



The Effect Of Ladder Drill, Zig Zag, And Ladder Drill In Out Training On Dribbling Ability In Futsal

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ABSTRACT

Dribbling is a fundamental technical skill in futsal because it enables players to maintain ball possession, evade opponents, and create attacking opportunities in limited playing space. However, preliminary observations of the futsal team at SMAN 4 Takalar showed that several players still had weaknesses in ball control, movement coordination, and agility during dribbling. Therefore, specific training methods are needed to improve this ability. This study aimed to determine the effect of ladder drill zig-zag and ladder drill in-out training on the dribbling ability of futsal players at SMAN 4 Takalar and to identify the more effective training model. This study employed an experimental method with a two-group pre-test-post-test design. The research was conducted in January 2025 at the futsal court of SMAN 4 Takalar. Twenty players were randomly selected from a population of 30 and then divided into two groups using ordinal pairing. Group A received ladder drill zig-zag training, while Group B received ladder drill in-out training. The training program was carried out for 16 sessions. Data were collected through observation, literature study, and a dribbling test using a stopwatch and supporting equipment. The data were analyzed using descriptive statistics, normality and homogeneity tests, paired-samples t-tests, and an independent-samples t-test with SPSS. The results showed that both training methods significantly improved dribbling performance. In Group A, the mean score decreased from 18.4630 to 17.5760, with a mean difference of 0.8870 ($p = 0.000$). In Group B, the mean score decreased from 18.4530 to 18.0900, with a mean difference of 0.3630 ($p = 0.000$). The independent t-test showed a significant difference between the two groups ($t = 3.420$; $p = 0.007$), indicating that ladder drill zig-zag was more effective than ladder drill in-out. In conclusion, both training methods improved dribbling ability, but ladder drill zig-zag produced a greater effect.

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INTRODUCTION

Sport is widely acknowledged as an important medium for developing human resources, not only through physical fitness but also through discipline, resilience, teamwork, and character formation. In the Indonesian context, futsal has become one of the most visible and accessible team sports at the school level, supported by its simple facilities, fast game tempo, and frequent interschool competitions. As a five-a-side invasion game, futsal requires players to execute technical actions in compressed spaces and under intense



time pressure. Among the fundamental techniques passing, controlling, dribbling, shooting, and goalkeeping dribbling occupies a particularly strategic role because it enables players to escape pressure, maintain possession, break defensive lines, and create scoring opportunities. Contemporary futsal and soccer literature also shows that high-level performance is shaped by the interaction of technical skill, movement efficiency, agility, and game-specific physical qualities rather than by isolated technical mastery alone (Ariyanto et al., 2023; Naser et al., 2017; Mendes et al., 2022; Sekulic et al., 2021).

In practical terms, effective dribbling in futsal depends on precise ball control while accelerating, decelerating, and changing direction repeatedly. For that reason, dribbling should be understood as a combined technical-biomotor skill supported by coordination, balance, footwork quality, and change-of-direction ability. The broader team-sport literature has consistently emphasized that agility is not merely running fast through cones, but the capacity to reposition the body rapidly and efficiently while preserving control and movement quality. Moreover, recent sport-specific testing studies indicate that dribbling performance is more meaningfully assessed when ball control is integrated into change-of-direction tasks, because technical execution and multidirectional speed are closely intertwined in match situations (Paul et al., 2016; Hojka et al., 2016; Makhlof et al., 2022; Palucci Vieira et al., 2021). Based on preliminary observations of the SMAN 4 Takalar futsal team, several players still demonstrate weak dribbling control, rigid body movement, insufficient agility when changing direction, and a tendency to lose possession under defensive pressure. These conditions indicate that the team needs a more specific and structured training stimulus targeting the footwork and coordination demands of dribbling.

One training method frequently recommended for improving multidirectional footwork is the agility ladder or ladder drill. This method is attractive in school-based coaching because it is low-cost, easy to organize, and adaptable to different training goals. Indonesian studies over the last decade have shown encouraging findings. Rahardian et al. (2019) reported that ladder-based zig-zag lateral patterns contributed to agility improvement. Nasuki (2021) found that agility-oriented futsal drills, including zig-zag and Z-pattern work, positively affected dribbling outcomes. Herlambang et al. (2022) further highlighted that speed, agility, and balance training can improve futsal dribbling, while Juliansyah et al. (2023) specifically compared zig-zag run and ladder drill interventions for dribbling development in school futsal players. Additional school-based evidence also suggests that crossover- or shuffle-type footwork drills can support dribbling improvement when they are implemented consistently in extracurricular futsal contexts (Rizhardi, 2021). Collectively, these findings imply that footwork-oriented training is relevant for technical improvement, especially when dribbling is constrained by rapid directional changes.

However, the wider international literature presents a more nuanced picture. Padrón-Cabo et al. (2020) examined agility-ladder training in youth soccer players and suggested that ladder-based coordination training alone does not automatically guarantee superior gains in sprint, agility, and dribbling compared with regular training. This caution is important because it indicates that ladder drills are not universally effective in every form or population. By contrast, broader coordination and agility interventions have produced stronger results. González-Fernández et al. (2021) showed that a 10-week combined coordination and agility program significantly improved agility in young soccer players. Likewise, Mitrousis et al. (2023) demonstrated that an 8-week balance training program enhanced balance and selected technical skills in adolescent soccer players, and Eraslan et al. (2025) reported that a 12-week proprioceptive program improved soccer-specific technical skills in youth players. Recent SAQ-based evidence also supports the value of multidirectional movement training for young athletes, especially for sprinting, change-of-direction speed, and agility-related performance (Lee et al., 2024; Sun et al., 2025; Ji et al., 2026).

Recent evidence also reinforces that technical performance in futsal and soccer should be interpreted in relation to game-specific movement demands. Karahan (2020) found that skill-based training and small-sided game approaches can improve physical performance in young soccer players, while Asgari et al. (2023) concluded that long-term implementation of the FIFA 11+ generally improves biomechanical and some physical indicators, although technical outcomes remain inconsistent across studies. At the same time, Nóbrega et al. (2023) proposed a reliable soccer-specific reactive agility test, and Kilci (2026) showed that sprinting, change-of-direction performance, and ball control are interrelated in youth players. These studies suggest that dribbling development should not be separated from movement specificity: the quality of foot placement, rhythm, body control, and directional transitions may determine whether physical training actually

transfers to dribbling performance. Although previous studies provide a useful foundation, several gaps remain. First, many Indonesian studies have examined agility training, zig-zag running, or generic ladder drills, but fewer studies have directly compared two specific ladder-drill patterns within the same experimental framework and linked them explicitly to futsal dribbling performance. Second, much of the evidence has focused on agility as an end variable, whereas coaches ultimately need evidence about transfer to sport-specific technique, especially dribbling with the ball. Third, international findings indicate that the effectiveness of ladder-based training is not uniform; isolated ladder drills may produce limited benefits unless the movement pattern is sufficiently specific, progressive, and connected to technical demands. Fourth, the literature reviewed appears to emphasize comparisons such as ladder drill versus zig-zag run or ladder drill within broader coordination programs, leaving head-to-head evidence on zig-zag ladder drill versus in-out ladder drill relatively limited, particularly in Indonesian school futsal settings (Padrón-Cabo et al., 2020; Juliansyah et al., 2023; González-Fernández et al., 2021). Therefore, the case of SMAN 4 Takalar is scientifically relevant because it allows the testing of two practical footwork models in a real school-team development environment.

Based on this background, the present study aims to examine the effect of zig-zag ladder drill training and in-out ladder drill training on the dribbling ability of SMAN 4 Takalar futsal players. More specifically, the study seeks to determine whether both training models improve dribbling performance and to identify which pattern provides a more meaningful training effect. The novelty of this research lies in three aspects. First, it compares two specific ladder-drill movement patterns, rather than comparing ladder drills with a non-ladder method. Second, it connects footwork training directly with a technical futsal outcome, namely dribbling ability, instead of limiting analysis to general agility. Third, it contributes context-specific evidence from a developing school futsal team in South Sulawesi, where low-cost, practical, and evidence-based training models are especially needed for sustainable coaching improvement. In this sense, the study is expected to provide both theoretical value for sport training literature and practical value for school futsal coaches.

In conclusion, the reviewed literature confirms that dribbling in futsal is a multidimensional skill requiring technical precision and efficient multidirectional movement. It also shows that ladder- and agility-based training can be relevant, but their transfer to dribbling performance depends on exercise specificity and design. Therefore, investigating the comparative effects of zig-zag and in-out ladder drills on the dribbling ability of SMAN 4 Takalar futsal players is both empirically justified and practically important for strengthening school-based futsal coaching.

METHODS

This study employed an experimental method using a two-group pre-test–post-test design to examine the effect of ladder drill zig-zag and ladder drill in-out training on the dribbling ability of futsal players at SMAN 4 Takalar. This design was selected because it is widely used in short-term sport intervention studies to detect training-induced changes within groups and to compare responses between matched groups under the same training environment. Comparable pre–post and parallel-group designs have been applied in recent studies on agility ladder training, coordination–agility programs, and change-of-direction interventions in youth football players, demonstrating their suitability for evaluating field-based training effects on movement performance and technical outcomes (Padrón-Cabo et al., 2020; González-Fernández et al., 2021; Martín-Moya et al., 2023; Sunaryo et al., 2022).

The research was conducted at the futsal court of SMAN 4 Takalar in January 2025. The population consisted of 30 futsal players, from which 20 players were randomly selected as the sample. To ensure baseline equivalence, the participants were divided into two groups using the ordinal pairing technique based on their pre-test dribbling scores. Group A received ladder drill zig-zag training, whereas Group B received ladder drill in-out training. Both groups completed a structured training program for 16 sessions. The zig-zag pattern was chosen because it emphasizes multidirectional footwork and rapid body repositioning, while the in-out pattern was selected because it trains step frequency, rhythm, and lower-limb coordination; both movement models are relevant to the agility and coordination demands of dribbling in invasion games (Fatchurrahman et al., 2019; Nurkadri et al., 2021; Maharani et al., 2024).

Data were collected through direct observation, literature review, and a time-based dribbling test administered before and after the intervention. The dribbling test used a stopwatch, cones, balls, and

supporting field equipment under standardized procedures. Time-based dribbling assessment was adopted because recent futsal research has shown that travel time provides an objective indicator of dribbling quality and performance efficiency, with lower times indicating better technical execution and ball control (Marhaendro et al., 2023; Supyana et al., 2026; Fahrezi & Bulqini, 2025). The data analysis began with normality and homogeneity tests as prerequisites for parametric statistics. Hypothesis testing was then conducted using paired-samples t-tests in SPSS to determine the significance of pre-test and post-test changes within each group. To strengthen interpretation, the post-test outcomes of both groups may also be compared using an independent-samples t-test. This analytical sequence was chosen to ensure that the findings were statistically valid, objective, and easily replicable in similar school-based futsal training contexts.

RESULTS AND DISCUSSION

Result

The empirical data from the pre-test and post-test of the ladder drill zig-zag and ladder drill in-out interventions on the dribbling ability of futsal players at SMAN 4 Takalar were first tabulated to facilitate statistical analysis. Descriptive analysis was conducted to provide a general overview of the data, including the mean, standard deviation, variance, range, minimum, maximum, and total score. Before hypothesis testing, assumption testing was carried out through normality and homogeneity tests. Because the data met the assumptions of normality and homogeneity, parametric analysis was used for hypothesis testing.

Descriptive Statistics

The descriptive statistics of dribbling performance for both treatment groups are presented in Table 1. The summary shows the distribution of scores before and after the intervention.

Table 1.
Descriptive Statistics of Dribbling Scores

Descriptive Statistics	Ladder Drill Zig-Zag Pre-Test	Ladder Drill Zig-Zag Post-Test	Ladder Drill In-Out Pre-Test	Ladder Drill In-Out Post-Test
N	10	10	10	10
Mean	18.4630	17.5760	18.4530	18.0900
Std. Deviation	2.76519	2.76595	2.70939	2.71208
Variance	7.646	7.650	7.341	7.355
Range	9.15	9.20	8.20	8.29
Minimum	15.29	14.29	15.45	15.12
Maximum	24.44	23.49	23.56	23.41
Sum	184.63	175.76	184.53	180.90

Source: Processed research data, 2025.

The descriptive results indicate differences between the pre-test and post-test scores in both groups. In the ladder drill zig-zag group, the mean score decreased from 18.4630 to 17.5760, while the standard deviation remained relatively stable. In the ladder drill in-out group, the mean score decreased from 18.4530 to 18.0900. Because dribbling performance was measured in time, a lower score indicates better performance. Thus, both groups showed improvement after treatment, although the reduction in mean score was greater in the zig-zag group. These descriptive findings suggest that both training models contributed positively to dribbling performance, but inferential testing was required to determine whether the changes were statistically significant.

Normality Test

Prior to inferential analysis, the normality of the data was tested using the Kolmogorov–Smirnov and Shapiro–Wilk tests. The results are presented in Table 2.

Table 2.
Normality Test Results

Variable	Kolmogorov–Smirnov Statistic	Sig.	Shapiro–Wilk Statistic	Sig.	α	Remark
Ladder drill zig-zag	0.259	0.055	0.902	0.229	0.05	Normal
Ladder drill in-out	0.256	0.061	0.868	0.094	0.05	Normal

Source: Processed research data, 2025.

The normality test results show that the significance values for both treatment groups were greater than 0.05. In the zig-zag group, the significance values were 0.055 (Kolmogorov–Smirnov) and 0.229 (Shapiro–Wilk). In the in-out group, the significance values were 0.061 and 0.094, respectively. Therefore, the data in both groups were normally distributed, indicating that parametric statistical analysis could be used in the next stage.

Homogeneity Test

A homogeneity test was then conducted on the pre-test scores using Levene's test to determine whether the variance of the two groups was equal. The results are shown in Table 3.

Table 3.
Homogeneity Test Results

Variable	Levene Statistic	Sig.	α	Remark
Pre-test scores of ladder drill zig-zag and ladder drill in-out	0.038	0.847	0.05	Homogeneous

Source: Processed research data, 2025.

The Levene's test yielded a significance value of 0.847, which is greater than 0.05. This means that the variance of the two groups was homogeneous. Since both the normality and homogeneity assumptions were satisfied, the data were appropriate for further hypothesis testing using parametric tests.

Paired-Samples t-Test for the Zig-Zag Group

To determine the effect of ladder drill zig-zag training on dribbling ability, a paired-samples *t*-test was conducted between the pre-test and post-test scores. The results are presented in Table 4.

Table 4.
Paired-Samples t-Test for Ladder Drill Zig-Zag

Group	Measurement	Mean	Mean Difference	t	df	Sig. (2-tailed)	t-table
Group A	Post-test	17.5760	0.8870	15.735	9	0.000	1.833
	Pre-test	18.4630					

Source: Primary data, 2025.

The paired-samples *t*-test for the zig-zag group produced a *t*-value of 15.735, which was higher than the *t*-table value of 1.833, with a significance value of 0.000 ($p < 0.05$). Therefore, the null hypothesis was rejected. This finding indicates that ladder drill zig-zag training had a significant effect on the dribbling ability of futsal players at SMAN 4 Takalar. The mean difference of 0.8870 confirms a substantial improvement after the intervention.

Paired-Samples t-Test for the In-Out Group

A similar analysis was performed to test the effect of ladder drill in-out training on dribbling ability. The results are shown in Table 5.

Table 5.
Paired-Samples t-Test for Ladder Drill In-Out

Group	Measurement	Mean	Mean Difference	t	df	Sig. (2-tailed)	t-table
Group B	Post-test	18.0900	0.3630	8.185	9	0.000	1.833
	Pre-test	18.4530					

Source: Primary data, 2025.

The paired-samples *t*-test for the in-out group showed a *t*-value of 8.185, which was also higher than the *t*-table value of 1.833, with a significance value of 0.000 ($p < 0.05$). Thus, the null hypothesis was rejected. This result indicates that ladder drill in-out training also had a significant effect on dribbling ability. The mean difference of 0.3630 shows that the players improved after completing the training program, although the magnitude of change was smaller than that of the zig-zag group.

Independent-Samples t-Test Between Groups

To compare the effects of the two training models, an independent-samples *t*-test was conducted on the post-test scores of both groups. The results are presented in Table 6.

Table 6.
Independent-Samples t-Test of Post-Test Scores

Variable	Group	Mean	Mean Difference	t	df	Sig. (2-tailed)	t-table
Post-test dribbling score	Ladder drill zig-zag	17.5760	0.5140	3.420	18	0.007	2.093
	Ladder drill in-out	18.0900					

Source: Primary data, 2025.

The independent-samples *t*-test showed that the calculated *t*-value was 3.420, which exceeded the *t*-table value of 2.093, with a significance value of 0.007 ($p < 0.05$). This means that there was a significant difference between the effects of ladder drill zig-zag and ladder drill in-out training on dribbling ability. The post-test mean of the zig-zag group (17.5760) was lower than that of the in-out group (18.0900), and because lower time indicates better dribbling performance, the zig-zag method produced the greater improvement. In addition, the reduction from pre-test to post-test was larger in the zig-zag group (0.8870) than in the in-out group (0.3630). Therefore, although both training methods significantly improved dribbling ability, ladder drill zig-zag was more effective than ladder drill in-out for futsal players at SMAN 4 Takalar.

Discussion

The findings of this study confirm that the data met the assumptions for parametric analysis, as both the normality and homogeneity tests showed acceptable results. This statistical condition strengthens the credibility of the paired *t*-test and independent *t*-test findings and indicates that the observed changes in dribbling performance can reasonably be attributed to the training interventions rather than to distribution bias or unequal group variance. In applied sport research, such prerequisite testing is essential because the accuracy of the final inference depends on whether the data structure supports the selected analytical model. Thus, the present study was methodologically adequate for comparing the effect of two ladder-drill variations on futsal dribbling performance. (Padrón-Cabo et al., 2020; Sunaryo et al., 2022; Zainuddin & Yusuf, 2021; Suryadi et al., 2023).

The paired *t*-test results demonstrated that both ladder drill zig-zag and ladder drill in-out training produced significant improvements in dribbling ability, as indicated by significance values of 0.000 (< 0.05) in both groups. Because the dribbling score was measured in time, the decrease in mean scores from pre-test to post-test reflects improved performance. This pattern supports the view that dribbling is not merely a technical action with the ball, but a complex motor skill that depends heavily on agility, step frequency, lower-limb coordination, and postural control. Recent literature consistently shows that agility and dribbling are strongly related in futsal and football, with better change-of-direction capacity associated with more efficient ball carrying under pressure. Studies in Indonesian and international settings likewise report that agility-oriented interventions improve dribbling performance when the exercises stimulate movement efficiency, body control, and rapid foot repositioning. (Selin et al., 2024; Paryadi et al., 2023; Rizal, 2025; Gidu et al., 2022; Lee & Joo, 2024).

The more substantial improvement in the zig-zag group, with a mean reduction of 0.887 points compared with 0.363 points in the in-out group, suggests that the zig-zag pattern was more effective in transferring training effects to dribbling performance. This result is theoretically plausible. Dribbling in futsal is performed in restricted spaces and usually requires quick lateral shifts, deceleration, re-acceleration, and repeated directional adjustments while maintaining close control of the ball. The ladder drill zig-zag pattern appears to better simulate these demands because it requires diagonal stepping, lateral body repositioning, and more complex neuromuscular coordination than a predominantly linear in-out pattern. Research on agility and reactive movement training has shown that exercises resembling sport-specific directional changes produce stronger transfer to technical performance than more general coordination tasks. This also explains why more task-specific agility or reactive agility programs tend to outperform simpler pre-planned drills when the goal is to improve ball-related movement performance. (Doua et al., 2026; Horníková et al., 2025; Birlik et al., 2026; Chaalali et al., 2016).

The superiority of the zig-zag model is also consistent with the principle of specificity in training. Effective skill development occurs when exercise patterns reproduce the spatial, temporal, and coordinative demands of actual performance. In futsal, players rarely dribble in a straight line for long distances; instead, they execute

frequent cuts, evasive movements, and multidirectional ball touches in response to opponents and limited space. Accordingly, zig-zag ladder movements may have provided a closer approximation to the real biomechanical and coordinative profile of futsal dribbling. Previous studies reported that agility-variation training combined with technically meaningful movement patterns significantly improves dribbling skills, and that drills involving movement redirection or zig-zag orientation are particularly beneficial for ball control under dynamic conditions. The present findings therefore extend earlier evidence by showing that, even when both interventions belong to the same ladder-drill family, the more directionally complex pattern yields superior gains. (Suryadi et al., 2023; Sunaryo et al., 2022; Ilham et al., 2025; Alimsyah, 2025; Apriliansyah, 2026).

At the same time, the in-out ladder drill should not be interpreted as ineffective. The significant pre–post improvement in Group B indicates that this exercise still contributed positively to dribbling development. Its likely contribution lies in increasing step quickness, movement rhythm, and bilateral foot coordination in a relatively simple structure. For beginner or intermediate school players, such a pattern may be especially valuable during the early phase of training because it strengthens the foundational speed and coordination needed before progressing to more complex directional drills. This interpretation is in line with studies showing that ladder-based or coordination-focused training can improve agility and speed, especially in young athletes, although the transfer to dribbling may be more modest when the drill lacks sufficient movement complexity. Thus, the in-out pattern remains useful, particularly as a preparatory or foundational exercise. (Zainuddin & Yusuf, 2021; Padrón-Cabo et al., 2020; Adi & Dwi, 2025; Harun, 2023).

The independent t-test further confirmed a significant difference between the two interventions, with $t = 3.420$, $p = 0.007$, and a post-test mean difference of 0.514 points favoring the zig-zag group. Importantly, because lower times indicate better dribbling, the lower post-test mean of the zig-zag group (17.576) reflects superior performance compared with the in-out group (18.090). This comparative outcome reinforces the view that coordinative complexity and directional specificity are decisive in futsal skill enhancement. It also aligns with evidence that balance, proprioception, and multidirectional agility influence technical execution in football-related sports. Studies on proprioceptive training, balance training, and functional training have repeatedly shown that when athletes improve postural stability and movement control, their technical actions—including dribbling—become more efficient. Therefore, the advantage of the zig-zag drill may not only reflect speed adaptation, but also better integration of balance, foot placement accuracy, and body control. (Mitrousis et al., 2023; Gidu et al., 2022; Eraslan et al., 2025; Haghighi et al., 2025; Pahrudin, 2024).

Overall, the present study indicates that coordinative ladder-drill training has a meaningful contribution to improving futsal dribbling ability, but the magnitude of its effect depends on the movement structure employed. The zig-zag model is more strongly recommended for competitive school futsal contexts because it better reflects the dynamic, evasive, and multidirectional nature of match play. In contrast, the in-out model remains relevant as a basic coordination drill, particularly for athletes who still require foundational foot-speed development. Practically, coaches at SMAN 4 Takalar and similar school teams can incorporate both methods progressively: the in-out drill may be used during early training phases to establish rhythm and footwork control, while the zig-zag drill may be emphasized during later phases to improve sport-specific dribbling under more realistic movement demands. In theoretical terms, this study strengthens the growing body of evidence that agility-related training is most effective when it is specific, progressive, and closely linked to the technical requirements of the game. (Mendes et al., 2022; Adi & Dwi, 2025; Doua et al., 2026; Zhao et al., 2026).

CONCLUSION

Based on the results of this study, it can be concluded that both ladder drill zig-zag and ladder drill in-out training had a significant effect on improving the dribbling ability of futsal players at SMAN 4 Takalar. This conclusion is supported by the results of the prerequisite tests, which showed that the data were normally distributed and homogeneous, indicating that the assumptions for parametric testing were fulfilled. The paired-samples t-test further confirmed significant differences between pre-test and post-test scores in both groups, with significance values of 0.000 ($p < 0.05$).

Empirically, the group that received ladder drill zig-zag training showed a greater improvement, with the mean dribbling score decreasing from 18.4630 in the pre-test to 17.5760 in the post-test, resulting in a mean difference of 0.8870. Meanwhile, the ladder drill in-out group also improved, with the mean score decreasing

from 18.4530 to 18.0900, with a mean difference of 0.3630. Since dribbling performance was measured in time, a lower score indicates better performance. Therefore, both groups improved, but the zig-zag group improved more substantially.

The independent-samples t-test also revealed a significant difference between the two training methods, with $t = 3.420$, $p = 0.007$ ($p < 0.05$). This finding indicates that the zig-zag ladder drill was more effective than the in-out ladder drill in enhancing dribbling ability. Conceptually, this may be explained by the fact that zig-zag movements more closely resemble actual futsal situations, which require rapid changes of direction, agility, coordination, and ball control under pressure. Therefore, zig-zag ladder drill training is recommended as a more effective method for improving dribbling performance in school-level futsal players.

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