



The Effect of Zig-Zag Run Training on Dribbling Agility in Futsal Games

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ABSTRACT

Futsal is a high-intensity team sport that requires players to perform rapid acceleration, deceleration, directional changes, body balance, coordination, and close ball control in a limited playing area. One of the fundamental technical skills in futsal is dribbling, which allows players to maintain possession, pass opponents, create attacking opportunities, and support team performance. However, dribbling effectiveness is strongly influenced by agility, especially the ability to change direction quickly without losing control of the ball. This study aimed to determine the effect of zig-zag run training on futsal dribbling agility among students of the Sports Coaching Education Program, Faculty of Sport and Health Sciences, Universitas Negeri Makassar. This research used an experimental method with a one-group pretest–posttest design. The sample consisted of 20 male students selected based on research criteria. The instrument used was a futsal dribbling agility test, supported by cones, stopwatch, whistle, and scoring sheets. Data were analyzed using descriptive statistics, normality testing, and paired sample t-test. The results showed that the mean pretest score was 9.095 seconds, while the mean posttest score decreased to 7.115 seconds. The mean difference was 1.980 seconds, indicating improved dribbling agility after treatment. The paired sample t-test showed that $t_{\text{observed}} = 7.631$ was greater than $t_{\text{table}} = 2.093$, with a significance value of $0.000 < 0.05$. The effect size value of Cohen's $d_z = 1.71$ indicated a large practical effect. Therefore, zig-zag run training significantly improves futsal dribbling agility and can be recommended as an effective training method for university students.

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INTRODUCTION

Sport is a structured, planned, and continuous physical activity performed to improve health, fitness, motor competence, social interaction, discipline, and competitive performance. In the context of team sports, futsal has developed into one of the most popular games among students because it is dynamic, attractive, relatively easy to organize, and demands high technical involvement from every player. Unlike conventional football, futsal is played in a smaller space, with fewer players, faster transitions, and more frequent ball contacts. These characteristics require players to execute rapid acceleration, deceleration, body feints, turning movements, and close ball control under pressure (Spyrou et al., 2020; Naser et al., 2017; Ribeiro et al., 2025). Therefore, futsal performance is not only determined by basic techniques such as passing, shooting, and controlling, but also by the physical ability to perform technical actions quickly and efficiently.



One of the most decisive skills in futsal is dribbling. Dribbling enables players to maintain possession, penetrate defensive lines, create space, avoid opponents, and support attacking transitions. However, in many university-level futsal learning and training contexts, including among students of Sports Coaching Education Program, Faculty of Sport and Health Sciences, Universitas Negeri Makassar, dribbling performance is often limited by weak agility, slow change of direction, poor body balance, and ineffective coordination between footwork and ball control. Players may understand the technical concept of dribbling, yet they often lose possession when facing opponents because their movement pattern is too linear, their reaction to spatial pressure is slow, and their ability to change direction while controlling the ball is not optimal. This problem indicates that dribbling in futsal must be trained not only as a technical skill, but also as a movement performance that depends strongly on agility and change-of-direction ability (Selin et al., 2024; Reis et al., 2019; Rico-González et al., 2021).

Recent literature emphasizes that futsal is a high-intensity intermittent sport that requires repeated short sprints, explosive stops, rapid turns, multidirectional movement, and tactical decision-making in limited space (Spyrou et al., 2020; Beato et al., 2017; Barreira et al., 2025). Agility is widely understood as the ability to change body position rapidly and effectively, while change-of-direction speed refers more specifically to pre-planned multidirectional movement. Both components are essential in court and invasion sports because decisive actions often occur in short distances and under time-space pressure (Falch et al., 2019; Zhao et al., 2026; Lin et al., 2025). In futsal, agility becomes even more specific because players must combine body movement, visual control, ball manipulation, and tactical awareness.

Empirical studies have shown that agility-based training can improve futsal players' physical and technical performance. Adi et al. (2025) reported through a systematic review that agility training contributes to movement reaction, physical readiness, and futsal-specific performance. Ilham et al. (2025) demonstrated that small-sided games and ladder drill interventions can influence agility among young futsal players. Selin et al. (2024) found a relationship between agility and dribbling skills among futsal players, confirming that players with better agility tend to show better dribbling performance. Other studies also support that specific futsal training, mini-game situations, and task constraints can enhance technical mastery because they expose players to realistic movement demands (Barbieri et al., 2016; Hidayat et al., 2022; Khurrohman et al., 2021; Oppici et al., 2019; Purwanto et al., 2026).

Among various agility training methods, zig-zag run training is considered relevant because its movement pattern resembles futsal situations: players must accelerate, decelerate, change direction, maintain body balance, and move through obstacles or markers. Wigunawangsa et al. (2022) found that zig-zag run training significantly improved agility among futsal players. Saliku et al. (2025) reported that a four-week zigzag run intervention produced significant agility improvement in futsal extracurricular students. Alrazid et al. (2025) also showed that zig-zag running training improved dribbling agility in futsal players, with a meaningful percentage increase after training. Similar findings were reported by Juniantoro et al. (2025), Taufik et al. (2026), and Marcojos et al. (2025), who emphasized that structured agility drills can improve dribbling efficiency, body control, and movement speed with the ball.

Although previous studies have established the importance of agility and zig-zag run training in futsal, several research gaps remain. First, many studies focus on school-level or extracurricular futsal participants, while research involving university students in sports coaching education programs is still limited. This population is important because PKO students are not only sport participants, but also prospective coaches, teachers, and sport practitioners who need evidence-based training experience. Second, several studies examine agility separately from dribbling, whereas futsal performance requires the integration of physical agility and ball-control ability. Third, existing research often reports general improvements but does not sufficiently contextualize zig-zag run training as a practical intervention for futsal learning in higher education settings. Fourth, Indonesian futsal research still needs more empirical evidence that links simple, low-cost, and easily implemented training methods with measurable improvement in dribbling agility (Suryadi et al., 2023; Rahmoune et al., 2025; Neag et al., 2024; Endriani et al., 2024).

Therefore, this study is positioned to strengthen the empirical basis of futsal training by examining whether zig-zag run exercises can significantly improve dribbling agility among PKO FIKK UNM students. The study also responds to the need for training models that are specific, measurable, practical, and suitable for university-based sports coaching education.

The objective of this study is to determine the effect of zig-zag run training on dribbling agility in futsal among students of the Sports Coaching Education Program, FIKK UNM. Conceptually, this study is grounded in the principle that agility development must involve repeated multidirectional movement, neuromuscular coordination, acceleration-deceleration control, and movement efficiency. Empirically, this study tests whether zig-zag run training can transfer to futsal dribbling performance, especially in situations that require players to change direction while maintaining control of the ball.

The novelty of this study lies in its specific focus on PKO FIKK UNM students as a higher education population, the integration of zig-zag run training with futsal dribbling agility, and the practical contribution of a simple training model that can be applied in coaching, physical education, and futsal skill development. While previous studies have discussed agility training in general, this research emphasizes the direct relevance of zig-zag movement patterns to dribbling actions in futsal.

Based on the theoretical and empirical evidence, agility is a fundamental component that supports effective dribbling in futsal. Zig-zag run training is considered appropriate because it reflects the movement demands of futsal, including quick directional changes, body control, balance, and spatial adjustment. Therefore, this study is expected to provide scientific evidence that zig-zag run training can improve dribbling agility among PKO FIKK UNM students and contribute to the development of evidence-based futsal training methods in the Indonesian sports education context.

METHODS

This study employed an experimental research method using a one-group pretest–posttest design. This design was selected because the study aimed to examine the effect of zig-zag run training on dribbling agility in futsal under a field-based learning and training condition where full control over all external variables was not practically possible. Although a one-group pretest–posttest design has limitations related to internal validity, it remains relevant for preliminary intervention studies in sports training when the researcher intends to compare participants' performance before and after a structured treatment (Sugiyono, 2019; Bierer et al., 2025).

The population of this study consisted of all active students of the Sports Coaching Education Program, Faculty of Sport and Health Sciences, Universitas Negeri Makassar. The sample was determined using purposive sampling based on the following criteria: active PKO FIKK UNM students, male, physically able to participate in futsal training, and willing to follow the complete treatment program. Based on these criteria, 15 students were selected as research participants. This sampling strategy was considered appropriate because agility and dribbling performance in futsal require participants with relatively similar physical activity backgrounds and training readiness (Naser et al., 2017; Spyrou et al., 2020; Nam et al., 2025).

The independent variable in this study was zig-zag run training, while the dependent variable was futsal dribbling agility. The treatment was implemented through structured zig-zag running exercises designed to stimulate acceleration, deceleration, body balance, coordination, and rapid change of direction, which are essential components of futsal performance (Serrano et al., 2020; Friebe et al., 2024; Baharov, 2025). The research instrument used to collect data was a dribbling agility test adapted from the shuttle-run movement pattern, using cones, stopwatch, whistle, and recording sheets. The pretest was conducted before the treatment, while the posttest was administered after the completion of the zig-zag run training program. Similar agility-based interventions have been reported to improve futsal agility and dribbling performance in recent studies (Fahri et al., 2024; Bahtra et al., 2024; Alrazid et al., 2025; Juniantoro et al., 2025). The collected data were analyzed quantitatively by comparing pretest and posttest scores to determine the effect of the treatment.

RESULTS AND DISCUSSION

Result

This section presents the empirical findings regarding the effect of zig-zag run training on futsal dribbling agility among PKO FIKK UNM students. The data were obtained from pretest and posttest scores using a futsal dribbling agility test. In this test, a lower time score indicates better performance because the participant completed the dribbling agility task faster.

Descriptive Statistical Analysis

Table 1 presents the descriptive statistics of futsal dribbling agility before and after the zig-zag run training program.

Table 1.
Descriptive Statistics of Zig-Zag Run Training on Futsal Dribbling Agility

Descriptive Statistics	Pretest	Posttest
N	20	20
Mean	9.095	7.115
Standard Deviation	1.593	1.139
Range	5.48	4.66
Minimum	5.85	5.48
Maximum	11.33	10.14
Sum	181.90	142.30

Based on Table 1, the pretest score of futsal dribbling agility showed a total score of 181.90, with a mean of 9.095 and a standard deviation of 1.593. The lowest score was 5.85, while the highest score was 11.33, with a range of 5.48. After the zig-zag run training program, the posttest score decreased to a total of 142.30, with a mean of 7.115 and a standard deviation of 1.139. The minimum score was 5.48, while the maximum score was 10.14, with a range of 4.66. The decrease in mean score from 9.095 to 7.115 indicates that students completed the dribbling agility test faster after receiving zig-zag run training.

Frequency Distribution of Pretest Scores

Table 2.
Frequency Distribution of Pretest Scores of Futsal Dribbling Agility

Interval	Frequency	Percentage	Category
< 6.70	2	10%	Very Good
6.70–8.29	5	25%	Good
8.29–9.89	6	30%	Moderate
9.89–11.48	7	35%	Poor
> 11.48	0	0%	Very Poor
Total	20	100%	

Table 2 shows that before the treatment, 2 students or 10% were in the very good category, 5 students or 25% were in the good category, 6 students or 30% were in the moderate category, and 7 students or 35% were in the poor category. No student was classified in the very poor category. These results indicate that before the zig-zag run training program, the largest proportion of students was still in the poor category.

Frequency Distribution of Posttest Scores

Table 3.
Frequency Distribution of Posttest Scores of Futsal Dribbling Agility

Interval	Frequency	Percentage	Category
< 5.40	0	0%	Very Good
5.40–6.54	8	40%	Good
6.54–7.68	7	35%	Moderate
7.68–8.82	3	15%	Poor
> 8.82	2	10%	Very Poor
Total	20	100%	

Based on Table 3, after the treatment, 8 students or 40% were in the good category, 7 students or 35% were in the moderate category, 3 students or 15% were in the poor category, and 2 students or 10% were in the very poor category. No student was classified in the very good category. The posttest distribution shows that most students moved into the good and moderate categories after participating in the zig-zag run training program.

Normality Test

The normality test was conducted using the Kolmogorov–Smirnov test. The data are considered normally distributed if the significance value is greater than 0.05.

Table 4.

Normality Test Results

Variable	Test	Kolmogorov–Smirnov Statistic	Sig.	α	Description
Futsal Dribbling Agility	Pretest	0.087	0.200	0.05	Normal
Futsal Dribbling Agility	Posttest	0.174	0.115	0.05	Normal

Table 4 shows that the pretest data obtained a Kolmogorov–Smirnov statistic of 0.087 with a significance value of 0.200. Since $0.200 > 0.05$, the pretest data were normally distributed. The posttest data obtained a Kolmogorov–Smirnov statistic of 0.174 with a significance value of 0.115. Since $0.115 > 0.05$, the posttest data were also normally distributed. Therefore, the data met the normality assumption and were appropriate for hypothesis testing using the paired sample t-test.

Hypothesis Testing

The hypothesis test was conducted using a paired sample t-test to determine whether there was a significant effect of zig-zag run training on futsal dribbling agility among PKO FIKK UNM students.

Table 5.

Paired Sample t-Test Results

Test	Mean	Mean Difference	t-observed	t-table	p-value	α	Effect Size, Cohen's dz	Description
Pretest	9.095	1.980	7.631	2.093	0.000	0.05	1.71	Significant
Posttest	7.115							

The paired sample t-test showed that the value of t-observed was 7.631, which was greater than the t-table value of 2.093. In addition, the significance value was 0.000, which was lower than $\alpha = 0.05$. Therefore, H_0 was rejected and H_1 was accepted. These findings indicate that zig-zag run training had a significant effect on futsal dribbling agility among PKO FIKK UNM students. The mean score decreased from 9.095 in the pretest to 7.115 in the posttest, with a mean difference of 1.980 seconds. This means that the students performed the dribbling agility test faster after the treatment. The percentage improvement was approximately 21.77%, indicating a meaningful increase in performance. Furthermore, the Cohen's dz value of 1.71 indicates a large effect size. Thus, empirically, zig-zag run training can be considered an effective exercise method for improving futsal dribbling agility.

Discussion

The findings of this study demonstrate that zig-zag run training produced a significant improvement in futsal dribbling agility among PKO FIKK UNM students. Empirically, the mean pretest score was 9.095 seconds, while the posttest mean decreased to 7.115 seconds. Because the test was measured in time, the decrease of 1.980 seconds indicates faster and more efficient dribbling agility performance after the intervention. The paired sample t-test confirmed that the improvement was statistically significant, with t-observed = 7.631, which was higher than t-table = 2.093, and $p = 0.000 < 0.05$. The effect size was also large, with Cohen's dz = 1.71, meaning that the treatment did not merely produce a statistical difference but also generated a strong practical effect on students' futsal dribbling agility.

Conceptually, this result is relevant to the characteristics of futsal as a high-intensity intermittent sport that requires repeated acceleration, deceleration, rapid directional changes, dynamic balance, and close ball control in limited playing space. Futsal players are frequently required to make short explosive movements, stop suddenly, turn quickly, and reorganize body position while maintaining technical control of the ball (Naser et al., 2017; Spyrou et al., 2020; Barreira et al., 2025). Therefore, agility is not a complementary component but a core physical capacity that supports technical execution in futsal. The improvement found in this study confirms that dribbling agility is strongly influenced by the quality of movement patterns, especially the ability to change direction quickly without losing balance or rhythm.

The effectiveness of zig-zag run training can be explained through the principle of training specificity. The zig-zag run requires players to move through cones in a diagonal and multidirectional pattern, which closely

resembles futsal situations where players must avoid opponents, create space, and protect the ball under pressure. This movement pattern stimulates coordination between the lower limbs, trunk control, visual orientation, braking ability, and re-acceleration. Previous studies also emphasize that change-of-direction speed and reactive agility are crucial determinants of futsal performance because the sport is played in a compact area with frequent transitions (Zeljko et al., 2020; Mijatovic et al., 2022; Falch et al., 2019; Fiorilli et al., 2017). Thus, the improvement in this study is consistent with the view that agility training should be designed according to the actual movement demands of the game.

The descriptive results also indicate a meaningful shift in student performance. Before treatment, most students were distributed in the moderate and poor categories, with 30% in the moderate category and 35% in the poor category. After treatment, the distribution improved, with 40% of students in the good category and 35% in the moderate category. This shift suggests that the zig-zag run training program helped students perform dribbling movements more efficiently. The reduction in the standard deviation from 1.593 in the pretest to 1.139 in the posttest also indicates that participants' performance became more homogeneous after the intervention. This means that the training did not only benefit a few individuals, but also improved the overall group performance.

These findings are supported by several recent studies. Selin et al. (2024) found that agility has a significant relationship with futsal dribbling skills, indicating that players with better agility tend to perform better in dribbling situations. Adi et al. (2025), through a systematic review, reported that agility training provides important benefits for futsal players, especially in improving movement readiness, quick direction changes, and performance efficiency. Saliku et al. (2025) showed that zig-zag run training significantly improved futsal players' agility in a pretest–posttest design. Similarly, Yuwono and Bulqini (2024) reported that zig-zag run exercises significantly improved futsal dribbling skills among young players. Alrazid et al. (2025), Juniantoro et al. (2025), Taufik et al. (2026), and Marcojos et al. (2025) also confirmed that agility-based and modified dribbling drills positively influence futsal dribbling agility. These findings strengthen the empirical position of the present study.

In addition, the result is consistent with research on shuttle run, ladder drill, slalom run, small-sided games, and combined agility training. Ilham et al. (2025) reported that small-sided games and ladder drills affect futsal agility, while Fahrezi et al. (2024) showed that shuttle run and zig-zag methods significantly improved futsal dribbling ability. Wahono et al. (2024) found that slalom run training increased futsal agility, and Heliza et al. (2024) reported significant effects of zig-zag run and shuttle run training on ball dribbling. Similar evidence from Suryadi et al. (2023), Purwanto et al. (2026), Hidayat et al. (2025), Bernhardin and Fauzi (2022), Candra and Widodo (2019), Bahtra et al. (2024), Fahri et al. (2024), and Rizal et al. (2025) supports the argument that agility, speed, coordination, and change-of-direction training contribute to better ball-control performance in invasion games.

From a practical perspective, zig-zag run training is highly applicable for university futsal training because it is simple, economical, and easy to organize using cones, a stopwatch, and a structured field layout. For PKO FIKK UNM students, this training model is also pedagogically valuable because they are prospective coaches, teachers, and sport practitioners. By experiencing evidence-based agility training, students can understand how a simple drill can be systematically used to develop sport-specific performance. However, the findings should be interpreted with caution because this study used a one-group pretest–posttest design without a control group. Future studies are recommended to use a randomized control design, larger samples, comparison groups, and additional variables such as coordination, balance, leg power, and technical dribbling accuracy.

Overall, the findings confirm that zig-zag run training significantly improves futsal dribbling agility among PKO FIKK UNM students. The improvement from pretest to posttest, supported by a significant t-test result and a large effect size, shows that zig-zag run is an effective training method for developing agility-based dribbling performance in futsal.

CONCLUSION

Based on the results of the study, it can be concluded that zig-zag run training has a significant effect on futsal dribbling agility among students of the Sports Coaching Education Program, Faculty of Sport and Health Sciences, Universitas Negeri Makassar. The empirical data showed that the mean pretest score was 9.095

seconds, while the mean posttest score decreased to 7.115 seconds after the treatment. This decrease indicates that the students were able to complete the futsal dribbling agility test faster after participating in the zig-zag run training program. The mean difference of 1.980 seconds reflects a meaningful improvement in movement efficiency, directional change ability, body coordination, and ball-control performance.

The hypothesis test further confirmed this improvement. The paired sample t-test showed that the t-observed value was 7.631, which was greater than the t-table value of 2.093, with a significance value of $0.000 < 0.05$. Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted. In addition, the effect size value of Cohen's $d_z = 1.71$ indicated a large practical effect. Conceptually, zig-zag run training is effective because its movement pattern is closely related to futsal demands, especially acceleration, deceleration, balance, and rapid change of direction while dribbling. Thus, zig-zag run training can be recommended as an effective and practical training method to improve futsal dribbling agility among university students.

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