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Effects of a Progressive Circuit Training Program on Dribbling Performance in Adolescent Futsal Players

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Abstrac: This study addressed inconsistent close ball control and slow changes of direction among adolescent players at Pariaman City Futsal Academy by examining the effects of a progressive circuit-training program on timed dribbling performance. A quasi-experimental one-group pretest-posttest design involved all 15 eligible players aged 15–18 years. Across 18 meetings, participants completed a pretest, 16 training sessions, and a posttest. The intervention used six progressive stations emphasizing zig-zag, figure-eight, shuttle, obstacle, feinting, and slalom dribbling. Mean completion time decreased from 13.53 ± 1.92 to 10.13 ± 0.74 seconds. The mean improvement was 3.40 seconds (95% CI [2.45, 4.35]), t(14) = 7.64, p < .001, with a large within-player effect (Cohen's dz = 1.97). The program was associated with faster, more consistent dribbling, but controlled studies and match-based assessments are recommended to confirm causality and transfer to competition.

Keyword: Adolescent Players, Circuit Training, Dribbling Performance, Futsal, Motor learning

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INTRODUCTION

Futsal is a high-intensity invasion game played in a restricted area, requiring technical actions to be performed rapidly and accurately under continuous spatial and opponent pressure. The small court, frequent transitions, and repeated one-on-one situations reduce the time available for decision making and technical correction (Kharisma & Faruk, 2022). Match analysis confirms that futsal combines repeated high-intensity actions with dense technical involvement, creating substantial perceptual-motor demands (Yiannaki et al., 2020). In adolescent development settings, systematic training is especially important because technical weaknesses that are not corrected early may become habitual and constrain later performance. Reviews of futsal talent development emphasize the need to identify and train skills that reflect the sport-specific demands of the game (Mendes et al., 2022), while academy-based evidence also shows that physical readiness and fundamental technique are closely connected to effective play (Arian & Jatmiko, 2021).

Among the fundamental futsal techniques, dribbling has an important tactical function. It enables a player to transport the ball, escape pressure, penetrate open space, create a passing or shooting angle, and disrupt the defensive organization of the opposing team. In a narrow playing area, successful dribbling is not simply running while pushing the ball forward. It requires repeated short touches, coordinated use of the inside and outside of both feet, awareness of surrounding space, balance during acceleration and deceleration, and the ability to change direction without losing possession. Abdullah & Sari (2023) identified agility and speed as important contributors to dribbling performance, while Yolanda & Bahtra (2024) emphasized that sound fundamental technique supports both individual and team effectiveness in futsal.

The quality of dribbling is influenced by several mutually connected components. Speed allows a player to progress before an opponent closes the available space, whereas agility supports rapid changes of direction. Dynamic balance helps the player maintain body control when turning, stopping, or protecting the ball. Coordination links visual information to the timing and force of foot contact, and technical mastery determines whether the ball remains within a controllable distance. Humaedi et al. (2017) reported contributions of agility and dynamic balance to ball-carrying performance, and Siswandi et al. (2018) showed that structured technical practice can improve zig-zag dribbling. These findings support training designs that combine repeated ball contact with multidirectional movement patterns.

Initial observations at Pariaman City Futsal Academy indicated that several players aged 15–18 years had difficulty maintaining close ball control during rapid movement. The ball was often touched too far from the feet, directional changes were slow, and possession was easily lost when an opponent applied pressure. Players also showed limited balance and inconsistent use of both feet. These weaknesses were visible during regular training and friendly matches and reduced the players' ability to beat an opponent or move the ball into a more advantageous area. Although circuit training had previously been introduced by the academy, it had not been implemented routinely, through a written progression, or with a clear evaluation of its contribution to dribbling performance.

Circuit training offers a practical method for organizing repeated technical and physical tasks. In a circuit, players rotate through a sequence of stations, and each station can be designed to emphasize a specific performance component. For dribbling, the stations can reproduce accelerations, decelerations, tight turns, changes of direction, bilateral foot use, body feints, and repeated ball contact. The coach can also regulate repetitions, sets, intensity, and recovery without changing the basic technical purpose of the exercises. This structure is suitable for academy settings because several players can train simultaneously, simple equipment can be used, and variation between stations may reduce boredom while preserving a high amount of task-specific practice.

The theoretical rationale for the intervention was based on specificity, progressive overload, repetition, variation, and feedback. Specificity proposes that adaptation is strongest when practice reproduces the movement and information demands of performance. Progressive overload requires training demand to increase gradually without sacrificing movement quality. Repetition supplies the ball contacts needed to stabilize coordination, whereas variation requires

the player to adapt the same technical principles to different routes and turning patterns. From a motor-learning perspective, practice is most productive when task difficulty presents an appropriate challenge for the performer's current skill level (Guadagnoli & Lee, 2010). Brief, task-focused feedback and successful experiences may further support attention, confidence, and goal-action coupling (Wulf & Lewthwaite, 2016). The present circuit combined these principles by retaining dribbling as the central task while progressively changing volume, route, turning pattern, and immediate technical objective.

Previous studies support circuit-based and structured dribbling practice, but they also reveal an important research gap. Herlambang et al. (2022) linked speed, agility, and balance training with improved futsal dribbling. Pratama et al. (2020) and Latif & Bakhri (2023) reported positive effects of circuit training in football settings, while Citasari & Lestari (2025) examined a girls' school futsal team. International studies have shown that futsal-specific training can improve physical performance (Barbieri et al., 2016), that futsal task constraints can facilitate transfer of a passing skill (Oppici et al., 2018), and that a dribbling-based Hoff circuit can influence selected outcomes in highly trained youth soccer players (Rahmoune et al., 2025). These findings cannot be generalized directly to the present context because they differ in sport code, sex, competitive level, age, training history, station structure, comparator condition, and outcome measure. None evaluated a progressive six-station, dribbling-specific program across 16 sessions in a single male adolescent futsal academy using a standardized timed dribbling outcome.

Evidence was therefore needed for 15-18-year-old players at Pariaman City Futsal Academy. This study examined whether a five-week progressive circuit-training intervention could improve performance on a standardized timed dribbling test. The intervention incorporated six complementary stations: zig-zag cone dribbling, figure-eight dribbling, shuttle dribbling, obstacle dribbling, dribbling feints, and slalom dribbling. It was hypothesized that players would complete the course faster after the intervention. By reporting the station content, load progression, confidence interval, exact p-value, and within-player effect size, the study aimed to provide a transparent academy-level training reference and a basis for subsequent controlled research.

METHOD

Research Design

This study used a quasi-experimental one-group pretest-posttest design. A single existing academy squad was measured before and after receiving the same progressive circuit-training intervention. A control group was not used because the academy had only one eligible 15-18-year-old training group, and separating players or withholding the planned technical program would have disrupted the established schedule and coaching process. The research sequence was O1-X-O2, where O1 represented the initial dribbling test, X represented 16 circuit-training sessions, and O2 represented the final dribbling test. The design therefore estimates within-player change over the intervention period but cannot isolate the intervention from all alternative explanations.

The independent variable was circuit training, defined as a planned sequence of dribbling exercises performed at several stations with specified repetitions, sets, intensity, and recovery. The dependent variable was dribbling ability, defined operationally as the player's capacity to guide the ball rapidly and accurately through a prescribed course while maintaining control and using the feet according to the test instructions. Performance was recorded as completion time in seconds; a lower time represented better dribbling ability.

Participant

The population consisted of 15 active players at Pariaman City Futsal Academy aged 15-18 years. Total sampling was applied, so all eligible members of the academy population were included and completed the pretest, intervention, and posttest. No a priori power calculation was used; the sample represented 100% of the accessible population and was treated as an exploratory academy-level repeated-measures evaluation in which each participant served as his own reference. This approach improves sensitivity to individual change, but the small sample

limits precision and external generalizability. The research was conducted at the academy training venue in Pariaman, West Sumatra, from May 1 to June 7, 2026, across 18 meetings: one pretest, 16 treatment sessions, and one posttest. Academy management granted permission for the study. The procedures, voluntary nature of participation, confidentiality, and right to withdraw were explained before data collection. Players aged 18 years provided written consent; for players younger than 18 years, written parental or guardian consent and participant assent were obtained.

Instruments

Dribbling ability was measured with a standardized timed course. The equipment consisted of futsal balls, five cones or poles, a measuring tape, chalk, a flat playing surface, a recording sheet, a pen, a whistle, and a stopwatch. At the start command, the player stood behind the start line with the ball under control. After the "go" signal, the player dribbled through the prescribed obstacles according to the marked direction and continued until crossing the finish line. The right and left feet had to be used alternately. When a player moved in the wrong direction, the route had to be corrected while the stopwatch continued to run. One assessor gave the start signal and recorded the time, while another observed execution and documented the result.

The score was the elapsed time from the start signal until the player reached the finish line. Because the purpose of the course was to evaluate the efficiency of controlled movement, a lower score indicated better performance. For descriptive interpretation, times were classified as excellent (≤5 seconds), good (6–10 seconds), moderate (11–15 seconds), poor (16–20 seconds), or very poor (≥21 seconds). The same course, equipment, instructions, assessors' roles, and scoring procedure were used at pretest and posttest to improve measurement consistency.

Research Procedures and Data Collection

At the first meeting, the players received a standardized explanation of the test and then completed the pretest. The 16 treatment sessions were subsequently conducted according to the planned circuit progression. During each session, the coach demonstrated the movement at every station, corrected excessive ball distance, reminded players to use both feet, and monitored the work and recovery periods. The posttest was administered at the eighteenth meeting using the same procedure as the pretest. All recorded scores were checked before analysis, and every participant had a complete pretest and posttest value.

The intervention was delivered three times per week for approximately five weeks. Each treatment meeting included an opening explanation, a progressive warm-up, the six-station circuit, an evaluation period, and a closing activity. The main circuit emphasized close ball control, coordinated use of both feet, acceleration, rapid deceleration, balance, and efficient changes of direction. Players performed three repetitions at each station. The training load progressed from two sets during the early phase to three, four, and five sets in subsequent phases. The intended intensity was at least 80%, with recovery generally set at 30 seconds between sets and increased to 60 seconds during the final high-volume phase. Coaches emphasized technical quality and required the players to keep the ball close rather than merely completing the route as quickly as possible.

Table 1. Technical Content of the Circuit-training Intervention

Station	Exercise	Execution	Primary emphasis
1	Zig-zag cone dribbling	Dribble alternately left and right through 5–6 cones placed 1–2 m apart.	Close control, lateral movement, bilateral foot use
2	Figure-eight dribbling	Dribble around two cones placed approximately 2–3 m apart in a continuous figure-eight pattern.	Tight turning, balance, coordination
3	Shuttle dribbling	Dribble between three points placed approximately 5–6 m apart and reverse direction repeatedly.	Acceleration, deceleration, rapid turning
4	Obstacle dribbling	Guide the ball through cones or small flags arranged as varied obstacles.	Adaptation, spatial control, direction change

5	Dribbling feinting	Approach a cone or simulated defender, perform a body or direction feint, and accelerate away.	Deception, body orientation, explosive exit
6	Slalom dribbling	Dribble through 5–6 cones in a slalom route using the inside and outside of both feet.	Rhythm, close touches, movement efficiency

Note. All stations were repeated within each set. The number of sets increased progressively across the intervention.

The six exercises were selected because they represented complementary dribbling demands rather than six repetitions of the same movement. Zig-zag and slalom routes required frequent short touches and lateral adjustment. The figure-eight route increased the frequency of tight turns around a small radius. Shuttle dribbling emphasized stopping, reversing, and accelerating again. Obstacle dribbling required the player to adapt the route to a less predictable arrangement, while the feinting station connected ball control with body deception and an explosive movement away from a simulated defender. Together, the stations provided repeated practice of the core technical problem observed at the academy: controlling the ball during rapid multidirectional movement.

Data Analysis

Data were summarized using totals, means, standard deviations, minimum and maximum values, frequencies, and percentages. Inferential analysis was based on the paired difference score calculated as pretest time minus posttest time; positive values therefore represented improvement. The Lilliefors test examined normality of the paired differences. A two-tailed paired-sample t test evaluated mean change at alpha = .05. Statistical transparency was strengthened by reporting the exact p-value, the 95% confidence interval for the mean paired difference, and Cohen's dz as the within-participant effect size, calculated by dividing the mean difference by the standard deviation of the difference scores. Values of approximately 0.20, 0.50, and 0.80 were interpreted as small, moderate, and large effects, respectively. All analyses used the 15 complete pretest-posttest pairs.

RESULT

Descriptive Results

All 15 players completed every measurement required for analysis. The total pretest time was 203 seconds and the total posttest time was 152 seconds. As presented in Table 2, mean completion time decreased from 13.53 seconds at pretest to 10.13 seconds at posttest. The absolute mean improvement was 3.40 seconds, equivalent to approximately 25.1% of the pretest mean. The minimum time improved from 10 to 9 seconds, and the maximum improved from 16 to 12 seconds. The standard deviation decreased from 1.92 to 0.74 seconds, indicating that posttest performance was both faster and more consistent across the group.

Table 2. Descriptive Statistics of Dribbling-test Performance

Measure	Pretest	Posttest	Change
Number of players	15	15	—
Total time (s)	203	152	−51
Mean time (s)	13.53	10.13	−3.40
Standard deviation (s)	1.92	0.74	−1.18
Minimum time (s)	10	9	−1
Maximum time (s)	16	12	−4

Note. Lower completion time represents better dribbling performance.

The category distribution shifted markedly after the intervention. Before training, 10 players (66.67%) were in the moderate category and four players (26.67%) were in the poor category; only one player (6.67%) was categorized as good. At posttest, 12 players (80.00%) reached the good category and the remaining three players (20.00%) were moderate. No player remained in the poor or very poor categories. The distribution therefore shows that improvement

was not limited to a small number of high-performing players; the entire lower portion of the group moved toward more favorable classifications.

Table 3. Distribution of Dribbling-performance Categories

Category	Time criterion (s)	Pretest, n (%)	Posttest, n (%)
Excellent	≤5	0 (0.00)	0 (0.00)
Good	6–10	1 (6.67)	12 (80.00)
Moderate	11–15	10 (66.67)	3 (20.00)
Poor	16–20	4 (26.67)	0 (0.00)
Very poor	≥21	0 (0.00)	0 (0.00)
Total	**—**	**15 (100)**	**15 (100)**

Individual Changes

Every participant recorded a faster posttest time than pretest time. Individual improvements ranged from 1 to 6 seconds. The largest reduction was observed for Player 4, whose time improved from 15 to 9 seconds. Players who began with the slowest scores also showed meaningful gains: the participants with pretest scores of 16 seconds improved to values between 10 and 12 seconds. This pattern is consistent with the lower posttest standard deviation and indicates that the intervention may have helped less proficient players move closer to the performance level of their teammates.

Table 4. Individual Pretest and Posttest Completion Times

Player	Pretest (s)	Posttest (s)	Improvement (s)
P1	13	10	3
P2	16	11	5
P3	12	10	2
P4	15	9	6
P5	14	10	4
P6	12	10	2
P7	16	10	6
P8	16	10	6
P9	10	9	1
P10	13	10	3
P11	13	10	3
P12	16	12	4
P13	13	10	3
P14	13	11	2
P15	11	10	1

Note. Participant names were replaced with identification codes. Improvement equals pretest time minus posttest time.

Assumption and Hypothesis Tests

The paired difference scores met the normality assumption (Lilliefors D = 0.192, p = .152). The paired-sample t test showed a statistically significant reduction in completion time, t(14) = 7.64, p = .000002. The mean paired improvement was 3.40 seconds, with a 95% confidence interval from 2.45 to 4.35 seconds. Cohen's dz was 1.97, indicating a large within-player effect. Thus, the posttest times were substantially faster than the pretest times, although the one-group design does not by itself establish that circuit training was the sole cause of the change.

Table 5. Inferential Statistics And Effect Size

Analysis	Statistic or estimate	p-value	Interpretation
Lilliefors normality of paired differences	D = 0.192	.152	Normality assumption met
Paired-sample t test	t(14) = 7.64	.000002	Significant reduction in time
Mean paired improvement	3.40 s; 95% CI [2.45, 4.35]	—	Faster posttest performance
Cohen's dz	1.97	—	Large within-player effect

Note. Improvement was calculated as pretest time minus posttest time; positive values indicate faster posttest performance. The paired t-test p-value is two-tailed.

DISCUSSION

The principal finding was that the progressive circuit-training program was associated with a substantial improvement in timed dribbling performance among adolescent futsal academy players. The mean reduction was 3.40 seconds, the confidence interval excluded zero, and the within-player effect was large. In addition, every participant improved and the posttest scores were less variable. These results indicate that the players became faster and more consistent when guiding the ball through repeated predetermined changes of direction.

Specificity of training provides one explanation for the improvement. Every station required repeated ball contact while the player accelerated, decelerated, turned, or reorganized body position. Zig-zag and slalom routes demanded rapid lateral adjustment and alternation between the inside and outside of the feet; figure-eight and shuttle tasks emphasized tight turning, balance, and reacceleration; obstacle and feinting stations added spatial adaptation and body deception. These practice demands closely resembled the movement components assessed by the timed course. Futsal's constrained space can strengthen perception-action coupling and frequent technical engagement (Yiannaki et al., 2020), although the closed test used here represented only part of the information demands encountered against live opponents.

Motor-learning theory also helps explain the pattern of change. Repeated attempts allowed players to detect and correct errors in touch distance, supporting-foot placement, body orientation, and turning rhythm. At the same time, station-to-station variation prevented practice from becoming a single fixed movement sequence. According to the challenge-point framework, learning opportunities are enhanced when task information and difficulty are sufficient to challenge the performer without overwhelming the current skill level (Guadagnoli & Lee, 2010). The progressive increase in sets, combined with stable technical instructions, likely increased practice demand while preserving a recognizable task structure. Close control and bilateral foot use were central technical objectives. Before the intervention, players frequently pushed the ball too far from the feet and needed additional steps to recover possession. The circuit repeatedly required shorter touches near cones, a controlled reduction in speed before turning, and a stronger exit touch after the change of direction. Alternating the right and left feet may also have reduced unnecessary body repositioning and allowed a more direct route through the test. Such improvements are compatible with the view that efficient movement emerges when attention is directed toward the intended task outcome and successful actions strengthen confidence and goal-action coupling (Wulf & Lewthwaite, 2016).

The progressive load structure may have supported both physical and technical adaptation. Players began with two sets and advanced to as many as five sets while retaining three repetitions at each station. This increased the amount of task-specific practice without changing the central technical objective. Regular exposure three times per week provided repeated opportunities for consolidation and corrective feedback. Comparable evidence shows that specific futsal training can improve agility and other physical capacities (Barbieri et al., 2016), but the present program placed greater emphasis on controlled ball movement and direction changes than on general conditioning alone. The reduction in standard deviation is practically relevant because it suggests that the group became more uniform, not merely faster on average. The players who began with the slowest scores showed meaningful gains, and no participant recorded a worse posttest result. Nevertheless, improved test performance should not automatically be equated with permanent motor learning. A retention test was not conducted, so it remains unknown whether the gains persisted after training stopped or whether part of the change reflected temporary performance enhancement and familiarity with the course.

The findings are broadly consistent with circuit and structured-dribbling studies in football and futsal contexts (Pratama et al., 2020). Rahmoune et al. (2025) also demonstrated that a dribbling-based circuit can be implemented with highly trained youth players, although their comparative results favored small-sided games for several match-related technical and physical outcomes. Taken together, the evidence suggests that circuits are useful for focused repetition and controllable workload, whereas game-based tasks may be needed to strengthen perception, decision making, and transfer under pressure. A meta-analysis further showed that small-sided-

game interventions can improve technical execution in young team-sport players (Clemente et al., 2021). The large effect size must be interpreted within the study design. Because all players received the intervention, improvement may also have been influenced by ordinary academy practice, maturation, increased motivation, repeated exposure to the test, or other activities during the five-week period. The effect estimate therefore describes the magnitude of observed within-player change rather than a definitive causal contrast with an untreated group. This distinction is important when translating the findings into coaching practice.

The program offers a feasible model for academy coaches because it uses simple equipment and can be integrated into regular training. Six stations can be arranged around the court, players can be divided into small groups, and the number of sets can be increased gradually as execution becomes stable. Technical quality should remain the primary criterion: the ball should stay within controllable distance, both feet should be used, the upper body should remain balanced, and acceleration should occur only after the turn has been completed under control. Closed circuit exercises should not be used as the sole method of futsal development. The standardized course assessed movement through predetermined obstacles, whereas competitive dribbling requires perception of teammates, opponents, available space, and rapidly changing action possibilities. Coaches should therefore progress from unopposed stations to semi-opposed and opposed tasks, for example by adding a passive defender, a directional choice, or a pass or shot at the end of the route. This progression can preserve technical repetition while increasing representative decision-making demands. This recommendation is reinforced by evidence that dribbling quality depends on accuracy and the action created after the dribble, not only on movement speed (Iuliano et al., 2023).

Coaching behavior influences the quality of practice. High repetition is beneficial only when players do not repeatedly reproduce the same technical error. Coaches should focus feedback on one or two observable priorities, such as touch distance, body position before turning, or looking up after leaving an obstacle. Feedback should be brief enough to maintain circuit rhythm and should reinforce successful execution, especially when players use the weaker foot. Confidence is relevant because hesitant players may reduce speed excessively or take unnecessary touches (Hariawan & Kafrawi, 2022), while supportive feedback and an attainable challenge can promote engagement and motor learning (Wulf & Lewthwaite, 2016).

The findings must be considered within several limitations. The study included only 15 players from one academy and did not include a control group, so the observed change cannot be separated completely from ordinary training, test familiarity, maturation, or motivational effects. The intervention lasted approximately five weeks, and no retention test was conducted. Completion time was the principal outcome; technical errors, successful one-on-one actions, ball loss under pressure, and match performance were not measured.

Future research should use controlled or comparative designs with larger samples from multiple academies. Attendance, session rating of perceived exertion, and completed training volume should be documented, and retention testing should be conducted after the intervention. Researchers should compare different circuit progressions and work-to-rest ratios and combine timed tests with representative indicators such as successful take-ons, possession retention, progression distance, and decision quality under defensive pressure. Such designs would clarify whether gains in a planned course persist and transfer to competitive futsal.

CONCLUSION

The progressive six-station circuit program improved timed dribbling performance and produced more consistent execution among the adolescent academy players. Coaches may use a similar progression as a structured component of technical training, provided that close control, bilateral foot use, balance, movement accuracy, gradual workload progression, and adequate recovery are monitored. Because the study lacked a control group and assessed a closed timed course, the findings should be treated as preliminary evidence rather than definitive proof of transfer to competition. Future programs and studies should integrate semi-opposed and opposed tasks, evaluate retention, and measure match-based dribbling outcomes using controlled designs.

Attendance, recovery, and individual readiness should also be monitored. A player who misses several sessions may not be prepared for the same progression in volume as teammates who completed the earlier phases. Coaches can record attendance and completion quality, adjust sets when technique deteriorates, and maintain short recovery intervals only when players can preserve ball control. Progress should be judged by movement quality and consistency as well as by the fastest completion time. The circuit was designed around balls, cones, poles or small flags, a stopwatch, and a flat surface, making it suitable for an academy with limited equipment. The court should be organized so that groups do not cross paths and each player has sufficient room to accelerate safely after turning. When space is restricted, coaches may shorten routes, use staggered starts, or operate fewer stations rather than allowing congestion to reduce technical quality or increase collision risk.

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