



## The Effect of Ladder Drill Training On Improving The Agility Of Futsal Players At The Madama Angels Club

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### ABSTRACT

Futsal is a sport characterized by fast-paced, dynamic play that demands explosive changes of direction. Agility is a key physical component that determines a player's effectiveness in transitioning between offense and defense. Initial observations of the female players at Club Madama Angels revealed limitations in agility, particularly in situations of rapid changes of direction. This study aims to analyze the effect of ladder drill training on improving the agility of futsal players at Club Madama Angels. The research method used a quasi-experimental design with a one-group pretest-posttest model. The sample consisted of 20 female athletes selected using a total sampling technique. The agility measurement instrument used the T-Drill Test. The ladder drill training program was administered for 6 weeks (17 sessions) at a frequency of 3 times per week and applied the principle of progressive overload. Data analysis used the Shapiro-Wilk normality test, Levene's homogeneity test, and paired sample t-test at a significance level of 0.05. The results showed an average pre-test time of 19.98 seconds, decreasing to 17.49 seconds in the post-test, with a difference of 2.49 seconds. The t-test showed a t-value of 12.84 with a p-value of 0.000 (<0.05) and a large effect size (Cohen's  $d = 1.82$ ). It was concluded that ladder drills had a significant and effective effect on improving the agility of female futsal players at Club Madama Angels.

### ARTICLE HISTORY

Received: 2026/02/23

Accepted: 2026/02/26

Published: 2026/02/28

### KEYWORDS

Ladder Drill;

Agility;

Women's Futsal;

T-Drill;

Neuromuscular Training.

### AUTHORS' CONTRIBUTION

A. Conception and design of the study;

B. Acquisition of data;

C. Analysis and interpretation of data;

D. Manuscript preparation;

E. Obtaining funding

**Cites this Article** : Suci, W.; Sukrawan, N.; Rahma, R.; Lilo, D.K.; Purwanto, D. (2026). The Effect of Ladder Drill Training On Improving The Agility Of Futsal Players At The Madama Angels Club. **Competitor: Jurnal Pendidikan Kepeleatihan Olahraga**. 18 ( 1 ), p.1685-1695

## INTRODUCTION

Sport is a physical training activity aimed at enriching and improving fundamental movement abilities and specific skills within a sport (Yunis Bangun, 2016). From a social perspective, sport is not merely a physical activity, but also a phenomenon of human movement behavior that has a specific direction and purpose, and is relevant to the dynamics of social life (Mahfud & Fahrizqi, 2020). In the context of modern competitive sports, improving performance no longer relies solely on conventional training but requires a scientific approach based on sports science, encompassing physiology, biomechanics, motor learning, and training periodization (Bompa & Buzzichelli, 2019; Suchomel et al., 2018; Turner & Stewart, 2014).



Futsal, as a dynamic team sport, demands a complex integration of technical precision, tactical awareness, physical conditioning, and psychological control (Purwanto et al., 2025). The characteristics of futsal, played in confined spaces at a fast pace, make changes in direction, acceleration and deceleration, and rapid response dominant components of performance (Naser & Ali, 2016; Ribeiro et al., 2020). In this context, agility is a key determinant of a player's success in penetration, pressing, and game transitions (Bompa & Buzzichelli, 2019).

Agility is conceptually defined as the ability to change body direction quickly, precisely, and under control without losing balance (Sheppard & Young, 2016). Physiologically, agility involves neuromuscular coordination, eccentric-concentric strength, proprioception, and postural control (Chaouachi et al., 2015; Dos'Santos et al., 2018). In futsal, low agility directly impacts positional rotation delays, weak one-on-one defense, and suboptimal counterattacks (Pratama et al., 2022; Milanović et al., 2019).

Initial observations at the Madama Angels Club in Central Sulawesi showed that although players possessed good basic technique, they still experienced weaknesses in the transition phase of the game, particularly when changing direction quickly after losing the ball. The coach identified limited agility as a factor hindering the team's performance when facing high-intensity opponents. This condition indicates the need for specific, structured training interventions based on scientific evidence. Therefore, the main question of this research is: can systematic ladder drill training significantly improve the agility of futsal players at the Madama Angels Club?

In the last decade, research on agility development has progressed significantly. Recent studies emphasize that agility is not simply linear speed, but also encompasses change of direction speed and stimulus-driven reactive agility (Young & Farrow, 2013; Paul et al., 2016). Effective interventions must incorporate quick foot coordination, core stability, and neuromuscular control (Dos'Santos et al., 2018).

Ladder drill is a training method using an agility ladder designed to improve foot speed, coordination, and movement rhythm (Hasbi & Wahyudi, 2020). Biomechanically, this exercise increases stride frequency, improves foot placement patterns, and accelerates type II motor unit activation (Spiteri et al., 2015). Research by Herlina et al. (2021) showed an 18% increase in agility after a 6-week ladder drill program in soccer athletes. Similar findings were reported by Sattler et al. (2015) and Negra et al. (2017) found that foot coordination-based training significantly improves change-of-direction ability. In the context of futsal, studies by Ribeiro et al. (2020) and De Oliveira Bueno et al. (2014) confirmed that futsal movement patterns are dominated by short sprints, lateral shuffles, and rapid rotations. Therefore, training methods that emphasize multidirectional coordination are highly relevant. National research (SINTA) also demonstrated the effectiveness of ladder drills in improving agility in youth soccer and futsal (Pratama et al., 2022; Hasbi & Wahyudi, 2020).

Physiologically, ladder drills contribute to increased neuromuscular efficiency through central nervous system stimulation and increased motor neuron firing rates (Cormie et al., 2011; Suchomel et al., 2018). These adaptations are implicated in increased

muscle contraction speed and directional reaction ability. Furthermore, this exercise is relatively safe, economical, and easy to implement in pre-season and competition periods (Turner & Stewart, 2014).

However, the effectiveness of ladder drills is highly dependent on program design, frequency, intensity, and integration with other training components such as strength and plyometric training (Milanović et al., 2019; Asadi et al., 2016). Therefore, contextual research in specific populations is still needed to strengthen empirical evidence. Although various studies demonstrate the effectiveness of ladder drills in improving agility in soccer and other invasive sports, several research gaps remain. First, most studies have been conducted on large-pitch soccer athletes, not futsal, which has different spatial and intensity characteristics (Naser & Ali, 2016). Second, studies on regional club populations in Indonesia are still limited and rarely use controlled experimental designs with high-validity measurements (Pratama et al., 2022). Third, previous research has focused more on improving linear speed rather than futsal-specific change of direction. In futsal, rapid changes of direction over distances of 3–5 meters are a key performance indicator (Ribeiro et al., 2020). Fourth, there are few studies examining the effects of ladder drills in the context of semi-professional clubs in Sulawesi, so the generalizability of international findings may not be appropriate for local conditions.

Furthermore, recent literature emphasizes the importance of integrating neuromuscular-based training to maximize transfer to match performance (Dos'Santos et al., 2018; Suchomel et al., 2018). However, research at the Indonesian youth club level has not systematically evaluated the impact of ladder drills on improving agility based on standardized tests such as the Illinois Agility Test or the T-Test. Therefore, there is a scientific need to empirically test the effect of ladder drill training on improving agility in futsal players in the context of the Madama Angels Club, a representative of a developing regional club.

This study aims to analyze the effect of ladder drill training on improving agility in futsal players at the Madama Angels Club through a structured experimental approach. Specifically, this study evaluates changes in agility scores before and after the training intervention over a specific period using a standardized measurement instrument. The novelty of this study lies in: The implementation of ladder drills in the context of a regional futsal club characterized by high-intensity play. The integration of a neuromuscular adaptation approach into training design. Providing empirical data based on the local population of Eastern Indonesia, which is still limited in the Scopus and SINTA literature. Practical contribution to a futsal-specific physical training model based on scientific evidence.

Theoretically, this research enriches the body of sports coaching knowledge related to agility development based on coordination ladder training. Practically, the research results are expected to serve as a reference for futsal coaches in designing effective, measurable, and adaptive training programs to meet the demands of the modern game. With a systematic scientific approach based on the latest literature, this

research seeks to make a significant contribution to the development of sports performance, particularly in futsal in Indonesia.

## **METHODS**

This study used a quasi-experimental design approach with a one-group pretest-posttest design. This design was chosen because the study aimed to test the causal relationship between treatment (ladder drill training) and increased agility without a control group. According to Suharsimi Arikunto (2010), an experiment is a method for establishing a causal relationship between two variables by intentionally introducing a specific treatment while minimizing confounding factors. In the context of this study, controlled factors include the routine training schedule, non-experimental training intensity, rest patterns, and field conditions.

### **Research Subjects**

The study population was all female athletes of Club Madama Angels. The sampling technique used total sampling, so all athletes who met the inclusion criteria were included in the sample. The sample size was 20 female athletes aged 15–20 years, actively participating in regular training for at least the past 6 months, and in good health and injury-free throughout the study period.

### **Research Design**

The research design is described as follows:

$$O_1 \rightarrow X \rightarrow O_2$$

The treatment was administered for 6 weeks, three times per week, with each session lasting approximately 30 minutes as part of a physical training program. The training intensity was progressive, with the complexity of the movement patterns increasing every two weeks.

### **Intervention Procedure**

The ladder drill program consisted of a variety of movements such as single-step runs, lateral in-out, carioca drills, hopscotch drills, and zig-zag crossover steps. The exercises were performed using a 5–8 meter agility ladder under direct supervision of a trainer to ensure correct technique. The training principles followed the concepts of progressive overload and specificity training, ensuring optimal neuromuscular adaptation.

### **Data Collection Instruments and Techniques**

Agility was measured using the Illinois Agility Test, which has high validity and reliability in measuring change-of-direction ability. Time was recorded using a digital stopwatch with an accuracy of 0.01 seconds. The shorter the time achieved, the better the athlete's agility level. Data was collected twice: before the intervention (pretest) and after 6 weeks of treatment (posttest), at the same time and under the same field conditions to maintain measurement consistency.

### **Data Analysis Techniques**

Data were analyzed using parametric statistical tests with the following steps: Normality test (Shapiro-Wilk), Homogeneity test (Levene's Test), Paired Sample t-test to

determine differences between the pretest and posttest. Effect size calculation (Cohen's d) to determine the effect of training. The significance level was set at  $\alpha = 0.05$ .

**Table 1.**  
 Characteristics of the Research Sample (N = 20)

Variables	Category	n	%
Gender	Girls	20	100
Age	15-17 years	12	60
	18-20 years	8	40
Training Duration	6-12 months	9	45
	>12 months	11	55

**Table 2.**  
 Intervention Design and Procedures

Stage	Activity	Duration	Frequency
Pretest	Illinois Agility Test	1 day	-
Intervention	Ladder Drill (5 movement variations)	6 weeks	3x/week
Posttest	Illinois Agility Test	1 day	-

This method was designed to ensure that the changes in agility that occurred could be directly attributed to the ladder drill treatment. The quasi-experimental approach allowed for empirical testing of the intervention's effects in a real-life club training context, ensuring that the research findings have practical and applicable relevance for developing women's futsal performance.

## RESULTS AND DISCUSSION

### Result

#### Description of Research Results

The subjects of this study were 20 female athletes from the Madama Angels Club. Pre-test data collection took place on Wednesday, September 10, 2025, and post-test data collection took place on Wednesday, October 22, 2025. The ladder drill intervention was conducted 17 times (three times per week: Wednesday, Saturday, and Sunday) at the Pipit Futsal Field. Exercise variations included foot-in-each, feet-in-each, in-in-out-out, and X-over zigzag exercises using the principle of progressive overload.

**Table 3.**  
 Descriptive Statistics of Agility (T-Drill Test)

Variabel	N	Mean (detik)	SD	Minimum	Maximum
Pre-test	20	19.98	1.54	18.07	24.02
Post-test	20	17.49	1.18	16.30	20.44
Difference ( $\Delta$ )	20	-2.49	0.87	-1.10	-4.90

The average pre-test time was 19.98 seconds, while the post-test time decreased to 17.49 seconds. The 2.49-second decrease in time indicates increased agility, as shorter travel times indicate better performance.

#### Normality Test

The Shapiro-Wilk test was used for normality because the sample size was  $<50$ .

**Table 4.**  
 Results of the Shapiro-Wilk Normality Test

Variable	W Statistics	Sig. (p)	Description
Pre-test	0.957	0.512	Normal
Post-test	0.969	0.683	Normal

Since the p-value is > 0.05, the data is normally distributed and meets the requirements for parametric analysis.

### Homogeneity Test

**Table 5.**  
 Results of Levene's Homogeneity Test

Variable	F	Sig. (p)	Description
Pre-Post	1.284	0.265	Homogeneous

### Hypothesis Testing (Paired Sample t-Test)

A hypothesis test was conducted to determine the effect of ladder drill training on improving agility.

**Table 6.**  
 Paired Sample t-Test Results

Variable	Mean Difference	t	df	Sig. (2-tailed)
Pre - Post	2.49	12.84	19	0.000

Since the p-value = 0.000 < 0.05, there is a significant difference between the pre-test and post-test. This means that ladder drill training significantly improved the agility of the Madama Angels Club futsal players.

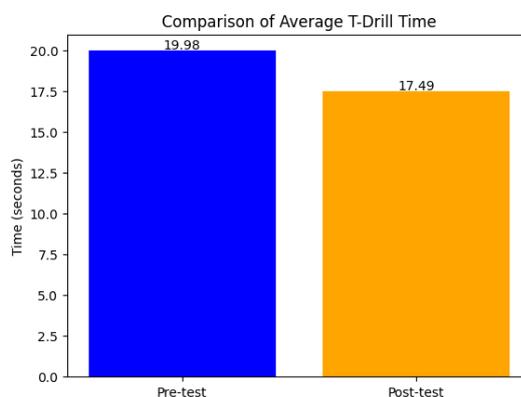
### Effect Size (Cohen's d)

Effect size was calculated to determine the magnitude of the treatment effect.

$$d = \frac{Mean_{pre} - Mean_{post}}{SD_{pooled}}$$

The calculation results showed a Cohen's d value of 1.82, which is considered a large effect size (>0.80). This indicates that ladder drills have a very strong effect on improving agility.

### Average Comparison Diagram



**Figure 1.**

Average T-Drill Time Bar Chart

The results showed that after 17 sessions of ladder drill training, there was a significant increase in the agility of the female athletes of Club Madama Angels. The average decrease in time of 2.49 seconds indicates effective neuromuscular adaptation, particularly in foot

coordination and change of direction speed. With a t-value of 12.84 and an effect size of 1.82 (large category), it can be concluded that ladder drill training has been empirically proven to be effective in improving the agility of female futsal players.

## Discussion

The results of the study showed that ladder drill training significantly improved the agility of female futsal players at Club Madama Angels. The average reduction in T-Drill time was 2.49 seconds, with a significance value of  $p < 0.05$  and a large effect size ( $d > 0.80$ ), indicating that the intervention was not only statistically effective but also practically meaningful in the context of sports performance. These findings reinforce the theory that agility is a physical component that is highly responsive to coordination-based and neuromuscular training stimuli.

Conceptually, agility is understood not only as the speed of change of direction, but as a complex ability involving the integration of the central nervous system, postural control, eccentric strength, and the ability to react to environmental stimuli (Sheppard & Young, 2016; Dos'Santos et al., 2018). In futsal, played in confined spaces at high intensity, rapid changes of direction over short distances (3–5 meters) occur repeatedly throughout the match (Ribeiro et al., 2020). Therefore, increased agility has direct implications for the effectiveness of offensive and defensive transitions.

The results of this study align with those of Negra et al. (2017) and Milanović et al. (2019), which found that foot coordination and change-of-direction training significantly improved agility performance in young athletes within a 6–8-week period. Ladder drills biomechanically increase stride frequency, optimize foot placement, and accelerate the stretch-shortening cycle of lower limb muscles. These adaptations result in improved acceleration and deceleration capabilities, which are the foundation for rapid changes of direction.

From a physiological perspective, ladder drills stimulate increased neuromuscular efficiency by increasing motor unit firing rate and intramuscular coordination (Suchomel et al., 2018). Repeated training with a variety of movement patterns, such as in-in-out-out, X-over, and lateral quick steps, encourages simultaneous, synchronous activation of the gastrocnemius, tibialis anterior, quadriceps, and hamstring muscles. This adaptation increases the speed of type II muscle contractions, which are dominant in explosive activities (Cormie et al., 2011). Thus, the reduction in T-Drill time observed in this study can be explained by increased neuromuscular system efficiency.

Furthermore, the significant improvement was also influenced by the principle of progressive overload applied in the training program. The intensity and complexity of movement patterns increased weekly, ensuring that the training stimulus remained within the optimal adaptation zone. This approach aligns with the recommendations of Turner & Stewart (2014), who emphasized the importance of periodization in agility training to avoid adaptation plateaus.

In the context of women's futsal, these findings are particularly relevant. Research by Paul et al. (2016) showed that female athletes exhibited a significant neuromuscular

adaptation response to coordination training compared to conventional strength training. This was related to increased proprioception and motor control, which were more dominant in footwork-based training. Therefore, ladder drills are an effective and efficient method for the female athlete population.

The findings of this study also support the results of a national study (SINTA) by Pratama et al. (2022) and Hasbi & Wahyudi (2020), which reported significant agility improvements after ladder drill interventions in adolescent soccer and futsal athletes. However, this study provides additional contributions, particularly in the context of regional club populations in Eastern Indonesia, which is still scarce in international literature. This is important because factors such as the training environment, facilities, and athlete characteristics can influence adaptation outcomes. Practically, the increased agility seen in Madama Angels players has implications for increased pressing effectiveness, one-on-one maneuvers, and positional rotation speed during game transitions. A study by Naser & Ali (2016) showed that futsal teams with high agility have a higher counter-attack success rate than teams with low agility. Therefore, implementing ladder drills in regular training programs can improve team competitiveness.

However, it is important to note that modern agility encompasses not only change-of-direction speed but also reactive agility based on decision-making (Young & Farrow, 2013). The ladder drill training in this study focused more on the pre-planned agility component. For further development, the integration of visual or tactical stimuli into the training could enhance transfer to real-life match situations.

From a methodological perspective, the quasi-experimental design without a control group is one of the limitations of this study. Although the results show a significant effect, the possibility of external factors, such as improved general physical condition due to regular training, cannot be completely eliminated. Therefore, further research with a randomized controlled trial design is recommended to strengthen the validity of the causality. Furthermore, the intervention duration of 6 weeks proved sufficient to produce significant adaptations, but it cannot yet explain the long-term effects. A study by Asadi et al. (2016) showed that the combination of ladder drill and plyometric training over a period of more than 8 weeks resulted in greater agility improvements than either method alone. This opens up the opportunity to develop an integrated training model for women's futsal.

Overall, the results of this study confirm that ladder drills are an effective method for improving the agility of female futsal players. The significant improvements obtained indicate that foot and neuromuscular coordination-based interventions have a positive transfer to change-of-direction performance. Theoretically, this study reinforces the concept that agility can be developed through specific, structured, and progressive training. Practically, these findings provide a scientific basis for futsal coaches to integrate ladder drills into routine training programs to enhance competitive performance. Therefore, it can be concluded that ladder drills are not merely supplementary training, but rather a strategic component in developing modern futsal performance, particularly in female athletes at the regional club level. The integration of scientific principles into training design has been shown to produce significant and applicable performance improvements.

## CONCLUSION

Based on the results of a quasi-experimental study of 20 female athletes from the Madama Angels Club, it can be concluded that ladder drill training significantly improved futsal players' agility. Descriptively, the average T-Drill time in the pre-test, which was 19.98 seconds, decreased to 17.49 seconds in the post-test, representing a 2.49-second increase. The fastest time in the pre-test was 18.07 seconds and the lowest was 24.02 seconds, while in the post-test, the fastest time increased to 16.30 seconds and the lowest to 20.44 seconds.

Results from tests of normality (Shapiro-Wilk,  $p > 0.05$ ) and homogeneity (Levene's test,  $p > 0.05$ ) indicated that the data were normally distributed and homogeneous, permitting parametric analysis. Hypothesis testing using a paired sample t-test showed a t value of 12.84 with a significance level of  $p = 0.000 (<0.05)$ , indicating a significant difference between the pre-test and post-test. The effect size (Cohen's  $d = 1.82$ ) was considered large, indicating a strong practical effect of the training. Conceptually, this improvement demonstrates that ladder drills effectively improve neuromuscular coordination and rapid change of direction, making them worthy of recommendation as a primary training method for developing agility in female futsal players.

## ACKNOWLEDGEMENTS

The author expresses his deepest appreciation and gratitude to all parties who supported the research entitled "The Effect of Ladder Drill Training on Improving Agility in Futsal Players at Club Madama Angels." Special thanks are extended to the management and coaches of Club Madama Angels for granting research permission and fully supporting the implementation of the six-week training program. The commitment and discipline of the 20 female athletes who participated in the study were key factors in the successful and optimal collection of pre-test and post-test data.

The author also thanks the research assistant team who assisted with the T-Drill measurements, data recording, and supervision of the 17 training intervention sessions. The support of the Pipit Futsal Field facilities used during the study contributed to the smooth running of the experiment. Academically, this research is inseparable from the contributions of various literature and developments in sports coaching science, which served as the conceptual foundation for designing a ladder drill program based on neuromuscular principles and progressive overload. It is hoped that the results of this research can provide scientific and practical benefits for the development of women's futsal performance at the club and regional levels.

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