Vol. 13 No. 2 September 2026
e-ISSN: 2807-2227
p-ISSN: 2355-4355

Changes in Dribbling Completion Time Following Slalom Training Variations among Female Field Hockey Athletes

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Received: June 12, 2026; Accepted: Auguts 18, 2026; Published: September 30, 2026
Ed: 2026: 546-560

Abstract

Dribbling ability is an important technical skill in field hockey that requires stick-ball coordination, movement control, changes in direction, and speed regulation. This study aims to analyze changes in dribbling time of female hockey athletes at PELATDA Nusa Tenggara Barat before and after participating in the slalom training variation program. The study used a quantitative approach with a one-group pretest–posttest pre-experimental design without a control group. A total of 15 female hockey athletes were involved through *purposive sampling technique*. The training program was conducted over four weeks with a frequency of three sessions per week, including *straight slalom*, *zigzag slalom*, *gradual speed slalom*, and *combination slalom*. Measurements were taken using the Hockey Slalom Dribbling Test (HSDT) with track completion time in seconds. Data were analyzed using descriptive statistics and paired-samples t-test, accompanied by estimates of Cohen's effect size dz. The results showed that the average travel time decreased from 49.60 ± 3.46 seconds in the pretest to 44.93 ± 5.56 seconds in the posttest, with a reduction of 4.67 seconds or 9.42%. The reported paired t-test showed a significant difference, $t(14) = 7.792$; $p < 0.001$, with Cohen's $dz = 2.012$. These findings indicate an improvement in dribbling test completion performance after the training program, but the causal relationship cannot yet be confirmed because the study did not involve a control group. The study provides preliminary evidence regarding changes in dribbling performance in the context of regional female hockey athlete development and supports the need for controlled experimental research.

Keywords: slalom training; dribbling ability; female hockey athletes; field hockey; technical skills.

INTRODUCTION

Field hockey is a team sport that demands the integration of technical skills, physical ability, visual perception, and decision-making in dynamic game situations. Players must be able to accelerate, decelerate, change direction, and maintain ball possession when facing pressure from space and time. These demands show that hockey performance depends not only on physical capacity but also on the ability to efficiently execute technical skills during the game. Research on hockey match characteristics identifies the importance of repeated sprint ability, movement intensity management, and differences in activity load based on playing position (Goods et al., 2022; Lam et al., 2021; Powell et al., 2023). In this context, dribbling skills are one of the fundamental technical abilities that enable players to hold the ball, pass opponents, create attack space, and support game transitions.

Dribbling in hockey is a complex skill involving stick-ball coordination, movement direction control, agility, dynamic balance, and speed regulation. The success of dribbling is not only determined by the ability to dribble the ball past obstacles but also by the efficiency of movement when players change direction while maintaining ball control. Antara et al. (2023) showed the relationship between agility, coordination, and flexibility with dribbling skills of female hockey players. Meanwhile, research by Bustamante-Garrido et al. (2023) and Rivera et al. (2024) shows the importance of mechanical characteristics of sprints, direction-change ability, and power-speed profiles in female hockey athletes. These findings provide the basis that dribbling development needs

to integrate mastery of technique with the ability to make quick and controlled changes of direction, not just increase running speed without the ball.

In the development of female hockey athletes at PELATDA West Nusa Tenggara (NTB), dribbling skill development is an important aspect to support athletes' readiness to face the demands of matches. The research manuscript identifies that the training patterns used are still relatively conventional and lack variety, especially in integrating changes in direction, ball control, and speed regulation on different trajectories. These issues indicate the need to evaluate training approaches that can provide skill repetition as well as variations in movement demands in a structured manner. However, the reported training conditions need to be understood as the basis of the research contextual problems, not as evidence that all athletes have the same dribbling weaknesses or that previous training approaches were ineffective.

The development of hockey technical skills can be done through training tailored to the characteristics of movement and game situations. Choi et al. (2025) examined activity-based hockey training on physical performance and movement variables related to the game. Osman et al. (2024) also studied the application of technical-tactical training modules to young hockey players, while Tajudin et al. (2022) compared *small-sided games* with traditional training for the development of player fitness and skills. These various approaches demonstrate the importance of aligning training characteristics with the abilities to be developed. Nevertheless, the results of game-based training or physical condition programs cannot be directly matched by the results of slalom training because each approach has different task structures, intensities, and decision-making demands.

Slalom training is a technique training approach that combines ball control, stick coordination, changes in direction, and speed regulation when the athlete moves through a series of obstacles. The use of winding tracks allows athletes to repeat movements that require continuous adjustment of body position and ball direction. Training variations can be done through changing the course pattern, using the forehand *and* reverse stick sides, gradually increasing speed, and integrating dribbling with passing or shots. Conceptually, this approach aligns with the principles of specificity and task variation in sports skills learning. Brocken et al. (2021) showed that modification of hockey training conditions can support skill transfer learning, while Kostiukevych et al. (2024) emphasized the importance of planning athlete preparation based on the demands of competitive activities. Thus, slalom variations are worth studying as an approach that potentially supports dribbling skill development, although their effectiveness still requires empirical proof according to the research design used.

Progressive training programs also need to consider the characteristics of female hockey athletes, especially the ability to maintain movement quality as task complexity increases. Lee and Choi (2024) reported changes in high-intensity movement variables after plyometric training in elite female hockey athletes, while Wang et al. (2025) examined explosive force adaptation through different training approaches. Saha et al.'s (2025) research also provided evidence regarding the anaerobic capacity response of adolescent hockey players to specific training programs. Although the study focused on physical components rather than directly on slalom dribbling skills, their findings highlight the importance of planned training planning tailored to athletes' needs. Therefore, increasing the complexity of slalom training should be understood as a strategy for managing technical tasks, not as a guarantee of improved performance.

The dribbling ability measured through the slalom track also has limitations in representing the overall performance of the match. During the match, players must control the ball while observing

the positions of teammates, opponents, and available space. Sneyimani et al. (2023) discuss the visual skills required in hockey, while van Dijk et al. (2025) study players' viewing behavior and decision-making in game situations. Huo et al.'s (2024) research also shows that women's hockey performance is influenced by match characteristics and opponent quality. Therefore, the slalom dribble test is more appropriate to evaluate technical performance on standardized tracks rather than being considered as a comprehensive measure of dribbling ability in actual match situations. This distinction is important so that research results are not interpreted beyond the characteristics of the instrument.

In time-based dribbling skill evaluation, travel time is a quantitative indicator indicating task completion efficiency, with shorter time reflecting better performance if the track and testing conditions are the same. The use of specific skill tests for sports branches is relevant to the needs for evaluating technical abilities of hockey players as studied by Mohan et al. (2021). However, the quality of interpreting results still depends on the clarity of measurement procedures, trajectory consistency, and accuracy of time recording. A decrease in test completion time may indicate improved performance on the measured task but does not automatically prove an improvement in all components of agility, coordination, or decision-making separately.

Based on this empirical study, the research gap lies in the limited evidence specifically describing changes in dribble travel time after the application of progressive slalom training variations on female hockey athletes in the context of regional development, especially PELATDA NTB. Previous research has discussed the physical demands of matches, characteristics of direction changes, technique learning, and game-based training, but these discussions have not directly addressed how dribel test performance changes after the four slalom variation programs were applied to the athlete groups studied. The novelty of this research is contextual and practical, namely the evaluation of straight, zigzag, gradual speed, and combined slalom programs conducted over four weeks using dribble time as the main performance indicator. This novelty is not seen as the first invention of the slalom training method nor as proof of its superiority compared to other training approaches.

This study aims to analyze changes in dribbling time of female hockey athletes at PELATDA Nusa Tenggara Barat before and after participating in a four-week slalom training variation program. The research hypothesis states that there is a significant difference between dribble travel time in the initial and final measurements. The study used a pretest–posttest pre-experimental design, so its contribution is directed at providing preliminary evidence of performance changes in the studied group, rather than definitively establishing cause-and-effect relationships. The research findings are expected to serve as a basis for evaluation for coaches in developing structured and measurable dribbling technique training programs.

METHODS

Research Design

This study used a quantitative approach with a pre-experimental method and *a one-group pretest–posttest design*. Fifteen female hockey athletes underwent initial measurements (*pretests*), followed by a slalom training variation program, and then a final measurement (*posttest*). This design was used to evaluate changes in dribbling time in the same participants after participating in a four-week training program. A training-based intervention approach was also used in hockey research to evaluate changes in physical ability and specific performance of sports branches (Choi et al., 2025; Wang et al., 2025). This study is pre-experimental because all participants were in one group without

randomization or control groups. Thus, differences in measurement results indicate changes in performance during the study period, but it is not sufficient to prove that these changes are caused exclusively by slalom training variations. The research design is defined as O_1–X–O_2, with O_1 as the pretest, X as the slalom training variation program, and O_2 as the posttest.

Subjects and Sampling Techniques

The research subjects consisted of 15 female field hockey athletes who are part of the development program of PELATDA West Nusa Tenggara. Sampling was done using *purposive sampling technique* based on participant characteristics that matched the research objectives. Inclusion criteria included female athletes who actively participated in hockey training, were in the adolescent to young adult development age range, had at least one year of training experience, had no musculoskeletal injuries in the last three months, and were willing to participate in the research series. Exclusion criteria included athletes who did not complete the training program, experienced injuries during the study, or did not attend more than two training sessions.

All participants were evaluated using paired measurements, so performance changes were calculated based on the pretest and posttest results of each athlete. The study was limited to the development group of PELATDA NTB, so the results were not intended to be generalized directly to all female hockey athletes. The selection of female athletes as subjects is scientifically based because women's hockey performance is influenced by a combination of physical ability, coordination, changes in direction, neuromuscular control, and technical skills. Previous research has shown that agility, coordination, and flexibility are related to dribbling skills in female hockey players (Antara et al., 2023). In addition, sprint ability, repeated sprint ability, and change of direction are important components in the performance of female field hockey athletes (Bustamante-Garrido et al., 2023; Rivera et al., 2024; Powell et al., 2023).

Research Instruments

The main instrument used to measure dribbling ability is the slalom hockey dribble test. This test is conducted by athletes dribbling the ball using sticks through seven cones in a slalom pattern from the start line to the finish line. Scores are obtained from dribbling performance according to the established measurement procedures. Each athlete is given the opportunity to make three attempts, and the best score is used as the final score. The use of specific skill tests for sports branches is important in hockey research because measurements must reflect the character of game movement, such as ball control, stick-ball coordination, agility, and changes of direction (Mohan et al., 2021; Cooke et al., 2026). Supporting instruments in this study include cones, hockey balls, hockey sticks, whistles, stopwatches, score sheets, and hockey fields consistently used in the pretest and posttest. All measurements were conducted by the same staff to reduce variation between testers. The measurement results are expressed as track completion time in seconds; the shorter the time recorded, the better the athlete's dribbling performance.

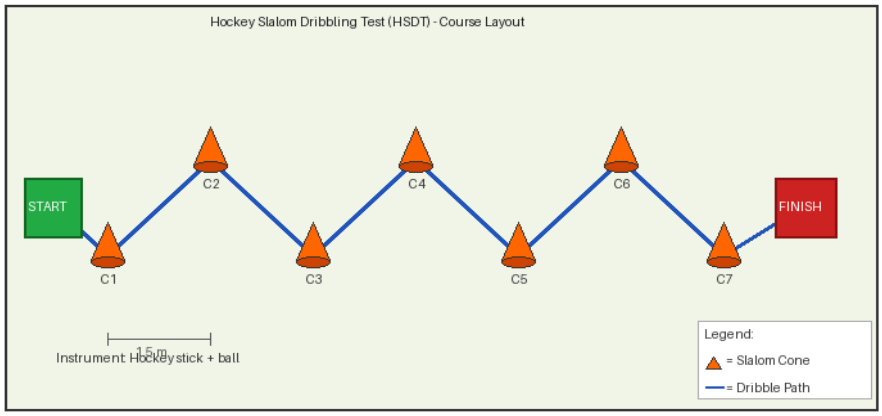


Figure 1. Hockey slalom dribbling test (HSDT)

Slalom Training Intervention Program

The intervention provided was a slalom training variation program over four weeks with a frequency of three sessions per week, totaling 12 training sessions. Each session lasted 90 minutes, consisting of 15 minutes of dynamic warm-up, 60 minutes of core training, and 15 minutes of cool-down. The program was progressively designed with the principle of increasing training load through variations in movement patterns, adding repetitions, adjusting cone spacing, and increasing the complexity of dribbling tasks.

Table 1. Slalom training variation program

Weeks	Training Focus	Frecuency	Traning Volume	Set	Repetition	Recovery
1	Straight slalom: mastery of the basic technique of dribbling hockey with a stick passing through a cone of a uniform distance of 1.5 m	3 time /weeks	70%	35	6	2 minute
2	Zigzag slalom: switching sides of the stick (forehand & reverse) with variations in the direction of movement change	3 time /weeks	70%	35	8	2 minute
3	Gradual speed slalom: progressive intensity, distance between cones 1.5 m and target travel time	3 time /weeks	80%	40	8	2 minute
4	Combination slalom: integration of dribbles with passes and shots to the goal after passing the last cone	3 time /weeks	70%	35	10	1,5 minute

The training variations consist of four main forms. The first week focuses on straight slaloms to build basic control of the stick and ball. The second week uses zigzag slalom with changes to the stick sides, including forehand and reverse movements. The third week emphasizes gradual speed slalom with higher intensity and target travel times. The fourth week integrates combined slalom with passing and shooting to the goal after passing the last cone. This sequence shows an increase in the complexity of technical tasks from mastering the basic trajectory to a combination of skills that better approximate the game situation. This training form is designed to approach the needs of hockey games that demand acceleration, deceleration, changes of direction, ball control, and movement response in confined spaces. This specific training approach aligns with findings that activity-based hockey training can improve physical performance and movement variables relevant to the match (Choi et al., 2025), while game-based training or training modifications can support the improvement of skills of young players (Tajudin et al., 2022; Osman et al., 2024; Saha et al., 2025).

Data Collection Procedure

Data collection was carried out in three stages. The first stage was the pretest, which measured dribbling ability before the subject's received treatment. All athletes underwent standard warm-up before the test was conducted. The second stage was the provision of a four-week slalom training variation program according to the training schedule. During the intervention, attendance and athletes' adherence to the program were recorded to ensure consistency of implementation. The third stage was the posttest, which was the re-measurement of dribbling ability after the entire training program was completed. The final measurement was carried out using the same instruments, tracks, equipment, and testers as in the pretest. The main data consisted of each participant's dribbling time at both measurement times. Performance changes were expressed through the reduction of travel time from pretest to posttest, with the time reduction indicating faster track completion.

Data Analysis Techniques

Data were analyzed using IBM SPSS Statistics version 25. The analysis began with descriptive statistics including mean, median, standard deviation, variance, minimum score, maximum score, and score range. Next, normality testing was conducted using Shapiro-Wilk because the sample size was less than 50. If the data were normally distributed, analysis continued using paired sample t-test to determine differences in dribbling ability between pretest and posttest. The significance level was set at $\alpha = 0.05$. In addition to significance values, this study also reported effect measurements using Cohen's d and eta squared so that results are interpreted not only statistically but also practically in the context of sports coaching. Reporting effect size is important because sports intervention research needs to show the magnitude of the effect of training programs on changes in athlete performance, not just whether there is or is not a difference in scores.

RESULTS

The study involved 15 female hockey athletes from PELATDA West Nusa Tenggara who participated in a slalom training variation program for four weeks with three sessions each week. Dribbling ability was measured using the Hockey Slalom Dribbling Test (HSDT) by recording track completion time in seconds. Shorter travel time indicates better dribbling performance. The results are presented through descriptive statistics, normality checks, as well as testing differences in travel time and effect size.

Based on Table 2, the average dribble time decreased from 49.60 seconds in the pretest to 44.93 seconds in the posttest. A decrease of 4.67 seconds or 9.42% indicates that athletes were on average able to complete the dribble track faster after participating in the slalom training variation program. The median time also decreased from 50 to 46 seconds. However, the standard deviation increased from 3.46 to 5.56 seconds, indicating that the variation in travel time among athletes in the posttest was greater than in the pretest. These results provide an initial overview of changes in dribbling performance relevant to hockey skill characteristics, as studied by Antara et al. (2023) which examined the relationship between agility, coordination, and flexibility with dribbling skills of female hockey players. Nevertheless, the changes in travel time in this study cannot be used to conclude the changes in each physical component separately.

Table 2. Descriptive and normality test result

	Pre Test (second)	Post Test (second)
Valid	15	15
Missing	0	0
Median	50	46
Mean	49.6	44.93
Std. Deviation	3.46	5.561
Shapiro-Wilk	0.951	0.946
P-value of Shapiro-Wilk	0.544	0.462
Range	13	21
Minimum	42	33
Maximum	55	54

The Shapiro-Wilk normality test results showed p-values of 0.462 in the pre-test and 0.544 in the post-test. Both values are greater than the 0.05 significance level, so the data are declared normally distributed. With the normality assumption fulfilled, parametric analysis using paired sample t-test can be performed accurately (Mishra et al., 2021; Field, 2024).

Table 3. Paired sample result test

Pre Test	Post Test	t	df	p	Mean Difference	SE Difference	95% CI for Mean Difference	
							Lower	Upper
Dribbling	Dribbling	7.792	14	< .001	2.012	0.101	1.106	2.895

The analysis results showed a significant difference in dribbling ability scores before and after the intervention. A significance value smaller than 0.05 indicates that the performance changes occurring after the slalom training variation program were not caused by chance but related to the treatment given. The 95% confidence interval was entirely positive and did not cross zero. This condition indicates that the direction of change is consistent and supports an improvement in dribbling ability after the training program is implemented. According to Lakens (2022), the confidence interval not exceeding zero provides additional evidence regarding the stability of the intervention effect estimation.

Table 4. Effect Size

Pre Test	Post Test	Cohen's d	SE Cohen's d	95% CI for Cohen's d	
				Lower	Upper
Dribbling	Dribbling	2.012	0.101	1.106	2.895

Cohen's dz value of 2.012 indicates a very large, standardized change in the group. The magnitude of these changes supports the hypothesis of a difference in dribbling performance between the two measurement times, but it has not been proven that all changes are caused exclusively by slalom training variations since there is no control group. Brocken et al.'s (2021) research on modification of training conditions and hockey skill learning transfer, as well as Osman et al. (2024) on technical-tactical training, provide empirical context that hockey skills can be developed through training task management, although the design and characteristics of the interventions differ from this study.

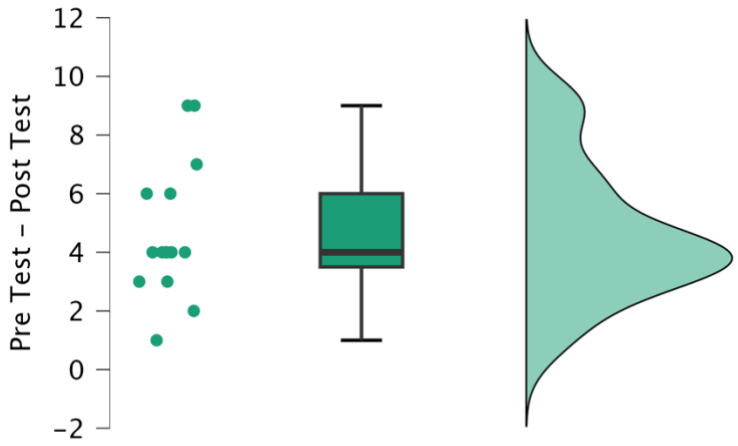


Figure 2. Raincloud difference plots

A visualization of the distribution of score changes are shown through a raincloud plot (Figure 2). The graph shows that most athletes experienced improved performance after participating in the slalom training variation program. The post-intervention data distribution also appeared more concentrated compared to data before the intervention, indicating an increase in consistency in dribbling ability among athletes. Overall, the results of descriptive analysis, normality test, paired difference test, and effect size show that the slalom training variation program has a positive effect on the dribbling ability of female hockey athletes at PELATDA Nusa Tenggara Barat.

DISCUSSION

The findings of this study show that slalom training variations contribute positively to improving the dribbling ability of female hockey athletes. Rationally, these results can be explained by the characteristics of slalom training that require athletes to control the ball, change the direction of movement, maintain body balance, and repeatedly adjust the stick position on changing trajectories. This training pattern is directly compatible with the characteristics of field hockey that require players to perform acceleration, deceleration, changes of direction, and make technical decisions within a limited playing space. These findings indicate that athletes on average were able to complete dribbling trajectories faster in the final measurement, but it has not yet been proven that these changes were caused exclusively by slalom training because the study used a single-group design without control. Performance improvement should be understood as changes within the group during the intervention period.

Technically, changes in travel time can be conceptually related to the alignment between training characteristics and measurement tasks. The four training variations used, namely *straight slalom*, *zigzag slalom*, *gradual speed slalom*, and *combination slalom*, require athletes to integrate ball control, stick-ball coordination, direction changes, and speed adjustment. Antara et al. (2023) identified the relationship between agility, coordination, and flexibility with dribbling skills of female hockey players, while Bustamante-Garrido et al. (2023) and Rivera et al. (2024) demonstrated the importance of mechanical characteristics of sprints and direction changes in female hockey athletes. The suitability of these movement demands provides a reasonable explanation for the reduction in travel time, although this study did not separately measure changes in agility, coordination, or other physical abilities.

Performance interpretation also needs to consider individual characteristics. Kim et al. (2024) examined differences in anthropometric and fitness characteristics of hockey athletes based on gender and playing position, while Bieryla et al. (2024) highlighted the importance of analyzing the activity profile of female hockey athletes in the context of changing match formats. Kostiukevych et al. (2021) also showed that the specific abilities of hockey players consist of several components that can be analyzed multidimensionally. Thus, the increase in group averages does not always show the same magnitude of change in each athlete.

The findings of this study can be placed in the context of developing technical skills through manipulation of training conditions. Brocken et al. (2021) showed that the use of modified equipment in hockey learning can result in positive learning transfer. Osman et al. (2024) also examined technical-tactical training modules for young hockey players, while Tajudin et al. (2022) compared *small-sided games* with traditional training approaches. Unlike this approach, this study focuses on changes in track completion time after four progressive slalom training variants. Although the forms of intervention are not identical, these studies provide a foundation that training condition regulation is an important aspect in hockey skill development.

Another comparison relates to the development of physical components that support technical movements. Ramasamy et al. (2022) studied core muscle training in relation to dynamic balance and strength endurance in junior hockey players. Quezada-Muñoz et al. (2021) examined high-intensity interval training on the fitness of female hockey players, while Choi et al. (2025), Lee and Choi (2024), and Wang et al. (2025) evaluated changes in various physical performance indicators after hockey training programs. Saha et al. (2025) also discussed anaerobic endurance responses to training approaches in adolescent players. However, the improvement in fitness or physical ability in previous studies cannot be used as direct evidence that the decrease in HSDT time in this study was caused by the same physical mechanisms. Differences in interventions, participants, and outcome variables need to be considered before drawing cross-study conclusions.

In the context of training load management, Cuadrado-Peñafiel et al. (2023) compared the distribution of sprint training to hockey player performance, while McGuinness et al. (2021) examined the relationship between player rotation and physical and physiological demands in elite women's hockey matches. Kostiukevych et al. (2024) also emphasized the importance of training programming based on competitive preparation needs. These findings support the importance of planned training structures but have not yet explained the optimal dose of slalom variations to improve dribbling skills. This study used a four-week program with three sessions each week; although there were performance changes, the design did not allow identification of the contribution of each variation or the most effective training dose.

The technical aspects of hockey can also be understood through the study of specific movement biomechanics. De la Fuente et al. (2022) developed an analytical approach to push techniques in hockey, while Wali et al. (2022) studied the relationship between kinematic and anthropometric factors with *drag-flick performance*. These two skills differ from dribbling but demonstrate the importance of movement characteristics and body position in the execution of hockey techniques. In slalom training, body position adjustment, use of the stick side, and direction of movement are relevant task characteristics; however, this study has not provided biomechanical data to objectively explain technique changes. Therefore, movement efficiency remains a theoretical explanation that requires further testing.

Comparisons with match-based research show limitations in travel time indicators. Morencos et al. (2021) identified differences in women's hockey match load profiles based on playing position. Konarski et al. (2023) examined external loads in the Hockey5s competition format, while Huo et al. (2024) showed that opponent quality and match context are related to women's hockey performance dynamics. These studies confirm that dribbling time on standardized routes represents only one aspect of technical performance and cannot be directly equated with dribbling success in competitive matches. Theoretically, performance changes can be explained through the principles of training specificity and task variation in motor learning. Slalom training provides repetition of dribbling skills while facing changes in direction and demands of movement coordination. The program starts with mastering simple tracks, followed by changing the stick sides, increasing speed, and integrating with passing and shooting. This sequence has the potential to expand athletes' motor skills through changes in task complexity, not just increasing the repetition of movements on a single track.

The principle of skill variation needs to be distinguished from mastery of certain techniques. Research by De la Fuente et al. (2022) and Wali et al. (2022) shows that hockey skills have specific biomechanical characteristics, while Abraham and Vinod Kumar (2024) discuss the asymmetric and unilateral characteristics of hockey movements. The use of forehand and reverse stick sides during slalom training can be understood as an effort to enrich variation in technique execution, but this study does not specifically measure movement asymmetry or bilateral ability. Thus, the statement that the program improves balance between using both sides of the stick cannot yet be established based solely on travel time data. Movement efficiency must also be placed in the context of coordination between technique mastery and cognitive demands. Klatt et al. (2021) studied players' viewing and decision-making behavior in *penalty corner situations*, while Malcolm et al. (2022) examined cognitive function in relation to competitive hockey matches. Gama et al. (2022) examined the relationship between psychological characteristics and perceptions of tactical knowledge in female hockey athletes. Khan et al.'s (2023) study also described the experiences of elite hockey players in psychological skill training. These studies show that hockey performance involves perceptual, cognitive, and psychological aspects. However, this study did not measure these components, so changes in travel time should not be interpreted as evidence of increased concentration, decision-making, or psychological readiness of athletes.

The difference between skills on standardized paths and abilities in real play also has implications for learning transfer. Sneyimani et al. (2023) discussed the visual skills required in hockey, while van Dijk et al. (2025) studied viewing behavior and decision-making in game situations. Wimshurst and Sowden (2025) developed a visual skills examination approach for sports contexts, while Mizawa et al. (2022) outlined the temporal and spatial structure of passing sequences in high-level hockey matches. These findings show that game performance is determined not only by the speed of movement execution but also by the ability to obtain information and adapt actions to environmental conditions. Therefore, the reduction in HSDT completion time is an indicator of standardized task improvement, not direct evidence of successful transfer to play. This distinction is also supported by research on match performance analysis. Lord et al. (2022) describe the use of performance analysis to systematically present hockey strategy information, while Lord et al. (2023) study the spatial distribution and patterns of ball movement in matches. This approach shows that skill evaluation needs to consider the context of skill use in the game. Thus, dribbling time measurement can be a component of technical evaluation, but it should be complemented with indicators of ball control accuracy, passing success through opponents, and decision-making.

The research results provide practical considerations for women's hockey coaches in designing structured technical training. Slalom variations can be used as a form of training to combine ball control, direction changes, and speed adjustments. Coaches can start from simple trajectories, increase complexity through direction changes, then integrate advanced skills. However, these programs should be positioned as alternative support for technical training, not methods that have proven more effective than conventional training or game-based approaches. Its use needs to be adjusted to the individual athletes' abilities and needs. Performance monitoring is also an important aspect in training implementation. Latino et al. (2024) discuss the use of sensors worn by athletes to evaluate the physiological performance of elite hockey players, while Lim et al. (2021) review the use of wearable technology in hockey matches. Shahar et al. (2025) examine the introduction of hockey activities through inertial sensor data. The study provides guidance for developing more objective training evaluations, but the use of advanced technology is not an absolute requirement for implementing slalom programs. In the context of regional coaching, consistent time recording, documentation of repetition counts, and observation of ball control quality can be the initial steps in training monitoring, if measurement procedures are standardized.

The main limitation of the study was the single-group design without controls, so changes in travel time could be influenced by routine training, repeated tests, increased familiarity with the track, motivation, or other factors during the intervention period. Additionally, the sample size was only 15 athletes from one development environment. Characteristics of age, anthropometry, training experience, and playing position have not been fully reported, even though these factors potentially relate to performance variations. Increasing standard deviation in the posttest reinforces the importance of examining individual changes so that group averages do not mask differences in response between athletes. Further research is recommended to use an experimental design with a control group, a larger number of participants, and standardized training dose documentation. Time measurement needs to be complemented by instrument reliability evaluation, individual change analysis, retention tests, and skill transfer assessments to game situations involving opponents and decision-making. Thus, further research can explain not only whether dribble travel time changes after training but also how these changes relate to the quality of technique and competitive performance of female hockey athletes.

CONCLUSION

This study concludes that the dribbling ability of female hockey athletes at PELATDA Nusa Tenggara Barat shows positive changes after participating in the slalom training variation program, marked by a reduction in dribble test completion time. These findings indicate that the implementation of structured and progressive training variations is relevant to support the development of dribbling technique skills in the context of regional athlete development. The main contribution of this study lies in providing initial empirical evidence regarding changes in dribbling task completion efficiency through training programs that integrate ball control, direction changes, stick-ball coordination, and speed regulation. However, the observed performance changes cannot yet be exclusively attributed to slalom training because the study used a single-group design without comparisons. Furthermore, measurements on standardized tracks do not fully represent dribbling skills in dynamic match situations. Thus, variations in slalom training can be considered as one of the supporting approaches for women's hockey technique training, while the certainty of effectiveness and skill transfer to game situations still requires validation through research with stronger designs.

RECOMMENDATION

Female hockey coaches can consider variations in slalom training as one of the supporting components for developing dribbling skills in athlete development programs. Its application can be progressive, starting from controlling the stick on a simple trajectory, changing direction through zigzag patterns, increasing movement speed, to combining dribbling with *passing* and *shooting*. Training evaluation should not only focus on reducing travel time but also pay attention to ball possession quality, accuracy of technique execution, and individual performance development. Coaches need to implement appropriate training load management and document the attendance and implementation of the program to support ongoing coaching evaluation. Further research is recommended to use an experimental design with control groups to obtain stronger evidence regarding the effectiveness of slalom training variations. The study needs to involve a broader sample, report participant characteristics comprehensively, and use instruments with evidence of adequate validity and reliability. Testing skill retention and transfer of training results to match situations needs to be conducted involving indicators of ball control, decision-making, and dribbling success when facing opponent pressure. Additionally, training dose documentation and analysis of individual changes are needed to explain athletes' responses more comprehensively.

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