

Influence of skill training variations on technical and physical performance in youth soccer

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Abstract:

This study examined how varied skill repetition affected the performance of 14–16-year-old male soccer players. Thirty-seven players were randomly assigned to a low repetition skill training group (LRSTG, n = 13), a high repetition skill training group (HRSTG, n = 12), or a control group (CG, n = 12). Over six weeks, the LRSTG and HRSTG supplemented their regular team training with structured drills in passing, shooting, and dribbling (DR), while the CG continued their usual football activities. Performance was assessed via anthropometric measurements, the Y Balance Test (YBT), 10 and 30 m sprint tests, vertical jump (VJ), the Little & Williams Zigzag Agility Test (LWZ), and the Mor & Christian Soccer Ability Test. A double-blind design was used. Both the LRSTG and HRSTG demonstrated statistically significant improvements ($p < 0.05$) in accurate passing (AP) and accurate shooting (AS), with DR performance improving only in the LRSTG. Compared to the CG, who showed no significant changes in these technical skills, both experimental groups exhibited significantly better AS, and LRSTG demonstrated higher DR. Additionally, the experimental groups showed significant gains in 10-m sprint and agility. However, no significant changes were found in VJ, YBT, or 30-m sprint across any group. These findings suggest that adjusting repetition volume in skill training can improve both technical and physical performance, challenging previous claims about the limited value of repetitive drills. The results have implications for coaches planning more effective training programs.

Keywords: Motor learning, Practice structure, Youth athletes, Football coaching, Movement variability

Introduction

The fundamental role of repetition in motor skill acquisition is well-established. During the learning process, repetitions induce synaptic-level plasticity, thereby promoting both cognitive and motor development (Lee & Schmidt, 2025). However, there is no prevailing consensus on the optimal amount, duration, or intensity of repetition necessary for effective learning. Experimental investigations specifically addressing this issue are limited. Bergmann et al. (2021) highlight the lack of experimental research exploring the impact of training volume on skill performance, especially in athletic contexts. Therefore, the lack of experimental studies detailing effective training parameters for performance enhancement poses considerable challenges for practitioners.

Skill development typically depends on structured and repeated practice, reinforcing neuromotor pathways and supporting procedural memory (Lee & Schmidt, 2025; Mang et al., 2019). Yet, skill acquisition is not only contingent upon motor repetition; it also incorporates athletes' goal processing, contextual adaptation, and feedback utilization for adjustments (Gabbett et al., 2017). This multifaceted nature complicates the design of evidence-based training plans, especially for developing athletes. Therefore, in skill-based sports such as football, the lack of empirical data on the influence of repetition volume on learning outcomes is a considerable challenge for coaches. Existing literature underscores the role of systematic repetition in skill acquisition. As performance progresses to become more fluid and automatic, athletes can more efficiently allocate attention and refine decision-making processes, thereby liberating cognitive resources to address the demands of competition (Lee & Schmidt, 2025). However, in practical settings characterized by finite time and resources, the efficacy of achieving skill acquisition through only fixed repetitions is a key implementation concern.

Although variable practice models are widely advocated in the literature, this study implemented an intervention program based on the repetition of fixed movement patterns. This approach offers an alternative perspective to the prevailing variable practice theoretical framework and experimentally tests the potential effectiveness of fixed-repetition-based training.

This study investigated the effects of different repetition volumes on the technical and physical performance of male soccer players aged 14–16. Over a six-week period, the low repetition skill training group (LRSTG) and a high repetition skill training group (HRSTG) engaged in structured drills focusing on passing, shooting, and dribbling (DR), while the control group (CG) maintained their regular training routines. A double-

blind design was used to measure both technical skill and biomotor performance parameters, and the impact of repetition volume on learning outcomes was systematically evaluated.

Materials and methods

Participants

The study cohort consisted of 37 male athletes, aged 14–16 years (mean age 14.86 ± 0.79 years). All participants held licenses from the Turkish Football Federation and possessed a minimum of two years of football experience with amateur clubs in Düzce, Turkey. Participants were randomly allocated to one of three groups: an LRSTG ($n = 13$), an HRSTG ($n = 12$), or a CG ($n = 12$). The athletes completed a voluntary consent form that was read and signed by their parents. Ethical approval for the research was provided by the Bolu Abant İzzet Baysal University Clinical Research Ethics Committee, in full compliance with the Helsinki Declaration (approval number: 416, September 22, 2023).

Procedure

For six weeks, athletes in the experimental groups (LRSTG and HRSTG) engaged in a specialized skill training program focusing on shooting, passing, and DR. This program was performed twice weekly, supplementing their regular team training sessions. In contrast, the CG only participated in their regular team training. The study was overseen by a team of physical education teachers. The researchers informed the designated personnel who administered performance tests and ensured the proper execution of all training sessions. To maintain a double-blind design, athletes, the coach, and the research team followed instructions without knowledge of the study's purpose, results, or group assignments.

Test protocols and measurements

Pre-tests were performed two days before, and post-tests two days after, the six-week intervention. All tests were completed over two days, with two sessions held each day. During these tests, body weight (BW), height (H), and leg length were recorded. Leg length was determined with the athlete in a supine position, measuring from the anterior superior iliac spine to the medial malleolus (Ateş, 2019).

Administered via a standard testing device, the Y Balance Test (YBT) involved each athlete performing reach attempts with both legs in anterior, posteromedial, and posterolateral directions. Distances were measured to the nearest 0.5 cm. After six practice trials, three test trials were completed for each directional set. A rest of 1–2 min was allowed between directional sets, and 30 s between individual trials. Attempts were repeated if an athlete removed their hands from their hips, touched the floor, or if any part of the standardized protocol was not followed. YBT results were then normalized using a standard calculation method (Lee & Ahn, 2018).

$$\text{YBT Score} = \frac{(\text{Anterior} + \text{Posteromedial} + \text{Posterolateral})}{3 \times \text{Leg Length}} \times 100$$

Measurements were taken in the following order: right anterior, left anterior, right posteromedial, left posteromedial, right posterolateral, and left posterolateral (Lee & Ahn, 2018).



Fig. 1. Y Balance Test application: (A) anterior, (B) posteromedial, (C) posterolateral

A jump mat was used to measure hang time for the vertical jump (VJ) test. Athletes performed a single jump while maintaining their hands on their hips and flexing their knees to at least 90 degrees. Two trials were completed by each athlete. Hang time values were then converted into centimeters using the following formula:

$$h = \frac{g \times t^2}{2}$$

where h is the vertical displacement (in meters), g is the gravitational acceleration (9.81 m/s^2), and t is the athlete's hang time (in seconds) (Sözbir, 2013).

For the agility assessment, the Little & Williams Zigzag (LWZ) Agility Test was used. Athletes ran a 20-m slalom, weaving through three cones set 5 m apart at 100-degree angles (Figure 2D). Each athlete completed two trials, and their best time was recorded as the final score. A photocell timing system was used to measure the duration of each run (Sözbir, 2013).

Sprint performance was evaluated on a 30-m course, using photocell timing gates positioned at the 10-m and 30-m marks. Athletes began each trial from a standing start, positioned 1 meter behind the line, and

initiated the sprint at their own discretion upon hearing the cue, "You can go." Each athlete performed two trials, separated by a 3-min rest period. The best result of the two trials was then used for statistical analysis (Lehri, 2018).

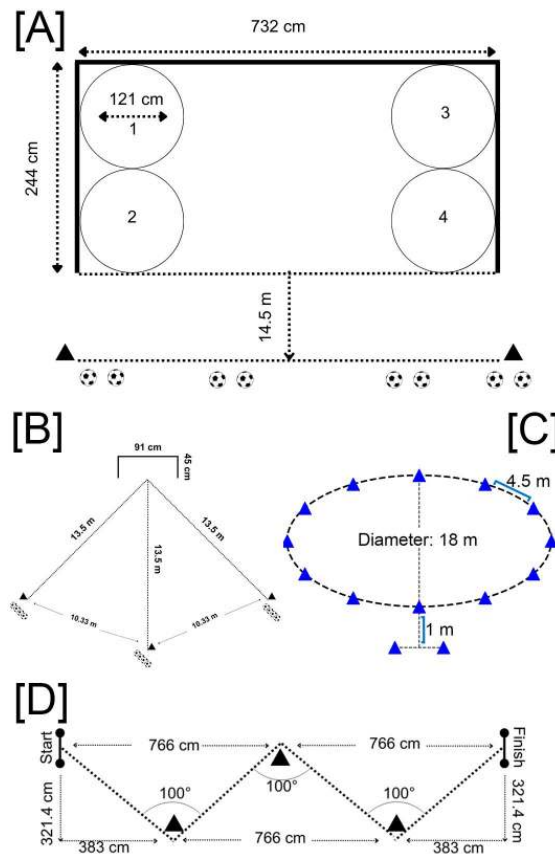


Fig. 2. (A) Mor & Christian Accurate Shooting Test, (B) Mor & Christian Accurate Passing Test, (C) Mor & Christian Dribbling Test, (D) Little & Williams Zigzag Agility Test. cm = centimeter; m = meter

The Mor & Christian Soccer Ability Test Battery assessed fundamental soccer skills, including accurate passing (AP), accurate shooting (AS), and DR. In the AP test (Figure 2B), athletes passed from two points positioned at a 45-degree angle and three points 13.5 m away at a 90-degree angle. Each athlete completed four passes from every location, and only accurate passes yielded points (Mor & Christian, 1979).

The Mor & Christian AS Test used a wall-mounted soccer goal with four circular target zones (Figure 2A), each 121 cm in diameter. Athletes took four sequential shots at each target, completing 16 attempts. Scoring was as follows: 10 points for shots striking the correct aerial target, and 4 points for shots hitting a different target. Shots that missed all targets or touched the ground before entering the goal received no points (Mor & Christian, 1979).

DR skill was evaluated using the Mor & Christian Dribbling Test with a photocell timing system. As shown in Figure 2C, 12 cones were placed 4.5 m apart along the circumference of a circle with a diameter of 18 m. Athletes completed three trials: one clockwise, one counterclockwise, and one in their preferred direction. The final score was the average of their two best times. Athletes who lost control of the ball, missed an obstacle, or hit a cone resumed from the point of error (Mor & Christian, 1979).

Training protocol/ instruments

LRSTG and HRSTG held their training sessions on Tuesdays and Thursdays at the indoor synthetic turf football field. LRSTG trained from 17:30 to 18:30, and HRSTG from 18:30 to 19:30. In both cases, the training sessions began after a warm-up.

LRSTG performed AP and DR exercises in interval sets of 4–6–8–6–4 repetitions, while HRSTG completed interval sets of 6–9–11–9–6 repetitions. LRSTG performed 28 total repetitions of AP and DR per session, compared to 41 repetitions by HRSTG. Athletes rested for 1–2 min between sets. The passing drill involved two targets, each 1 m wide and placed 15 m apart with cones. Athletes stood directly behind these targets and made accurate passes to the opposite target, using any part of their foot and taking as many touches as they preferred. In the DR drills, athletes slalomed through five cones spaced 1 m apart from the starting point, then dribbled straight back to the start.

The LRSTG performed AS exercises in interval sets of 3–3–4–3–3 repetitions, sequentially aiming at designated targets, while the HRSTG completed AS in interval sets of 5–5–5–5–5 repetitions, also targeting the same points. LRSTG achieved 16 accurate shots per session, compared to 25 by HRSTG. Athletes took an equal

number of shots at each target, with 1-min rest intervals between sets. For the AS drills, two goals were marked on the wall, each containing 120 cm diameter targets placed at the goal corners. Shots were taken from behind a designated shooting line located 15 m from the targets, according to each group's training program.

Over the 6-week period, each training session in the LRSTG lasted 40 min, totaling 480 min, during which 336 repetitions each of DR and AP, and 192 repetitions of AS were performed. In contrast, each HRSTG session lasted 50 min, totaling 600 min, with 492 repetitions each of DR and AP, and 300 repetitions of AS completed. Compared to LRSTG, HRSTG performed 46.42% more DR and AP exercises and 56.25% more AS exercises.

During training, the coach provided verbal feedback focused on equipment, ball speed, direction, and target, without addressing athletes' body movements (Ghorbani et al., 2019). The researcher observed the sessions without participating. The coach monitored exercise repetitions by counting aloud and confirming with the athletes.

Data analysis/statistical analysis

Levene's test was used to assess the equality of variances across groups. The Shapiro–Wilk test was used to evaluate the normality of the data, with results confirming a normal distribution. Descriptive statistics summarized the data. For comparing pre-test and post-test results in each group, the Paired Samples T-test was applied. Because the study involved three groups, One-Way Analysis of Variance (ANOVA) examined differences between them. When significant differences were detected, the Tukey Post Hoc test identified which specific groups differed. In this study, the significance level was set at $p < 0.05$. This study was experimental in nature; therefore, no a priori sample size calculation was performed using G-Power. Instead of power analysis, Cohen's d values were calculated for statistically significant results to quantify the effect size. Group means and statistical outcomes are presented in Table 1 (Vincent & Weir, 2020).

Results

The average age, H, and BW of the participants were reported separately for each group. In the LRSTG, the mean age was 15.00 ± 0.82 years, H was 166.85 ± 8.59 cm, and BW was 53.99 ± 9.49 kg. In the HRSTG, participants had a mean age of 14.92 ± 0.79 years, H of 168.41 ± 5.81 cm, and BW of 56.64 ± 7.02 kg. For the CG, the average age was 14.67 ± 0.78 years, H was 167.04 ± 5.65 cm, and BW was 55.14 ± 7.77 kg.

The mean values and statistical analysis results from the study are presented below (Table 1).

Table 1. Pre-test and post-test mean $\pm$ SD values. Statistically significant differences are indicated by (*); non-significant differences are not shown.

Variables	LRSTG	HRSTG	CG
AP (Point)	Pre-test	3.69 ± 1.80	2.92 ± 1.68
	Post-test	4.69 ± 1.38	4.50 ± 1.38
	t	-2.793	-3.171
	p	0.016*	0.009**
	Cohen's d	0.775	0.915
AS (Point)	Pre-test	39.23 ± 14.78	34.33 ± 19.69
	Post-test	47.08 ± 11.68	60.17 ± 14.21
	t	-2.268	-4.631
	p	0.043*	0.001**
	Cohen's d	0.629	1.337
DR Skill (s)	Pre-test	16.498 ± 1.641	16.128 ± 1.330
	Post-test	15.053 ± 1.442	15.508 ± 0.991
	t	5.897	1.767
	p	0.000***	0.105
	Cohen's d	1.636	0.51
VJ (cm)	Pre-test	31.04 ± 3.70	32.30 ± 4.74
	Post-test	31.96 ± 4.27	31.90 ± 5.45
	t	-0.840	0.402
	p	0.417	0.696
	Cohen's d	0.233	0.116
Right Leg Y Balance (%)	Pre-test	95.58 ± 5.50	92.88 ± 9.94
	Post-test	95.70 ± 7.18	92.61 ± 6.28
	t	-0.053	0.138
	p	0.958	0.893
	Cohen's d	0.015	0.04
Left Leg Y Balance (%)	Pre-test	96.73 ± 5.61	94.26 ± 10.09
	Post-test	97.29 ± 7.62	92.78 ± 5.11
	t	-0.277	0.782
	p	0.786	0.451
	Cohen's d	0.077	0.226
10 m Sprint Time (s)	Pre-test	1.930 ± 0.083	1.887 ± 0.109
	Post-test	1.884 ± 0.109	1.825 ± 0.068
	t	2.295	2.324
	p	0.041*	0.040*
	Cohen's d	0.637	0.671
30 m Sprint Time (s)	Pre-test	4.771 ± 0.237	4.617 ± 0.255
	Post-test	4.743 ± 0.260	4.549 ± 0.187

	t	0.922	1.707	-0.255
	p	0.375	0.116	0.803
	Cohen's d	0.256	0.493	0.074
	Pre-test	6.01 ± 0.20	5.88 ± 0.24	5.88 ± 0.22
	Post-test	5.76 ± 0.22	5.73 ± 0.09	5.71 ± 0.27
Agility (s)	t	4.633	2.299	3.350
	p	0.001**	0.042*	0.006**
	Cohen's d	1.285	0.664	0.967

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ indicate levels of statistical significance. CG = control group; cm = centimeter; HRSTG = high-repetition skill training group; LRSTG = low-repetition skill training group; s = second; t = Paired Samples T-test statistic; Cohen's d indicates effect size: 0.2 = small, 0.5 = medium, 0.8+ = large

According to the results in Table 1, both LRSTG and HRSTG demonstrated significant improvements in AP and AS after the training program ($p < 0.05$). DR performance improved significantly only in LRSTG, with no significant change in HRSTG. Regarding sprint performance, both experimental groups showed better 10-m sprint times, while the CG showed no change. Agility scores increased in all three groups, including the control, indicating that regular training alone may improve agility. However, there were no significant changes in VJ, YBT scores, or 30-m sprint performance in any group ($p > 0.05$).

Cohen's d values were calculated for all variables in Table 1. In both LRSTG and HRSTG, AP and AS demonstrated large effect sizes ($d > 0.8$). DR in LRSTG showed a moderate effect size ($d \approx 0.5$). Agility scores exhibited large effects across all groups. The 10-m sprint displayed moderate effect sizes in both LRSTG and HRSTG.

Table 2. Between-group differences and results of the One-Way ANOVA test

Variables	Group	Sum of squares	Degrees of freedom (DF)	Mean square	F	p
Accurate Passing (Point)	Between groups	5.173	2	2.587	0.803	0.456
	Within groups	109.583	34	3.223		
	Total	114.757	36			
Accurate Shooting (Point)	Between groups	9551.560	2	4775.780	13.345	0.000***
	Within groups	12167.359	34	357.863		
	Total	21718.919	36			
Dribbling Skill (s)	Between groups	18.531	2	9.265	6.886	0.003**
	Within groups	45.750	34	1.346		
	Total	64.280	36			
Vertical Jump (cm)	Between groups	46.314	2	23.157	1.160	0.325
	Within groups	678.473	34	19.955		
	Total	724.787	36			
Right Leg YBT (%)	Between groups	14.981	2	7.491	0.164	0.849
	Within groups	1552.754	34	45.669		
	Total	1567.735	36			
Left Leg YBT (%)	Between groups	60.699	2	30.349	0.616	0.546
	Within groups	1675.894	34	49.291		
	Total	1736.593	36			
10 m Sprint Time (s)	Between groups	0.036	2	0.018	2.758	0.078
	Within groups	0.221	34	0.006		
	Total	0.256	36			
30 m Sprint Time (s)	Between groups	0.034	2	0.017	1.278	0.292
	Within groups	0.449	34	0.013		
	Total	0.482	36			
Agility (s)	Between groups	0.077	2	0.038	0.967	0.390
	Within groups	1.349	34	0.040		
	Total	1.425	36			

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ indicate levels of statistical significance. CG = control group; cm = centimeter; F = One-Way ANOVA test statistic; HRSTG = high-repetition skill training group; LRSTG = low-repetition skill training group; s = second

Table 2 presents the results of the One-Way ANOVA comparing post-test scores across the three groups. Statistically significant differences were found in AS and DR performances ($p < 0.05$). No significant differences were observed between the groups for the other performance variables, including AP, VJ, 10-m sprint, 30-m sprint, YBT, and LWZ ($p > 0.05$). The specific groups with significant differences are detailed in Table 3.

Table 3. Post Hoc Tukey Test results for group comparisons

	Group (Mean $\pm$ SD) (points)	Groups	Group Means $\pm$ SD	Mean differences	Standard error	p
AS Performance (point)	LRSTG (7.85 $\pm$ 12.48)	HRSTG	25.83 $\pm$ 19.32	-17.99	7.57	0.059
		CG	-14.00 $\pm$ 23.73	21.85	7.57	0.018*
	HRSTG (25.83 $\pm$ 19.32)	LRSTG	7.85 $\pm$ 12.48	17.99	7.57	0.059
		CG	-14.00 $\pm$ 23.73	39.83	7.72	0.000***
	CG (-14.00 $\pm$ 23.73)	LRSTG	7.85 $\pm$ 12.48	-21.85	7.57	0.018*
		HRSTG	25.83 $\pm$ 19.32	-39.83	7.72	0.000***
DR Performance (s)	LRSTG (-1.446 $\pm$ 0.884)	HRSTG	-0.620 $\pm$ 1.215	-0.826	0.46	0.192
		CG	0.278 $\pm$ 1.353	-1.723	0.46	0.002**
	HRSTG (-0.620 $\pm$ 1.215)	LRSTG	-1.446 $\pm$ 0.884	0.826	0.46	0.192
		CG	0.278 $\pm$ 1.353	-0.898	0.47	0.156
	CG (0.278 $\pm$ 1.353)	LRSTG	-1.446 $\pm$ 0.884	1.723	0.46	0.002**
		HRSTG	-0.620 $\pm$ 1.215	0.898	0.47	0.156

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ indicate levels of statistical significance. CG = control group; HRSTG = high-repetition skill training group; LRSTG = low-repetition skill training group; s = second

Both experimental groups, LRSTG and HRSTG, performed significantly better than the CG in AS ($p < 0.018^*$ and $p < 0.000^{***}$, respectively). In AP, only the LRSTG showed a significant improvement compared to the CG ($p < 0.002^{**}$).

Discussion

No previous study has investigated the effects of skill-based training with different repetitions on skill performance and accuracy. Because sports are performance activities that require the execution of specialized skills, understanding the number of repetitions needed to optimize the efficiency of training time for improving skill performance and accuracy is essential for both athletes and coaches. This study explored the appropriate training volume in soccer and identified the number of repetitions that impact skill performance. Relevant previous studies related to the findings are briefly summarized below, followed by a discussion of the effects of the independent variables under corresponding headings.

AP performance increased significantly by 27.10% in LRSTG and 54.10% in HRSTG. Although the CG showed a 16.42% improvement, it was not statistically significant. Wondirad & Atomsa (2019) reported a 14.64% increase in AP performance after 10 weeks of skill-based training, while Kurban & Kaya (2017) also found significant improvements after 8 weeks of general soccer training. In contrast, Taga & Asai (2012) observed no improvement after 14 weeks of DR drills. Importantly, none of these studies detailed the structure of the exercises or the number of repetitions involved. More passing drills seem to have contributed to greater improvements in passing accuracy. This aligns with Vleugels et al. (2020), who demonstrated that reducing repetition between trials enhanced motor learning. In this study, the improvements in AP for both LRSTG and HRSTG were supported by large effect sizes ($d > 0.8$), underscoring the robustness of the differences observed. Overall, these findings highlight the practical importance of adjusting repetition volume during training, a subject that warrants further research in both applied and experimental settings.

AS performance increased significantly by 20.12% in LRSTG and 75% in HRSTG, while the CG experienced a 28.22% decline. Athletes in LRSTG and HRSTG performed significantly better than those in CG. Supporting this, García-Herrero et al. (2016) observed considerable AS improvements after a 10-week program performed three times a week. Similarly, Ngangom (2022) reported improved AS after training five times per week over 12 weeks. Additionally, Wondirad & Atomsa (2019) and Kurban & Kaya (2017) reported AS performance improvements after general soccer training. The results of this study indicate that increased training

correlates with better AS results. However, the literature lacks clear guidelines on the number of repetitions needed to improve skill performance. This study addresses that gap by providing a concrete example of training structure and volume, which can serve as a reference for future research. Specifically, AS improvements in LRSTG ($d = 0.629$) and HRSTG ($d = 1.337$) were accompanied by large effect sizes in HRSTG, demonstrating strong practical significance.

In this study, DR performance improved significantly only in LRSTG, with a 9.03% increase ($p < 0.01$), while HRSTG showed a non-significant 4.13% gain and the CG experienced a slight decline of 1.84%. Similar findings appear in the literature. Kurban & Kaya (2017) and Taga & Asai (2012) reported meaningful gains in DR through structured skill-based training, with Taga and Asai highlighting significant differences between experimental and control groups. Additionally, D'Isanto et al. (2017) found that low-intensity serve practice improved volleyball performance, supporting the notion that focused repetition is more effective than high training volume. Excessive practice without variation or feedback may hinder learning progress. Motor learning research indicates that simply repeating the same drills without variation is not always beneficial (Davids et al., 2007). However, this study contradicts that view by demonstrating that repetition of unchanged drills can enhance skill performance. The improvement in DR for LRSTG was supported by a moderate effect size (Cohen's $d = 0.515$), showing that the gain was both statistically significant and practically meaningful.

VJ performance showed no statistically significant changes in any group. LRSTG improved by 2.96%, HRSTG decreased by 1.25%, and CG improved by 9.89%, but none of these changes were significant. Previous studies also report mixed results. Kurban & Kaya (2017) observed no major improvements after standard soccer training, while González-Badillo et al. (2015) found that U16 players improved VJ more than U21 players after velocity-based resistance training. Explosive strength training is essential for jump development (Sözbir, 2013), and because our program lacked such exercises, this may explain the limited improvements. Additionally, the players were not in an age range associated with rapid jump development (Behringer et al., 2011). Cohen's d values were small across all groups, indicating that the changes were neither statistically significant nor practically relevant.

YBT right leg reach changed by -0.012% in LRSTG, -0.29% in HRSTG, and $+1.27\%$ in CG. Left leg reach improved by $+0.57\%$ in LRSTG, $+1.59\%$ in HRSTG, and $+1.68\%$ in CG. YBT reach distance is an important indicator of how the body adapts to training or sport (Thorpe & Ebersole, 2008). Güler (2018) demonstrated that Bosu and wobble board exercises improved dynamic balance, while Giftoşidou et al. (2006) reported significant balance improvements after 20-min Biodex sessions performed three times a week for 12 weeks. Some studies show that regular soccer training can improve static balance (Hammami et al., 2018), though other studies found no differences related to player positions (Kartal et al., 2016). Ateş (2019) found no relationship between hamstring flexibility and YBT scores. These results suggest that balance improvements likely require specific balance-focused training rather than soccer practice alone. Cohen's d values were very low, indicating that a larger sample size may be necessary to detect training effects.

10 m sprint performance improved significantly by 2.55% in LRSTG and 3.44% in HRSTG, while the CG showed a slight, non-significant decrease of 0.61%. These findings agree with previous research. For example, Padrón-Cabo et al. (2020) demonstrated that agility and coordination drills improved 10 m sprint speed. In contrast, Hammami et al. (2018) found no improvement in 10–20 m sprint performance after small-sided games. Additionally, González-Badillo et al. (2015) reported that U18 players showed greater 20 m sprint improvements compared to younger athletes. Together, these studies suggest that sprint performance gains depend on the nature of the training and the age of participants. Aslan et al. (2017) found no correlation between DR speed and 10 or 30 m sprint performance in soccer players. However, the improvement in 10 m sprint performance observed in both training groups is likely related to the DR tasks, which focused on the consistent execution of the same skill. Cohen's d values for LRSTG (0.637) and HRSTG (0.671) indicate a moderate effect size, suggesting that the training program had a meaningful impact on 10 m sprint performance.

Furthermore, 30 m sprint performance increased by 0.59% in LRSTG, 1.51% in HRSTG, and decreased by 0.13% in the CG, with no statistically significant changes. Similar studies have reported that skill-based training does not significantly affect 30 m sprint times (Hammami et al., 2018). However, other studies have shown significant improvements (Aslan et al., 2017). Yapıcı et al. (2016) observed that midfielders performed better than forwards, while Kartal et al. (2016) found no differences based on player position. The lack of improvement in this study could be attributed to the absence of dedicated sprint training or to the fact that the athletes had already reached their sprint capacity through regular training. Cohen's d values were small in both training groups. This indicates that the training had a limited impact on 30-m sprint performance.

The LWZ agility test showed a statistically significant improvement of 4.38% in LRSTG, 2.63% in HRSTG, and 2.98% in the CG. A review of previous research indicates that soccer training improves agility performance (Kurban & Kaya, 2017). Some studies report significant improvements in both experimental and control groups (Wondirad & Atomsa, 2019), while others find no effect of soccer training on agility (Padron-Cabo et al., 2020). In previous studies, the independent variable was often not clearly defined; thus, changes were attributed broadly to general soccer training. The findings of this study align well with existing literature. The smaller performance improvement observed in HRSTG is likely attributed to the broader focus of their training. The increase in CG's performance is attributed to athletes having at least two years of soccer experience

and ongoing training with their teams. These results highlight the value of targeted, skill-specific training over general soccer practice, highlighting the need for tailored programs to maximize performance gains. All groups demonstrated moderate to large effect sizes in agility: LRSTG showed a very large effect ($d = 1.285$), CG a large effect ($d = 0.967$), and HRSTG a moderate-to-large effect ($d = 0.664$). This indicates that both general soccer training and skill-based interventions improve agility, with the greatest improvements observed in the low-volume training group.

Conclusions

Skill training with different repetition counts resulted in significant improvements in both technical skills and select biomotor abilities in 14–16-year-old male soccer players after structured interventions. These results provide valuable guidance for coaches and athletes for optimizing training plans. Although existing research confirms that repeated practice improves skill performance, it often lacks clear recommendations on the ideal number and type of repetitions. Our study addresses this gap by showing that simply varying repetition counts can lead to improvement, even when the movement type remains unchanged. Additionally, these findings provide a foundation for further research in this area. For example, by modifying factors such as training duration, age group, or increasing the number of measurement points, more diverse and experimentally robust results can be obtained, thereby making a stronger contribution to the literature. Our study was performed under double-blind conditions, carefully controlling coaching behavior, feedback, and environmental influences to ensure unbiased observations. This methodological rigor improves the reliability of our findings and provides valuable insights for sports training. While Davids et al. (2007) argue that skill learning is more effective under varied practice conditions than through repeating the same movement in the same way—a concept called "repetition without repetition"—our results challenge this view. We found that both low and high repetition conditions led to improvements even without changing how the movement was performed.

Conflicts of interest

The authors declare no conflicts of interest.

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