Effectiveness of an Innovative Biomechanical Analysis System in Improving Shooting Accuracy Among Youth Football Players

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Abstract

This research was aimed at investigating the hypothesis that a new real-time biomechanical feedback mechanism could enhance the long-range shooting performance in young soccer players. Experimental and control groups were formed by random selection of ten youth players of Al-Zawraa SC, Iraq (5 in each group). During 8 weeks, three sessions a week were attended by both groups; however, only the experimental group practiced using an integrated system of light and sound signals, 4K high-speed video (64-512 fps), motion sensors, speed radars, and real-time display of the kinematic parameters. The accuracy of the shooting conditions was measured in three conditions of the task which consisted of: stationary ball, shot after a dribbling and shot in the presence of a defender with three levels of difficulty. Means and interquartile ranges were given and Wilcoxon and Mann-Whitney tests were applied due to small sample. The experimental group showed a significant improvement in all the 9 conditions of shooting, compared to the control group which only experienced trivial changes. There was concurrent increase in the alignment of the joints, trunk control, foot speed, knee angular speed, ball speed, impulse, average force, momentum, kinetic energy, and mechanical power. The results confirm the use of real-time biomechanical feedback in practical training to enhance speed in learning how to play soccer and improve shooting skill in young soccer players.

Keywords: youth soccer; shooting accuracy; biomechanics; real-time feedback; kinematics

Introduction

The enhancement of shooting accuracy during time pressure and a dynamic externality is one of the most important goals pursued in the youth soccer training. The interaction of perception, decision making, whole-body coordination, transfer of segmental speed, and the capacity to maintain the technical organization during pressure are required to shoot success. According to a recent literature review of the soccer-biomechanics field, there is active expansive development of the studies on kicking activity, mechanisms of performance control, and the use of technology in assisting the evaluation process, which proves that the issue of shooting-based biomechanics is still of high priority in the field of football science (Plakias et al., 2024). The retained basic work of the original manuscript also emphasized the importance of immediate-information systems and technical biomechanical control in sport (Hussein et al., 2016a, 2016b, 2017).

Meanwhile, the methodological landscape is evolving at a very high pace. The recent reviews and protocols on the use of wearable kicking have highlighted that field based systems are becoming more feasible, yet validity, reliability, and accuracy should be reported on cautiously before these systems are implemented in training or talent development environments (Vieira et al., 2024a, 2024b). Equally, new soccer diagnostics technologies are currently underway to integrate sensor-based tracking,

movement analysis, and actionable feedback of football-specific behaviors like passing, shooting, and changes of direction (Gascón et al., 2025). It was also demonstrated through real-time sensor-guided training interventions that immediate training can enhance technical and physical football performance during an 8-week timeframe (Liang et al., 2025).

Recent findings also indicate that the accuracy of shooting is influenced by the training design and task conditions. Technique-based training including attentional cues and increasing complexity has been more effective than less specific forms of practice in enhancing the accuracy of kicks in youth soccer players (Carlsson et al., 2025). It has been demonstrated by developmental studies that the age-related improvements in the leg strength, segmental angular velocities, and neuromuscular activities are inherently linked to improved instep-kick performance (Cerrah et al., 2024). Further research has also attributed knee kinematics to kicking performance (Xu et al., 2025) and demonstrated that stance arrangement may modify kicking performance at the adolescent stage (Davis et al., 2025). Mental fatigue, in its turn, is capable of reducing shooting accuracy in soccer despite the comparative stability of the movement timing (Liu et al., 2025).

Nevertheless, relatively little research has investigated a field-based system that concomitantly incorporates light and sound targets, high-speed video, motion sensors, speed radar and instant biomechanical feedback in youth players under more complicated shooting activity. The current research bridged that gap by experimenting with a new integrated system that aimed at enhancing shooting accuracy by outside of the penalty area under three task conditions: a stationary shot, a shot after dribbling, and a shot with a defender. It was assumed that the experimental group would experience more improvement than the control group in the accuracy of shooting as well as the biomechanical indicators of efficient force transfer to the ball.

Research Problem

Shooting accuracy is a decisive performance variable in soccer yet during many youth training programs they are still using traditional methods of observation and delayed verbal feedback which might not be adequate to identify quick technical errors in the kicking action.

Recent advances in technology have facilitated the field based biomechanical measurement, however minimal research has been conducted regarding an integrated training system incorporating light and sound targets, high speed video, motion sensor, speed radar, and instant feedback in gradually more complex shooting drills in youth soccer.

Thus, the current research will respond to the necessity to investigate whether this innovative real-time biomechanical system could be better than the traditional training in enhancing shooting accuracy and the corresponding mechanical predictors.

Research Objectives

1. To identify the efficiency of a novel biomechanical examination and instant-feedback apparatus in enhancing long-range shooting accuracy in youth soccer athletes.

2. To compare the performance development of experimental group and control group under three task conditions: stationary shot, shot after dribbling and shot with a defender.
3. The question to be answered is whether the training system enhances some of the biomechanical indicators of the efficient kicking technique and force transfer.
4. To offer viable suggestions to coaches and youth academies to use real-time biomechanical feedback during the shooting training in football.

Research Hypotheses

1. It would be shown that the experimental group would show considerably higher improvement than the control group in terms of long-range shooting accuracy when shooting stationary-ball, dribbling and defender-pressure conditions.
2. Application of the real-time biomechanical feedback system would result in quantifiable changes in the kinematic measures of knee angle, hip angle, ankle angle, trunk lean, foot speed, and knee angular speed during the kicking movement.
3. There would also be an improved kinetic indicator of force transfer to the ball using the real-time biomechanical feedback system that included ball speed, impulse, average force, momentum, kinetic energy, and mechanical power.

Scope of the Study

- Human Scope (Population): The participants of the study were male youth soccer players of the Al-Zawraa SC in Iraq who participated in regular football training and were belonging to the category of developmental age and were appropriate to be improved in terms of technical and biomechanical training.
- Temporal Scope (Timeframe): The intervention lasted 8 weeks with three lessons per week and the pre- and post-test procedures followed right before and after the period of training in the same field conditions.
- Geographical Scope (Location): The study was taken on a football field background where skills are to be tested and biomechanical data are to be recorded in Iraq with one goal, shooting distance, equipment arrangement, and technological equipment being the same to all the subjects.

Method

Design and Participants

The research incorporated experimental pre-test- post -test design which had a control group. The study involved 10 youth male soccer players of the Al-Zawraa SC (Iraq) that were randomly split into an experimental group (n = 5) and control group (n = 5). Both teams had an eight weeks training program that was three sessions a week. The experimental group had finished the program using the innovative biomechanical system and the control group exercised using conventional methods without the integrated feedback platform.

Research Tools

It used a combination of field and analytical tools, such as the innovative biomechanical feedback platform, 4K high-speed cameras, motion sensors, speed-

measurement radars, wireless cue systems, an electronic data-recording unit, and software to display and compare kinematic variables immediately and compare them.

Pilot Study

Exploratory preparation was completed before the actual application to check the functionality of the light/sound response, the strength of the the Wi-Fi connection, the placement of the cameras, the quality of the recording, the calibration of the radars, and the understandability of the testing process to the players. This was preparation that aided standardization of the test environment to minimize errors of technology in the main intervention.

Main Experiment

The experimental procedure comprised of the pre-test, the 8 week training regimen and the post-test to determine the training in that identical field condition. The two groups trained three times a week, and the experimental group had real-time biomechanical feedback of the integrated system during the performance and repetition of the shooting performances.

Innovative Biomechanical System

The new system was also created as a unified real-time solution of performance evaluation, movement diagnosis and real-time correction. Its operating philosophy relied on simultaneous visual capture of high resolution, high-speed recording, speed measurement, and motion sensing and conversion of the inputs into interpretable visual and auditory signals in one training environment.

It consisted of a central control unit with light and sound indicators, wireless communication, instant analysis processing unit, 4K high-speed cameras with the possibility of recording 64-512 fps, motion sensors, speed-measurement radars, an electronic recording/storage unit, and live analytical software to map the joint-angle and to compare trials. Functionally, the platform allowed the coach and the player to see quick phases of movement which would be challenging to see visually with standard observation and get corrective feedback when the movement is repeated.

It is in line with the recent literature that suggests field-usable, valid, sensor-based evaluation systems in soccer training (Vieira et al., 2024a, 2024b) and with those emerging performance-diagnostic systems designed to capture and analyze the actions of football players such as shooting and passing (Gascón et al., 2025). Figures 1-4 record the system description and the three levels of performance adopted in the current research.

Figure 1. *Overview of the football shot accuracy training system. The platform integrates light-target zones, a central control unit, high-speed 4K cameras, motion sensors, speed radars, and an electronic recording/storage system.*

Testing Conditions

The tests were conducted in standardized field conditions to achieve objectivity and comparison both between trials and between players. Distance of the shooting, field of execution, equipment, order of attempts and rest were kept constant. Before the actual series of testing, Wi-Fi connection, light and sound options, record information and storage options were tested. Every effort was documented to enable review later including slow-motion analysis, which can have a fine pre-post comparison.

Task complexity was applied in three levels. Level 1 was the case of a stationary shot and the simplest technical situation. Level 2 was associated with a post dribble shot and it introduced an additional coordinative requirement of approach and contact time. Level 3 consisted of shooting a defender and was a more ecologically valid game-like situation that put time constraints and external interference.

Three levels of target difficulty were used within each level. One light target was activated by difficulty 1. Target 2 and Target 2 were triggered. Difficulty 3 had four corner targets which were identified with color. Therefore, the players had not only to shoot at the goal, but to identify a visual stimulus fast and pass the ball to the specified section. This design generated spatial accuracy, response speed and movement control at progressively more complex.

Figure 2. *Level 1 testing condition: stationary shot with three progressively more difficult target configurations.*

Figure 3. *Level 2 testing condition: shot after dribbling with three progressively more difficult target configurations.*

Figure 4. *Level 3 testing condition: shot with a defender and three progressively more difficult target configurations.*

Measured Variables

The dependent variables involved performance outcomes and biomechanical variables. Performance outcomes were in the score of shooting-accuracy scores at the three task levels and the three-difficulty conditions at each level. Biomechanical measurements were knee angle, hip angle, ankle angle, trunk lean, foot speed at contact, knee angular speed, ball speed, the ratio of ball speed, to foot speed (Vball/Vfoot) and impulse.

As a further elaboration of the mechanical interpretation of performance change, kinetic variables that are the products of the kicking action (average force, linear momentum, kinetic energy and mechanical power) were also explored in the study. Taken together, these were meant to be coupled to visible performance improvement with underlying changes in movement organization and force transfer.

Statistical Analysis

The sample size was small, thus non-parametric statistics were applied along the way without the possibility to assume normality. There were medians and interquartile ranges (Q1-Q3). The Wilcoxon signed-rank test was used to compare within-group pre-post comparisons. The differences between the change scores in between groups were compared using the Mann-Whitney U test. Statistical significance was considered as $p < .05$.

Results

Tables 1-3 and Figure 5-10 provide a summary of the alteration of the shooting accuracy. The experimental group demonstrated a higher raw score in all the nine testing conditions as compared to the control group even when the baseline is

considered, and the post-test distributions demonstrate definite increases following eight weeks of training that is run with feedback. On the contrary, the control group was mostly stable in conditions.

Table 3 indicates that all experiments-condition comparisons were statistically significant with Wilcoxon p of .031 but not the comparisons between the control-group (p =.157). The between-group comparisons of change were also significant in all shooting conditions (Mann-Whitney p values range between.010 and.032). These gains were not restricted to the stationary state, but were also observed in the more challenging game-relevant conditions of shot-after-dribbling and shot-with-a-defender, which indicated that the intervention was associated with the improvement of the performance in the game-relevant complexity and not only the simplified exercises.

Table 1. ***Experimental-group shooting-accuracy scores across testing conditions.***

Player	L1-D1	L1-D2	L1-D3	L2-D1	L2-D2	L2-D3	L3-D1	L3-D2	L3-D3
E1	3	3	3	3	3	2	3	2	2
E2	3	2	2	2	2	2	2	2	1
E3	4	3	3	3	3	3	3	2	2
E4	4	4	4	4	4	3	4	3	3
E5	4	4	3	4	3	3	3	3	2

Note. E1-E5 = experimental-group players. L1 = stationary shot; L2 = shot after dribbling; L3 = shot with defender; D1-D3 = difficulty levels.

Figure 5. *Line plot of mean experimental-group shooting accuracy across the nine test conditions.*

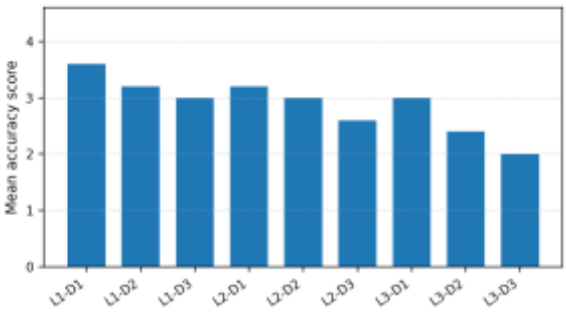

Figure 6. *Bar chart of mean experimental-group shooting accuracy across the nine test conditions.*

Table 2. ***Control-group shooting-accuracy scores across testing conditions.***

Player	L1-D1	L1-D2	L1-D3	L2-D1	L2-D2	L2-D3	L3-D1	L3-D2	L3-D3
C1	1	1	1	1	1	0	0	0	0
C2	0	0	0	0	0	0	0	0	0
C3	1	1	0	1	0	0	0	0	0
C4	1	0	0	0	0	0	1	0	0
C5	0	0	0	0	0	1	1	1	0

Note. C1-C5 = control-group players. L1 = stationary shot; L2 = shot after dribbling; L3 = shot with defender; D1-D3 = difficulty levels.

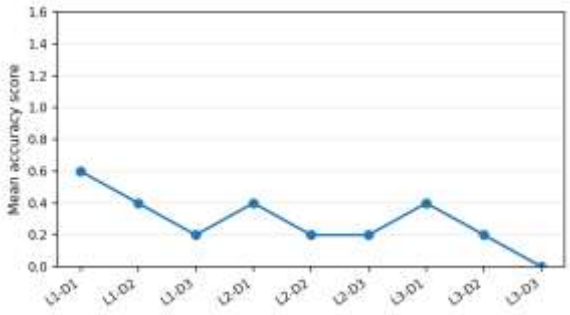

Figure 7. *Line plot of mean control-group shooting accuracy across the nine test conditions.*

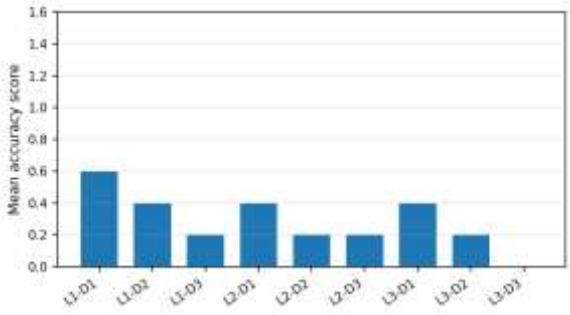

Figure 8. *Bar chart of mean control-group shooting accuracy across the nine test conditions.*

Table 3. ***Pre-test and post-test shooting accuracy by group (median [Q1-Q3]).***

Condition	Exp. pre	Exp. post	Wilcoxon p	Ctrl. pre	Ctrl. post	Wilcoxon p	Mann-Whitney p
L1-D1	5 (4–6)	8 (7–9)	0.031*	5 (4–6)	5 (5–6)	0.157	0.010*
L1-D2	4 (3–5)	7 (6–8)	0.031*	4 (3–5)	4 (4–5)	0.157	0.010*
L1-D3	3 (2–4)	6 (5–7)	0.031*	3 (2–4)	3 (3–4)	0.157	0.010*
L2-D1	4 (3–5)	7 (6–8)	0.031*	4 (3–5)	4 (4–5)	0.157	0.010*
L2-D2	3 (2–4)	6 (5–7)	0.031*	3 (2–4)	3 (3–4)	0.157	0.010*
L2-D3	2 (1–3)	5 (4–6)	0.031*	2 (1–3)	2 (2–3)	0.157	0.016*
L3-D1	3 (2–4)	6 (5–7)	0.031*	3 (2–4)	3 (3–4)	0.157	0.010*
L3-D2	2 (1–3)	4 (4–5)	0.031*	2 (1–3)	2 (2–3)	0.157	0.021*
L3-D3	1 (0–2)	3 (3–4)	0.031*	1 (0–2)	1 (1–2)	0.157	0.032*

Note. Data are reported as medians and interquartile ranges. Mann-Whitney tests were applied to change scores. * $p < .05$.

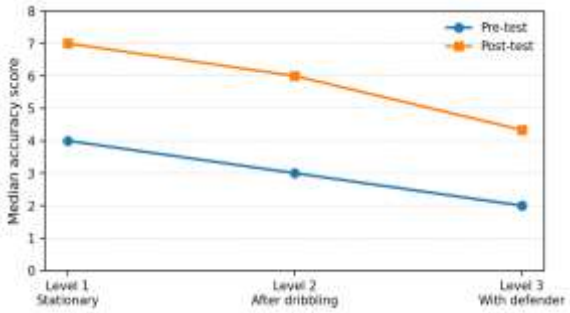

Figure 9. *Experimental-group median shooting accuracy across Levels 1-3 (pre-test vs. post-test).*

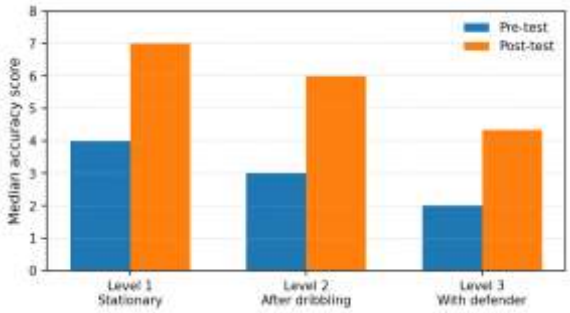

Figure 10. *Experimental-group comparison of median shooting accuracy across Levels 1-3 (pre-test vs. post-test).*

Tables 4 and 5 present the biomechanical changes and are visualized in Figures 11-13. The experimental group increased knee angle to 160, hips to 140, ankles to 124 and decreased trunk lean to 12 compared to 15. Foot speed topped 18.2 to 20.1 m/s, knee angular speed topped 980 to 1120 o/s, ball speed topped 23.5 to 26.8 m/s, ball/foot speed ratio topped 1.29 to 1.33 and impulse toppled 10.1 to 11.5 Ns. Only marginal changes were detected in the control group, and all comparison between-group differences were in favor of the experimental one.

Table 4. ***Individual changes (Δ) in biomechanical indicators.***

Player	Δ Knee	Δ Hip	Δ Ankle	Δ Trunk	Δ Foot speed	Δ Knee angular speed	Δ Ball speed	Δ Ratio	Δ Impulse
E1	+8	+7	+6	−3	+1.8	+150	+3.2	+0.03	+1.4
E2	+7	+6	+5	−2	+1.5	+120	+2.8	+0.03	+1.2
E3	+9	+8	+6	−3	+2.0	+180	+3.5	+0.04	+1.5
E4	+8	+7	+6	−3	+1.7	+160	+3.0	+0.03	+1.3
E5	+10	+9	+7	−4	+2.3	+190	+3.8	+0.04	+1.7
C1	+1	+1	+0	−1	+0.2	+10	+0.3	+0.00	+0.1
C2	+0	+1	+0	+0	+0.1	+8	+0.2	+0.00	+0.1
C3	+1	+0	+1	−1	+0.2	+12	+0.4	+0.01	+0.2
C4	+1	+1	+0	+0	+0.1	+9	+0.3	+0.00	+0.1
C5	+0	+0	+0	−1	+0.1	+5	+0.2	+0.00	+0.1

Note. Positive values indicate increases and negative values indicate decreases. Impulse was estimated from ball mass × ΔV, assuming a ball mass of 0.43 kg.

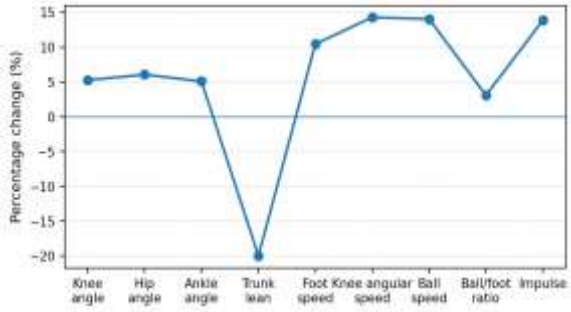

Figure 11. *Percentage change in experimental-group biomechanical indicators, derived from pre- and post-test medians to enable cross-variable comparison.*

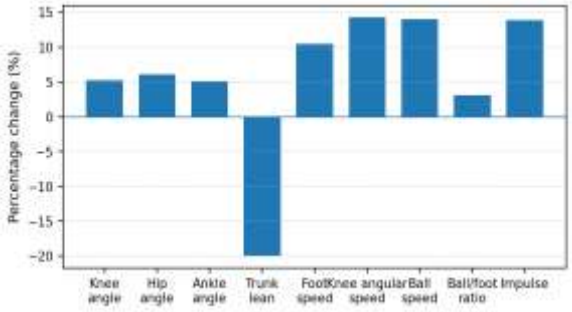

Figure 12. *Bar-chart version of the percentage change in experimental-group biomechanical indicators.*

Table 5. ***Biomechanical indicators before and after training in the experimental and control groups (median [Q1-Q3]).***

Indicator	Exp. pre	Exp. post	Wilcoxon p	Ctrl. pre	Ctrl. post	Wilcoxon p	Mann-Whitney p
Knee angle (°)	152 (148–156)	160 (156–164)	0.031*	153 (149–156)	154 (150–157)	0.317	0.010*
Hip angle (°)	132 (128–136)	140 (136–144)	0.031*	133 (129–136)	134 (130–137)	0.317	0.010*
Ankle angle (°)	118 (114–122)	124 (120–128)	0.031*	119 (115–122)	120 (116–123)	0.317	0.010*
Trunk lean (°)	15 (14–16)	12 (11–13)	0.031*	15 (14–16)	14 (13–15)	0.317	0.016*
Foot speed (m/s)	18.2 (17.6–18.9)	20.1 (19.4–20.8)	0.031*	18.2 (17.7–18.9)	18.4 (17.9–19.0)	0.317	0.010*

Indicator	Exp. pre	Exp. post	Wilcoxon p	Ctrl. pre	Ctrl. post	Wilcoxon p	Mann-Whitney p
Knee angular speed ω (°/s)	980 (930–1030)	1120 (1070–1170)	0.031*	980 (935–1030)	990 (945–1040)	0.317	0.010*
Ball speed (m/s)	23.5 (22.8–24.2)	26.8 (26.0–27.6)	0.031*	23.5 (22.9–24.1)	23.8 (23.1–24.4)	0.317	0.010*
Vball/Vfoot	1.29 (1.25–1.33)	1.33 (1.29–1.37)	0.031*	1.29 (1.25–1.33)	1.29 (1.25–1.33)	0.317	0.021*
Impulse (N·s)	10.1 (9.7–10.6)	11.5 (11.0–12.0)	0.031*	10.1 (9.7–10.6)	10.3 (9.9–10.7)	0.317	0.021*

Note. Data are reported as medians and interquartile ranges. Mann-Whitney tests were applied to change scores. * p < .05.

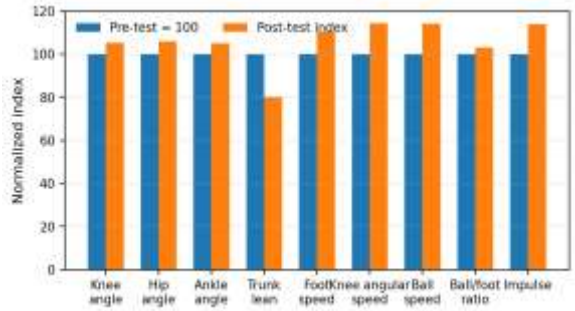

Figure 13. *Normalized experimental-group comparison of biomechanical indicators (pre-test = 100; post-test shown as an index relative to pre-test) to visualize variables with different units on a common scale.*

Table 6 and 7 show that the enhanced kinematic structure was coupled with a superior mechanical production. The mean force of the experimental group increased by 612 to 654 N, by 10.1 to 11.4 kg m/s, by 276 to 300 J, and 1418 to 1536 W. The interpretation of these values is that the intervention enhanced the effectiveness of energy transfer to the ball, as well as directional control.

Table 6. ***Individual changes (Δ) in kinetic variables.***

Player	Δ Average force (N)	Δ Momentum (kg·m/s)	Δ Kinetic energy (J)	Δ Mechanical power (W)
E1	+42	+1.38	+24	+118
E2	+37	+1.20	+21	+104
E3	+46	+1.51	+27	+126
E4	+41	+1.29	+23	+112
E5	+49	+1.63	+29	+131
C1	+6	+0.13	+3	+14
C2	+4	+0.09	+2	+11
C3	+7	+0.17	+4	+16
C4	+5	+0.13	+3	+12
C5	+6	+0.17	+4	+15

Note. E1-E5 = experimental-group players; C1-C5 = control-group players. Δ = post-test minus pre-test.

Table 7. ***Kinetic variables before and after training in the experimental and control groups (median [Q1-Q3]).***

Indicator	Exp. pre	Exp. post	Wilcoxon p	Ctrl. pre	Ctrl. post	Wilcoxon p	Mann-Whitney p
Average force (N)	612 (588-636)	654 (631-678)	0.031*	614 (590-637)	620 (596-643)	0.317	0.010*
Linear momentum (kg·m/s)	10.1 (9.7-10.6)	11.4 (11.0-11.9)	0.031*	10.2 (9.8-10.6)	10.3 (9.9-10.7)	0.317	0.010*
Kinetic energy (J)	276 (264-288)	300 (289-312)	0.031*	277 (265-289)	280 (268-291)	0.317	0.016*
Mechanical power (W)	1418 (1366-1470)	1536 (1482-1591)	0.031*	1422 (1370-1474)	1435 (1382-1487)	0.317	0.010*

Note. Data are reported as medians and interquartile ranges. Mann-Whitney tests were applied to change scores. * $p < .05$.

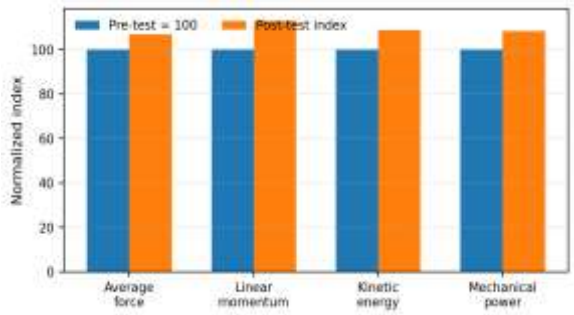

Figure 14. *Normalized experimental-group comparison of kinetic variables (pre-test = 100; post-test shown as an index relative to pre-test) to visualize variables with different units on a common scale.*

Discussion

The main conclusion of the research is that the accuracy of shooting was better when real-time biomechanical feedback was used in all the nine conditions of testing including the most challenging ones with dribbling and defender pressure. This effect implies that the practice was not just a polishing of a practiced standing shot, but an enhancement of how the players were able to maintain technical accuracy with greater perceptual and coordinating loads. Such a meaning is generally consistent with the recent youth data indicating that coordinated, feedback-based skills training may be more effective than more not-targeted designs in the context of kick accuracy as the primary performance measure (Carlsson et al., 2025).

The current findings also justify the feasibility of integrated monitoring in training in football. The experimental platform applied in this case entailed light targets, sound cues, high speed video, motion sensors and speed radars to provide instant correction. Ideally, such an arrangement is consistent with the current advances in soccer-specific diagnostic technology and with controlled evidence showing that real-time sensor-based monitoring can enhance football performance measures throughout an eight-week training period (Gascón et al., 2025; Liang et al., 2025). The present results

build on that line of reasoning by demonstrating that a combined system can be useful in particular with regard to the accuracy of long-range shooting in young players.

Biomechanically, the increases in joint angles, trunk position, segmental speed, and ball speed, indicate a smoother order of steps taken in kicking. The existing research on the topic of the developmental disparities in instep kicking has demonstrated that the rise in strength and neuromuscular organization within age is accompanied by an increase in angular velocities and consequent ball velocity (Cerrah et al., 2024). Additionally older studies have continued to associate the knee kinematics with kicking production (Xu et al., 2025) and have shown that the configuration of stance can significantly change the kicking mechanics in adolescence (Davis et al., 2025). The feedback system might have perpetrated this sort of technical organization faster in the current study because the errors were made visible and actionable.

The task design could also be the reason why the effects were generalised across the levels of difficulty. As the players were required to react to a light target under stationary, moving and defended conditions, the system necessitated perceptual processing, in addition to the execution of movements. This matters as the accuracy of soccer shooting is relative to the state of mind and attention. Recent results indicate that mental fatigue is capable of decreasing shooting-test scores (Liu et al., 2025), whereas structure-specific attentional focus and autonomy support can be used to enhance accuracy in penalty-kick (Niźnikowski et al., 2025). The light-signal paradigm applied in the present study might have thus promoted closer association between perception and action, and allowed the players maintain quality movement in more complicated situations.

It has a number of limitations. The sample was also small and was selected in one club and the intervention was only eight weeks and the original data was not provided with follow-up retention testing and effect-size estimates. Also, despite the apparent evidence of statistically significant change, future research in a larger sample size, various ages, and direct comparisons of the measurement system with criterion techniques would be desirable. Recent contributions on wearable and field-based kicking assessment also suggest such work as it is necessary to have a stronger evidence on validity and reliability in the applied training context (Vieira et al., 2024a, 2024b).

Conclusion

The eight-week training programme indicated that an on-field biomechanical feedback device could induce statistically significant changes in youth soccer shooting accuracy outside of the penalty area. The advantages were clear in all stationary, dribbling, and defender-pressure conditions, that is, the intervention was transferred to more demanding tasks.

The success of the technique has been found to be determined by the ability of the system to integrate high-speed image acquisition, real-time biomechanical information and real-time light-sound feedback within one training cycle. Practically, the system will assist the coach to overcome the tendency of giving delayed verbal correction by providing the players with objective information that is instantaneously connected to the performed movement.

The research thus justifies the incorporation of these systems in the training programs of the clubs and academies willing to enhance the sharpness, coordination, and uniformity in movements when the game has a set of realistic restrictions. It should be

noted that future research must recapitulate the method with bigger samples, longer interventions and more metrological verification of system operation under other operating conditions.

Recommendations

Youth soccer coaches have been recommended to consider the inclusion of real-time biomechanical feedback during shooting, due to the apparent speeding up of technical learning and the enhancement of accuracy in a series of increasingly challenging shooting exercises.

The training programs must encompass stationary shots, shots following the dribbling and shots when the defenders put pressure on the shooter so that training is done to create shooting accuracy under conditions that are more likely to simulate the demands of the match than by isolated training exercises.

Monitoring biomechanical indicators of knee and hip positioning, trunk position, speed of foot, speed of ball and impulse during the kicking act should be monitored by clubs and academies as these variables are convenient biomarkers of quality and force transfer of the movement.

The new system employed in the current study can be borrowed as an assistive coaching device particularly in the youth development environment to assist in the determination of individual technical mistakes that are hard to identify with the use of ordinary visual observation alone.

The long-lasting intervention and the bigger sample that represents the various age groups and levels of competition are to be incorporated in future applied programs so as to establish the long-term efficacies of real-time biomechanical feedback in the development of soccer shooting.

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