown in Table 3, the analysis revealed significant improvements in both the five-cone drill and ladder drill groups, with a p-value of 0.001. These results indicate that each training method effectively enhanced the athletes' agility performance from pretest to posttest. Although both groups demonstrated positive gains, the five-cone drill group showed slightly greater improvement compared to the ladder drill group. Overall, the findings confirm that both drills were effective in improving agility outcomes.

DISCUSSION

The findings of this study demonstrate that both five-cone drills and ladder drills significantly enhanced the agility of U15 players at SSB Bina Talenta Pemalang Regency. The paired-sample t-test results ($p = 0.001$) confirm that each training

method produced meaningful improvements in agility performance. While both approaches were practical, the five-cone drills yielded greater gains compared to ladder drills, suggesting that the dynamic and multidirectional nature of the five-cone drill more closely reflects the movement demands of football. This is consistent with the principle that agility requires rapid changes of direction, acceleration, and high coordination, which are fundamental determinants of performance in football (Adhi & Wismanadi, 2018; Hasanuddin & Hasruddin, 2018; Kovacikova & Zemková, 2021).

The superior improvement observed in the five-cone drill group may be attributed to training patterns that simulate game-like scenarios. These drills encourage sharper direction changes, reactive acceleration, and complex body coordination, leading to more effective neuromuscular adaptations. Existing literature supports this notion, emphasizing that task variability and obstacle-based movement patterns lead to greater gains in agility (Adhi & Wismanadi, 2018; Kovacikova & Zemková, 2021). The five-cone drills also stimulate explosive strength, balance, and whole-body coordination—key components of agility development in youth football.

In contrast, ladder drills primarily emphasize linear footwork, rhythm, and coordination. Although these components contribute to agility, they do not fully replicate the multidirectional demands of actual match situations. Nevertheless, the ladder drills still produced significant improvements, reflecting their value in building foundational movement skills, foot speed, and coordination (Adhi & Wismanadi, 2018; Liu et al., 2020; Ramdhan et al., 2024). In the context of early-stage athlete development at SSBs, ladder drills remain a beneficial introductory component of agility training.

The four-week training duration, with three sessions per week, proved sufficient to induce neuromuscular adaptations without causing excessive fatigue, making it suitable for young athletes. This training load aligns with recommendations for youth player development, where structured, progressive, and systematic programs are essential for maximizing performance outcomes (Chaabouni et al., 2025; Hasanuddin & Hasruddin, 2018). The use of the Illinois Agility Run Test further strengthens the validity of the study, as it is widely recognized as a reliable instrument for assessing changes in agility performance.

These findings are also in line with several previous studies. Ramdhan et al. (2024) reported significant effects of ladder and cone-based agility training on dribbling skills among young football players. Santoso et al. (2023) found no significant difference between ladder and cone drills in improving agility in U15 players, while Yohanes & Komaini (2021) demonstrated the effectiveness of ladder drill variations in enhancing agility at the Koto Pulai Youth Development Club. Furthermore, Haryono et al. (2021) highlighted the positive influence of shuttle run and ladder drills, and Neviantoko et al. (2020) observed greater improvements in agility and speed from ladder drill training compared to cone training. Additional studies, such as Zainuddin (2022) on the five-cone snake drill and Wati et al. (2020) on various cone drill configurations, reinforce the notion that cone and ladder drills consistently contribute to improvements in agility and speed among young football athletes. Collectively, these studies support the conclusion that structured agility training—particularly involving ladder and cone drills—plays a crucial role in enhancing the performance of youth.

Limitations of the study

Despite these positive findings, this study has several limitations. First, the sample size was relatively small and drawn from a single SSB, limiting the generalizability of the results. Second, the training duration was only four weeks, which may not reflect long-term adaptations or sustained improvements. Third, the study relied solely on agility assessments and did not incorporate technical, tactical, or psychological variables that are also essential for holistic football development. Finally, external factors such as player motivation, prior training experience, and environmental conditions were not controlled, and these may have influenced the performance outcomes. Future research should consider a larger, more diverse sample, a longer intervention period, and additional performance indicators to provide a more comprehensive understanding of the effectiveness of agility training.

CONCLUSIONS

The results of this study, supported by existing literature, indicate that both five-cone drills and ladder drills significantly enhance the agility of U15 football players at SSB Bina Talenta, Pemalang Regency. These training methods effectively improve essential agility components—such as rapid directional changes, balance, coordination, and reaction speed—which play a critical role in football performance.

The findings also align with prior research highlighting the positive effects of cone- and ladder-based agility training on the physical and technical development of young athletes. Although both training types were effective, the five-cone drills produced greater overall improvements, suggesting that this method offers movement patterns more closely aligned with the dynamic demands of football.

Based on these outcomes, youth football coaches are encouraged to incorporate both five-cone and ladder drills into their regular training programs to enhance players' agility development and better prepare them for competitive match situations.

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DATA AVAILABILITY

All data supporting the findings of this study are included in the article and its supplementary materials. Additional datasets are available from the corresponding author upon reasonable request.

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CONFLICT OF INTEREST

The authors hereby declare that this research is free from any conflict of interest with any party.

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