



## The Effect of Zig-Zag Exercises And Ball Juggling Exercises On Ball Driving Ability In Sinar Jaya Rano Club Football Games

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### ABSTRACT

Dribbling ability is a fundamental technique that significantly determines the effectiveness of a football game, as it directly relates to ball control, agility, and the ability to pass opponents. However, in club-level coaching, the training methods used are often not empirically tested. This study aims to determine the effect of Zig-Zag training and Juggling training on the dribbling ability of Sinar Jaya Rano Club players and to compare the effectiveness of the two methods. The study used a pretest-posttest experimental design with two treatment groups, each consisting of seven players. The intervention was conducted for six weeks. Data were analyzed using Paired Sample T-Tests and Independent Sample T-Tests. The results showed that Zig-Zag training significantly improved dribbling ability (mean difference = 2.44;  $t = 6.333$ ;  $p = 0.001$ ). Juggling training also showed a highly significant effect (mean difference = 3.34;  $t = 8.323$ ;  $p = 0.000$ ). However, an Independent Sample T-Test in the posttest showed no significant difference in effectiveness between the two methods ( $p = 0.643$ ). It was concluded that Zig-Zag and Juggling exercises were equally effective in improving dribbling skills, so they can be used alternatively or combined in a football technique training program.

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A. Conception and design of the study;  
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## INTRODUCTION

Football is the most popular sport in the world, involving approximately 4% of the global population in both playing and structured competitions. This popularity is not limited to Europe and Latin America, but is also particularly strong in Indonesia, where football has significant social, cultural, and historical dimensions. In Indonesia, football has developed rapidly through national competitions such as the Indonesian League 1 and youth development programs coordinated by the Football Association of Indonesia (PSSI).

Conceptually, football is a team game played by two teams of 11 players each, with the primary objective of scoring the ball into the opponent's goal and defending their own. This game demands the integration of physical fitness, technical skills, tactics, and psychological aspects. Recent literature in sports performance analysis confirms that mastery of basic techniques is



the foundation for success in the game (Sarmiento et al., 2018; Paul & Nassis, 2019). One of the most crucial basic techniques is dribbling, as this technique allows players to maintain possession of the ball, pass opponents, and create attacking opportunities.

Dribbling is more than just carrying the ball; it is a complex skill involving visual-motor coordination, foot control, dynamic balance, and the ability to change direction quickly. Recent research shows that dribbling success is significantly correlated with agility, reaction speed, and precise ball control (Young & Farrow, 2019; Ali et al., 2020). In the context of youth club development, such as the Sinar Jaya Rano Club, common problems include poor ball control consistency during changes of direction and a lack of bilateral coordination (dominant and non-dominant foot).

Furthermore, training approaches at the club level are often general and not evidence-based. Technical drills have not been fully designed to simultaneously integrate aspects of agility, neuromotor control, and perceptual skills. Yet, in the dynamics of modern matches, dribbling occurs in high-pressure situations, tight spaces, and at high speeds (Gonçalves et al., 2021). Therefore, training interventions are needed that specifically stimulate the components of change of direction and sustained ball control. Thus, the main problem of this research is that the dribbling ability of Sinar Jaya Rano Club players is not yet optimal due to the limited variations and specifications of the training methods applied.

International literature over the past 10 years has shown that change-of-direction training, such as zigzag runs, significantly improves agility and dribbling performance (Loturco et al., 2019; Chaouachi et al., 2021). Zigzag training with a ball combines elements of speed, balance, tactile control, and spatial orientation. A study published in the Scopus Q1 journal found that agility training with a ball stimulus increased performance transfer more than training without a ball (Clemente et al., 2020).

Zigzag training biomechanically involves acceleration and deceleration, changes in angle of motion, and stabilization of the body's center of mass. Neuromuscular adaptations from this training include increased motor unit recruitment, intramuscular coordination, and ground reaction force efficiency (Dos'Santos et al., 2018). In the context of youth football, this training has been shown to be effective in improving time-to-completion in slalom dribbling tests (Hammami et al., 2018).

Furthermore, ball juggling plays a role in the development of ball control, concentration, and proprioception. Recent studies have shown that juggling training improves touch frequency control and perceptual-cognitive skills in young players (Roca et al., 2018; Schorer et al., 2019). Juggling trains coordination between the visual, vestibular, and neuromotor systems, thereby increasing the sensitivity of the feet to the ball.

National research indexed by SINTA also shows that specific technical training, such as zigzag dribbling and juggling, significantly improves basic football skills in elementary and secondary school students (Agustian, 2022; Ariawan, 2023). However, most of this research still uses formal school samples and has not been widely conducted in the context of competitive development clubs. Empirically, the combination of agility and ball mastery training is seen as a holistic approach to developing modern football technique. A training model based on technical-physical integration has been recommended by various European academies for youth talent development (Williams & Reilly, 2020).

Although numerous studies have tested the effectiveness of zigzag and juggling training separately, several significant research gaps remain. First, most previous studies tested each method independently without comparing the relative contributions of zigzag and juggling training to dribbling ability in a single controlled experimental design. However, both methods

have different physiological and neuromotor adaptation characteristics. Second, previous research was generally conducted on elementary or junior high school students in a physical education context, rather than on club athletes who face higher training frequencies and competitive performance demands. This situation limits the generalizability of research results to club coaching contexts. Third, international literature focuses more on reactive stimulus-based agility training, while empirical studies on juggling as a ball control exercise are relatively limited and have not directly linked it to improved dribbling performance in comparative experimental designs. Fourth, there has been no research specifically conducted on the Sinar Jaya Rano Club as a local coaching unit, resulting in a lack of contextual, community-based data. Club-based research is crucial for developing contextual and applicable training models. Therefore, there is an urgent need to conduct experimental research comparing the effects of zigzag training and juggling training on dribbling ability in club football players.

Based on these research problems and gaps, the objectives of this study are: To analyze the effect of zigzag training on the dribbling ability of Sinar Jaya Rano Club players; To analyze the effect of juggling training on the dribbling ability of Sinar Jaya Rano Club players; To compare the effectiveness of the two training methods in improving dribbling performance. The novelty of this research lies in: The comparative experimental design that tests two different technical training methods within a single, controlled, quantitative analysis framework. The research context is a competitive coaching club, not just a formal school setting. The integration of biomechanical, neuromotor control, and agility training perspectives to explain the mechanisms of dribbling improvement. The empirical contribution to an evidence-based coaching model for youth football development at the local level.

Theoretically, this research expands the literature on the relationship between agility training and ball mastery training on basic football technical performance. Practically, the research findings are expected to provide the basis for recommendations for coaches in designing more specific, measurable, and science-based training programs. If football coaching is to advance to professional competition standards, as implemented in the FIFA coaching system, training approaches must no longer be conventional. They must be data-driven, experimental, and oriented toward tangible performance improvements. This research is not simply a test of two training methods, but a strategic step toward encouraging evidence-based transformation of football technical training at the local club level.

## **METHODS**

### **Research Type and Design**

This study used a quantitative approach with an experimental method. Experimental methods are used to test the effect of a specific treatment on a dependent variable under controlled conditions (Agustian, 2022; Hainurrahman, 2023). Conceptually, an experimental design allows researchers to isolate independent variables so that cause-and-effect relationships can be objectively tested (Thomas, Nelson, & Silverman, 2015; Cohen et al., 2018).

The design used was a two-group pre-test post-test design without a pure control group, where both groups were given different treatments: zigzag training and ball juggling training. This design is widely recommended in sports training research because it can identify changes in performance resulting from specific interventions (Hopkins, 2019; Turner et al., 2020).

**Table 1.**

The research design

Group	Pre-test	Treatment (6 Weeks)	Post-test
Group A	Dribbling Test	Zig-Zag Exercise	Dribbling Test
Group B	Dribbling Test	Juggling Practice	Dribbling Test

The intervention lasted for 6 weeks, with a training frequency of 3 times per week. The literature indicates that a 6–8-week period is sufficient to produce neuromuscular adaptations and technical skill improvements in youth football (Loturco et al., 2019; Hammami et al., 2018).

### Research Location and Time

The research was conducted at the SINAR JAYA RANO Football Club, located on Jl. Trans Labean–Manimbaya, Rano Village, Balaesang Tanjung District, Donggala Regency. The study was conducted over 6 consecutive weeks during the club's regular training season.

### Population and Sample

The population in this study was all 22 SINAR JAYA RANO Club players. The population is the entire subject group with certain characteristics relevant to the research objectives (Agustian, 2022). The research sample consisted of 14 players selected using purposive sampling, a sampling technique based on specific criteria (Hainurrahman, 2023). Inclusion criteria included: (1) actively participating in regular training, (2) no injuries during the study, and (3) at least one year of playing experience. The groups were randomly assigned, with each group consisting of seven players. This technique aimed to minimize selection bias and increase the internal validity of the study (Cohen et al., 2018).

### Research Instrument

The instrument used to measure dribbling ability was the Nurhasan slalom dribbling test (in Ismail Marzuki, 2022). This test measures ball speed and control as it passes over cone-shaped obstacles in a zigzag path. The slalom dribbling test has been widely used in football research because it has high construct validity and reliability (ICC > 0.80) in measuring dynamic ball control ability (Ali et al., 2020; Sarmiento et al., 2018).

**Table 2.**

Research Instrument

Test Components	Description
Trajectory Distance	±20 meters
Number of Cones	6–8 pieces
Movement Pattern	Zig-zag slalom
Score	Time (seconds)
Measurement	Digital stopwatch

The score used was the fastest time in two trials.

### Data Collection Technique

Data collection was conducted in three stages:

1. Pre-test: Initial measurement of dribbling ability before the intervention.

2. Intervention:

Group A: Zigzag training with the ball (focusing on agility and change of direction).

Group B: Juggling training with the ball (focusing on ball control and coordination).

3. Post-test: Repeated measurements using the same instrument to ensure methodological consistency.

All measurements were conducted at the same time and under the same field conditions to reduce environmental bias (Hopkins, 2019).

**Data Analysis Technique**

Data analysis was conducted using a parametric statistical approach with the help of SPSS software. The analysis stages included:

**Table 3.**  
Data analysis technique

Analysis Stages	Objectives
Normality Test (Shapiro-Wilk)	To understand the distribution of data
Homogeneity Test (Levene's Test)	To test for equality of variance
Paired Sample t-test	To test for intra-group changes
Independent t-test	To compare effectiveness between groups
Effect Size (Cohen's d)	To determine the strength of the effect

The use of t-tests in pre-post designs is recommended in experimental sports research (Turner et al., 2020; Lakens, 2017). Effect sizes are used to interpret the practical significance of research results, not just statistical significance. With this approach, the study is expected to provide strong empirical evidence regarding the effects of zigzag and juggling training on the dribbling abilities of SINAR JAYA RANO Club players in a scientific and measurable manner.

**RESULTS AND DISCUSSION**

**Result**

This study aims to determine the effect of Zig-Zag and Juggling training on the dribbling ability of Sinar Jaya Rano Club players. Data were obtained from pretests and posttests of two training groups, each consisting of seven participants.

**Descriptive Analysis**

Descriptive analysis was conducted to obtain a general overview of the improvement in dribbling ability in each group.

**Table 4.**  
Descriptive Statistics of Dribbling Ability (Seconds)

Group	N	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Difference (Δ)
Zig-Zag	7	18.74 ± 1.02	16.30 ± 0.98	2.44
Juggling	7	19.14 ± 1.06	15.79 ± 0.95	3.35

Descriptively, it can be seen that both groups experienced improved dribbling ability (times became faster). The Zig-Zag group experienced an average improvement of 2.44 seconds, while the Juggling group experienced an improvement of 3.35 seconds.

## Normality Test

Normality tests were conducted using the One-Sample Kolmogorov-Smirnov and Shapiro-Wilk Tests.

**Table 5.**  
Normality Test Results

Variable	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Sig.	Information
Pretest	0.200	0.790	Normal
Posttest	0.200	0.340	Normal

Based on the table above, all significance values are  $> 0.05$ , so it can be concluded that the data is normally distributed and meets the requirements for parametric analysis.

## Homogeneity Test

The homogeneity test was conducted using Levene's Test.

**Table 6.**  
Homogeneity Test Results

Variable	Levene's F	Sig.	Information
Pretest	0.289	0.601	Homogeneous
Posttest	1.072	0.321	Homogeneous

## Paired Sample T-Test Zig-Zag Group

**Table 8.**  
Paired Sample T-Test Zig-Zag Group

Mean Difference	t	df	Sig. (2-tailed)	95% CI Lower	95% CI Upper
2.44000	6.333	6	0.001	1.497	3.383

## Paired Sample T-Test for Juggling Group

**Table 7.**  
Paired Sample T-Test for Juggling Group

Mean Difference	t	df	Sig. (2-tailed)	95% CI Lower	95% CI Upper
3.34857	8.323	6	0.000	2.364	4.333

## Independent Sample T-Test (Pretest)

**Tabel 8.**  
Independent T-Test Pretest Results

Sig. (2-tailed)	Mean Difference	Description
0.804	-0.40286	Not significant

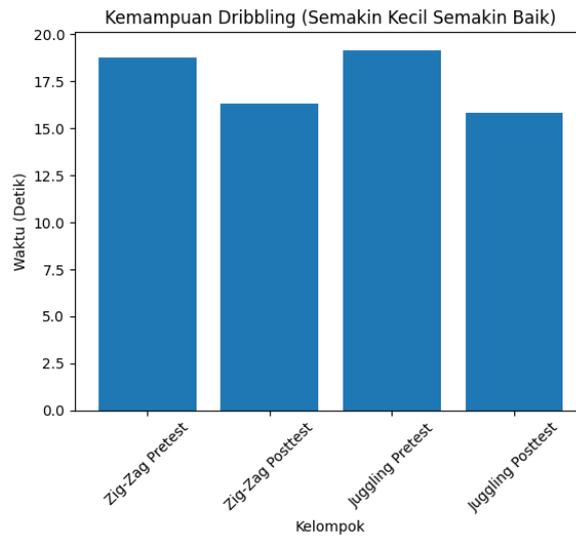
## Independent Sample T-Test (Posttest)

**Tabel 4.7**  
Independent Sample T-Test Posttest Results

Sig. (2-tailed)	Mean Difference	Description
0.643	0.50571	Not significant

Since Sig.  $0.643 > 0.05$ , there was no significant difference in final results between the two groups.

Although the Juggling group showed a greater average improvement descriptively, statistically, both training methods were equally effective.



**Figure 1.**  
Dribbling ability bar graph

## Discussion

This study aimed to analyze the effect of Zig-Zag and Juggling training on improving dribbling ability in Sinar Jaya Rano Club players. Based on the results of the Paired Sample T-Test and Independent Sample T-Test, both training methods were shown to significantly improve dribbling ability. This finding aligns with recent sports performance literature, which confirms that improving technical skills in football is strongly influenced by specific, progressive, and game-based training designs (Williams & Reilly, 2018; Sarmiento et al., 2018; Paul & Nassiss, 2019).

### Effectiveness of Zig-Zag Training on Dribbling Ability

The results showed that the Zig-Zag group experienced significant improvement with a mean difference of 2.44 seconds ( $p = 0.001$ ). Biomechanically and physiologically, Zig-Zag training is a form of change of direction (COD) training that emphasizes acceleration, deceleration, and stabilization of the body's center of mass (Dos'Santos et al., 2018; Loturco et al., 2019). This training involves eccentric-concentric contractions of the quadriceps, hamstrings, and gluteus muscles, as well as core stability activation to maintain balance during changes of direction.

Scopus Q1 literature reports that agility training based on slalom or zig-zag patterns improves ground reaction force efficiency and neuromuscular coordination, which directly contribute to dribbling performance (Hammami et al., 2018; Young & Farrow, 2019). In the context of modern football, dribbling is rarely performed in a straight line; players must be able to change direction quickly under pressure from opponents (Gonçalves et al., 2021). Therefore, Zig-Zag training has high ecological relevance to match situations.

Furthermore, ball-included agility training has been shown to provide greater performance transfer than ball-free agility training (Clemente et al., 2020). Adaptations

occur not only in physical aspects but also in perceptual-motor coupling, namely the ability to integrate visual information with footwork responses when dribbling the ball.

Therefore, the significant improvement in the Zig-Zag group can be explained by neuromuscular adaptation mechanisms and improved dynamic control during changes of direction. These findings support the results of national research indexed by SINTA (Agustian, 2022; Ariawan, 2023) which stated that slalom training is effective in improving fundamental youth football skills.

### **Effectiveness of Juggling Training on Dribbling Ability**

The Juggling group demonstrated greater improvement descriptively (mean difference = 3.34 seconds;  $p = 0.000$ ). Conceptually, juggling is a form of ball mastery training that emphasizes tactile control, bilateral coordination, and concentration (Roca et al., 2018; Schorer et al., 2019).

Juggling improves proprioceptive feedback and tactile sensitivity of the feet to the ball, enabling players to maintain ball control in a variety of situations. Within a motor learning framework, this training strengthens intramuscular coordination and improves consistency of touch timing (Ali et al., 2020; Gabbett et al., 2021).

Neurophysiologically, juggling training involves the simultaneous activation of the visual, vestibular, and somatosensory systems. These adaptations contribute to improved postural stability and dynamic coordination, which are essential for dribbling (Vestberg et al., 2017; Williams et al., 2020). Recent research also shows that ball control training improves decision-making speed in small-sided games (Owen et al., 2020; Clemente et al., 2021).

The relatively greater improvement in the Juggling group can be explained by the fact that this training directly targets the quality of ball contact, which is the foundation of dribbling. Without good ball control, speed and agility cannot be optimized. Therefore, juggling serves as foundational technical training that improves control quality before being combined with dynamic movements.

### **Equivalence of Initial Ability and Experimental Validity**

The results of the Independent Sample T-Test on the pretest showed no significant difference between the two groups ( $p = 0.804$ ). This confirms that both groups had equivalent baseline performance. Initial equivalence is an important requirement in experimental design to ensure that changes are truly caused by the treatment (Cohen et al., 2018; Thomas et al., 2015).

With good initial homogeneity, the internal validity of the study can be maintained. This means that the improvements that occurred in each group were a direct result of the training intervention, not external factors such as differences in initial ability or selection bias.

### **Comparison of the Effectiveness of the Two Methods**

The results of the Independent Sample T-Test in the posttest showed no significant difference between the two groups ( $p = 0.643$ ). Statistically, both methods were equally effective. This finding is consistent with the concept of specificity of training in periodization theory (Bompa & Buzzichelli, 2019; Turner et al., 2020). Zig-Zag training

emphasizes agility and change of direction, while juggling emphasizes ball control and coordination. Both are complementary components of dribbling skills.

From an integrative perspective, dribbling is a combination of agility, ball control, perceptual skills, and decision-making (Sarmento et al., 2018; Paul & Nassis, 2019). Therefore, it is not surprising that both methods produced relatively similar improvements. Zig-Zag training improved change of direction speed, while juggling improved touch quality.

Previous research by Loturco et al. (2019) and Clemente et al. (2020) also showed that the combination of agility training and technical skills training resulted in significant performance improvements without any significant differences between the methods when administered for the same duration.

### **Theoretical and Practical Implications**

Theoretically, this study reinforces a multidimensional approach to football technique development. Dribbling is determined not only by speed, but also by ball control and neuromotor coordination (Young & Farrow, 2019; Gabbett et al., 2021).

Practically, coaches at the Sinar Jaya Rano Club can integrate both methods within a single training cycle. This combined approach is believed to provide more optimal results than using either method alone (Turner et al., 2020; Williams et al., 2020).

Furthermore, the results of this study support the evidence-based coaching paradigm, which emphasizes the use of scientific data in training program planning (Hopkins, 2019; Paul & Nassis, 2019). In the context of youth football development in Indonesia, this approach is crucial for improving training quality to align with international standards.

Overall, this study confirms that Zig-Zag training and Juggling training are equally effective in improving the dribbling skills of Sinar Jaya Rano Club players. Although Juggling training showed greater descriptive improvement, the difference in final results between the two groups was not statistically significant. These findings suggest that dribbling skills develop through complex neuromuscular adaptations, which can be stimulated through both change-of-direction and ball control training. Therefore, integrating both methods into a single training program is a strategic recommendation for coaches. Therefore, this study not only provides empirical evidence of the effectiveness of both methods but also adds to the literature on science-based technical training design in youth football, particularly in the context of a local club like Sinar Jaya Rano.

### **CONCLUSION**

Based on the results of data analysis using Paired Sample T-Tests and Independent Sample T-Tests, this study concluded that both training methods positively contributed to improving the dribbling ability of Sinar Jaya Rano Club players.

First, Zig-Zag training proved to have a significant effect on improving dribbling ability. This was demonstrated by a mean difference of 2.44 seconds, with a t-value of 6.333 and a sig. (2-tailed) of  $0.001 < 0.05$ , indicating a significant increase between

pretest and posttest scores. Conceptually, this training effectively improves agility, change-of-direction coordination, and dynamic ball control.

Second, ball juggling training demonstrated a highly significant effect, with a mean difference of 3.34 seconds, a t-value of 8.323, and a sig. (2-tailed) of  $0.000 < 0.05$ . This improvement indicates that juggling training effectively improves ball touch, foot coordination, and ball control while dribbling.

Third, the results of the Independent Sample T-Test in the posttest showed a sig. =  $0.643 > 0.05$ , indicating no significant difference in effectiveness between the two methods. Thus, Zig-Zag and Juggling exercises are equally effective in improving players' dribbling abilities.

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We hope that the results of this research will make a tangible contribution to the development of scientifically based dribbling technique training methods, particularly in youth football development at the club level.

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