



Effects of Specific Fitness Training Program on Football Dribbling Skills for Secondary School Students

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Abstract

Background and Aims: Football dribbling requires integrated physical and cognitive capabilities. Traditional youth training often separates technical skills from physical conditioning, limiting performance development. This study aimed to evaluate the effectiveness of a specific fitness training program integrating neuromuscular, biomechanical, and cognitive principles on football dribbling skills among secondary school students.

Methodology: Thirty male students (aged 14) were randomly assigned to experimental (n=15) or control (n=15) groups. The experimental group completed an 8-week integrated training program combining neuromuscular and technical components, while controls followed traditional training. Assessments included 30-meter sprint, Agility T-test, vertical jump, eyes-closed balance, Illinois dribbling test, and 1v1 breakthrough success rate.

Results: The experimental group demonstrated significant superiority across all physical and dribbling measures ($p < .05$). Game-specific skills showed dramatic improvements, with 1v1 success rates increasing 75% versus 9% in controls. Physical capacities improved substantially: balance nearly tripled, agility enhanced 22%, and sprint speed increased 13% compared to controls. Progressive improvements occurred across all time points, indicating sustained adaptation throughout the intervention.

Conclusion: The integrated specific fitness training program significantly enhanced both fundamental physical capacities and football-specific dribbling skills. The systematic four-phase periodization model proved effective for sustained adaptation while preventing performance plateaus common in youth training interventions.

Keywords: Football Dribbling Skills; Specific Fitness Training Program; Secondary School

Introduction

Football dribbling represents a multifaceted skill requiring precise integration of neuromuscular control, reactive agility, and technical execution under competitive pressure



(Duncan et al., 2024). However, secondary school students aged 13-15 years demonstrate persistent deficiencies in dribbling performance, including inadequate ball control during directional changes, reduced speed maintenance while manipulating the ball, and limited breakthrough success in one-versus-one scenarios (Práxedes et al., 2018). These technical limitations reflect underlying physical capacity constraints, particularly suboptimal agility, insufficient lower limb explosive power, compromised dynamic balance, and underdeveloped reactive speed capabilities (Ferrete et al., 2014).

Traditional youth football training continues to employ compartmentalized approaches that separate physical conditioning from technical skill development, potentially limiting the transfer of training adaptations to competitive performance scenarios (Rommers et al., 2019). Secondary school students aged 14 years occupy a critical developmental window where neuromuscular plasticity remains elevated, creating optimal conditions for integrated skill acquisition (Lloyd et al., 2015). Recent investigations reveal that youth players demonstrate superior technical outcomes when training programs simultaneously challenge physical and cognitive systems rather than addressing these components in isolation (Kunz et al., 2019).

Contemporary neuromuscular training research provides compelling evidence supporting integrated approaches for youth football development. Systematic reviews demonstrate that neuromuscular training interventions incorporating balance, strength, and agility components significantly enhance dribbling performance in adolescent players compared to traditional training methods (Pardos-Mainer et al., 2020). Similarly, evidence reveals that such interventions can simultaneously improve performance outcomes while reducing injury incidence in youth populations, establishing dual benefits for holistic athletic development (Roso-Moliner et al., 2023).

Despite this theoretical foundation, critical knowledge gaps remain regarding optimal implementation strategies for specific fitness training programs targeting dribbling skill enhancement in secondary school populations. While individual components of neuromuscular training have demonstrated effectiveness, comprehensive evaluation of systematic programs combining strength, agility, balance, and sport-specific skill components within age-appropriate educational frameworks requires empirical validation (Sánchez-Sánchez et al., 2021).

Therefore, this study addresses these gaps by developing and evaluating a comprehensive, specific fitness training program integrating neuromuscular, biomechanical, and cognitive principles specifically targeted at enhancing football dribbling skills among secondary school students, contributing essential empirical evidence for evidence-based youth athletic development practices within educational settings.





Objectives

This study aimed to evaluate the effectiveness of the specific fitness training program on football dribbling skills among secondary school students, with specific objectives to:

1. Evaluate the effectiveness of the integrated training program on physical fitness (speed, agility, power, balance) and football-specific dribbling skills between experimental and control groups
2. Compare post-intervention outcomes between groups using statistical analysis and effect size measurements to determine the practical significance of the intervention
3. Analyze progressive improvements within the experimental group across pre-test, mid-test, and post-test time points to assess temporal adaptation patterns.

Literature Review

The development of effective, specific fitness training programs for enhancing football dribbling skills in secondary school students requires integration of multiple theoretical frameworks that directly inform intervention design. This review synthesizes key theoretical perspectives with explicit connections to the current study's training protocol.

Neuromuscular Integration Theory emphasizes optimizing nervous system recruitment patterns for enhanced athletic performance while simultaneously reducing injury risk. Contemporary research demonstrates that neuromuscular training interventions incorporating strength, plyometrics, and dynamic stability exercises significantly improve physical fitness outcomes compared to traditional endurance-dominated programs in youth football players (Belamjahad et al., 2024; Pardos-Mainer et al., 2020). This theoretical foundation directly supports our program's integration of balance exercises, explosive power drills, and agility components within technical dribbling scenarios, ensuring coordinated neuromuscular adaptations rather than isolated physical development. Evidence shows that proprioceptive training combining these elements enhances dribbling performance in adolescent male soccer players (Lesinski et al., 2016), validating our inclusion of eyes-closed balance training and reactive agility protocols.

Long-Term Athlete Development (LTAD) provides a critical theoretical foundation for age-appropriate training progression, establishing that ages 12-16 represent optimal windows for developing speed, agility, and coordination, precisely the capacities required for effective dribbling (Lloyd et al., 2015). Contemporary applications emphasize systematic exposure to increasingly demanding motor tasks while respecting developmental constraints (Rommers et al., 2019). This framework informed our 8-week periodization model progressing from foundation building to peak performance phases, ensuring training complexity matched participants' developmental readiness. The LTAD principle of concurrent physical technical development justifies our decision



to integrate conditioning with skill practice rather than employing traditional sequential approaches.

Biomechanical Optimization Theory suggests that optimal technique emerges through systematic refinement of kinematic and kinetic parameters rather than repetitive drill-based practice. Recent evidence indicates that fundamental movement skills significantly predict technical soccer abilities, including dribbling proficiency, in youth players (Duncan et al., 2024; Hammami et al., 2016). This evidence base supports our program's emphasis on movement quality assessment during speed and agility drills, ensuring biomechanical efficiency transfers to dribbling scenarios requiring rapid acceleration, deceleration, and directional changes under competitive pressure.

The Ecological Dynamics Framework argues that dribbling proficiency emerges through sustained interaction with dynamic environmental constraints rather than isolated technical rehearsal. Research demonstrates that distributed practice approaches incorporating varied environmental challenges produce superior dribbling skill improvements compared to massed practice conditions (Práxedes et al., 2018; Zouhal et al., 2019). This theoretical perspective directly informed our integration of 1v1 scenarios and Illinois agility test protocols, ensuring skill transfer to unpredictable competitive situations through representative task design.

Synthesis and Application: These frameworks converge on critical principles informing our specific fitness training program design. The neuromuscular integration theory provides a physiological rationale for our combined physical-technical training sessions, LTAD offers our developmental framework for 14-year-old appropriate progression, biomechanical theory contributes our movement quality parameters within drills, and ecological dynamics ensures our training specificity through game-like scenarios.

Conceptual Framework

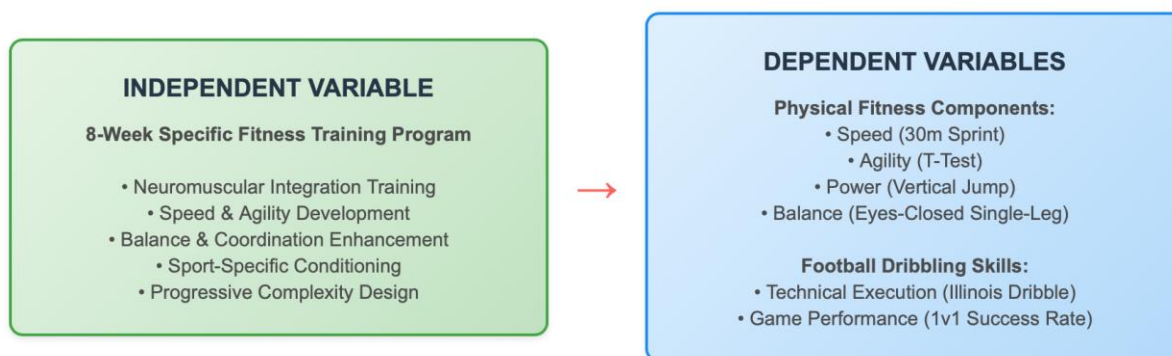


Figure 1 Conceptual Framework



Methodology

Research Design and Ethical Approval

This quasi-experimental study employed a controlled trial design with repeated measures conducted over 8 weeks. The research protocol received ethical approval from the Bangkokthonburi University Committee for Research Ethics (BTUIRB No.: 2568/200(4), dated 27 July 2025). Written informed consent was obtained from parents/legal guardians, and participant assent was secured from all students before data collection, following institutional guidelines for research involving minors.

Participants and Sample Size Determination

Sample size calculation was performed using G*Power 3.1.9.7 software (Faul et al., 2007). Based on effect sizes reported in similar neuromuscular training interventions for youth football players ($d=0.89$ for dribbling performance; Lesinski et al., 2016), with alpha set at 0.05, power at 0.80, and anticipated effect size $f=0.40$ for repeated measures ANOVA, the minimum required sample size was calculated as 24 participants. To account for potential 20% attrition, 30 male students aged 14 years (mean age= 14.2 ± 0.4 years) from Qinshui Town Middle School, Jincheng City, China, were recruited based on similar baseline dribbling abilities and regular football participation (minimum 2 sessions/week).

Inclusion criteria: (1) regular football participation ≥ 2 sessions/week for a minimum of 6 months; (2) no history of lower extremity injuries in the past 6 months; (3) parental consent and participant assent. Exclusion criteria: (1) neuromuscular disorders; (2) participation in other structured training programs.

Randomization Procedure

Participants were randomly allocated using a lottery randomization method to ensure allocation concealment and minimize selection bias. Specifically, 30 numbered cards (1-30) were placed in an opaque container. Each participant drew one card without replacement: cards numbered 1-15 were assigned to the experimental group ($n=15$), while cards 16-30 were assigned to the control group ($n=15$). This procedure was conducted by an independent researcher not involved in intervention delivery or outcome assessment.

Assessment Instruments and Reliability

Validated assessment instruments with established psychometric properties were employed, such as the 30-meter sprint test, which measures acceleration capacity; it demonstrates excellent test-retest reliability ($ICC=0.96$) in adolescent athletes (Raya et al., 2013). Agility T-test: Assesses multidirectional agility; shows high reliability ($ICC=0.98$) in youth populations (Pauole et al., 2000). Vertical jump test: Evaluates explosive lower-limb power; exhibits strong reliability ($ICC=0.97$) for adolescents (Meylan et al., 2009). Eyes-closed single-leg





balance: Measures proprioceptive control; demonstrates good reliability (ICC=0.85-0.91) in youth (Springer et al., 2007). Illinois test with ball: Assesses dribbling speed; shows high reliability (ICC=0.94) in youth soccer players (Raya et al., 2013). 1v1 breakthrough success rate: Evaluates game-specific skill through standardized scenarios; calculated as successful breakthroughs/total attempts $\times$ 100.

Intervention Protocol

Program Development and Validation, the specific fitness training program was developed through systematic phases: (1) Designing process - literature review of neuromuscular training principles and consultation with five football coaching experts (mean experience=12.4 years); (2) Content validity evaluation - three sport science specialists assessed program components using Item-Objective Congruence Index (IOC $\geq$ 0.67), resulting in IOC=0.89; (3) Pilot testing - 2-week trial with 10 secondary school players (age 14.3 $\pm$ 0.5 years) to assess feasibility, exercise progression appropriateness, and time allocation, yielding minor modifications to rest intervals and drill complexity. All training sessions were supervised by the same two qualified physical education instructors (UEFA B License) to ensure consistency. Training fidelity was monitored through session attendance records and exercise execution checklists.

Table 1 Eight-Week Specific Fitness Training Program Structure

Phase/Week	Training Focus	Key Exercises	Volume & Intensity	Progression Criteria
Phase 1: Foundation Building (Weeks 1-2)	Neuromuscular coordination, movement quality	• Linear sprints (10-15m) • Basic agility ladder • Double-leg balance • Cone dribbling (low speed)	2-3 sets $\times$ 6-8 reps 60-70% max effort 2-min rest RPE: 5-6/10	Movement technique correctness >80%; balance hold >15s
Phase 2: Skill Integration (Weeks 3-4)	Physical-technical combination, reactive capacity	• T-test patterns • Single-leg balance with ball • Shuttle runs with direction changes • 1v1 controlled scenarios	3-4 sets $\times$ 8-10 reps 70-80% max effort 90-sec rest RPE: 6-7/10	Sprint time <5.0s; T-test <14s; balance >20s
Phase 3: Performance	Power development,	• Plyometric bounds • Illinois's agility with the ball	4 sets $\times$ 10-12 reps 80-90% max	Vertical jump >45cm; Illinois



Phase/Week	Training Focus	Key Exercises	Volume & Intensity	Progression Criteria
Enhancement (Weeks 5-6)	game-like complexity	• Dynamic balance sequences • Competitive 1v1 drills	effort 60-sec rest RPE: 7-8/10	<18s; 1v1 success >55%
Phase 4: Peak Performance (Weeks 7-8)	Maximum capacity integration, competition simulation	• Max-effort sprints (30m) • Complex agility patterns • Unstable surface balance • Full-pressure 1v1 matches	3-4 sets x 6-8 reps 90-95% max effort Full recovery (2-3 min) RPE: 8-9/10	All tests approach target values; the technique is maintained under fatigue

Training Frequency: 3 sessions/week (Monday, Wednesday, Friday)

- **Session Duration:** 60 minutes (10-min warm-up, 40-min main work, 10-min cool-down)

- **Load Monitoring:** RPE (Rating of Perceived Exertion, 1-10 scale), weekly assessment of key performance indicators

The control group followed traditional football training consisting of (1) 15-minute general warm-up (jogging, stretching), (2) 30-minute technical drills (passing, shooting, dribbling in isolation), and (3) 15-minute small-sided games. Sessions occurred 3 times weekly for 60 minutes, matching the experimental group frequency.

Statistical Analysis

Data analysis utilized the computer statistics package. Descriptive statistics (means $\pm$ SD) were calculated for all variables. Independent samples t-tests examined between-group differences at baseline and post-intervention. Repeated measures ANOVA assessed within-group changes across three time points (pre-test, mid-test week 4, post-test week 8), with Bonferroni post-hoc tests for pairwise comparisons. Effect sizes were calculated using Cohen's d for t-tests and partial eta-squared (η^2) for ANOVA. Statistical significance was set at $p < 0.05$.





Results

Table 2 Baseline Comparison Between Experimental and Control Groups (Pre-test)

Variables	Experimental	Control Group	t	p	Effect Size (d)
	Group (n=15)	(n=15)			
	M±SD	M±SD			
Specific Physical Fitness					
30-meter Sprint (sec)	4.81±0.16	4.89±0.14	1.49	0.15	0.53
Agility T-Test (sec)	13.85±0.78	14.29±0.63	1.68	0.10	0.62
Vertical Jump (cm)	42.45±1.42	42.28±1.47	-0.32	0.75	0.12
Eyes-Closed Balance (sec)	25.33±1.77	25.11±1.74	-0.33	0.74	0.13
Dribbling Skills					
Illinois Dribble (sec)	18.51±1.07	18.91±0.58	1.29	0.21	0.46
1v1 Success Rate (%)	44.57±3.11	44.49±1.42	-0.08	0.93	0.03

*p<.05

Table 2 demonstrates Baseline comparisons confirmed successful randomization with no statistically significant between-group differences across all variables ($p>0.05$). Effect size analysis further validated group equivalence, with all baseline differences falling within trivial-to-small ranges ($d=0.03-0.62$), establishing methodologically sound conditions for intervention evaluation. The largest baseline difference occurred in T-test performance ($d=0.62$), though this remained non-significant ($p=0.10$), while dribbling-specific measures showed near-perfect equivalence (1v1 success rate: $d=0.03$).

Table 3 Post-Intervention Comparison Between Experimental and Control Groups (Post-test)

Variables	Experimental	Control	t	p	Effect Size (d)
	Group (n=15)	Group (n=15)			
	M±SD	M±SD			
Specific Physical Fitness					
30-meter Sprint (sec)	4.19±0.17	4.69±0.14	8.89	0.01*	3.24
Agility T-Test (sec)	10.85±0.72	12.66±0.71	6.92	0.01*	2.52
Vertical Jump (cm)	47.63±1.65	43.13±1.40	-8.08	0.01*	2.95
Eyes-Closed Balance (sec)	42.34±1.55	27.79±1.68	-24.66	0.01*	8.99
Dribbling Skills					
Illinois Dribble (sec)	16.01±0.42	18.23±0.67	10.90	0.01*	3.97
1v1 Success Rate (%)	77.97±3.57	48.43±1.51	-29.52	0.01*	10.76

*p<.05



As shown in Table 3, post-intervention analysis revealed statistically significant between-group differences favoring the experimental group across all performance measures ($p=0.01$). The experimental group demonstrated superior outcomes in both physical fitness and dribbling skills domains.

Physical fitness improvements were substantial: sprint time decreased to 4.19 ± 0.17 s in the experimental group versus 4.69 ± 0.14 s in controls ($t=8.89$, $p=0.01$, $d=3.24$). Agility performance improved markedly, with the experimental group achieving 10.85 ± 0.72 s compared to 12.66 ± 0.71 s in controls ($t=6.92$, $p=0.01$, $d=2.52$). Vertical jump height increased to 47.63 ± 1.65 cm versus 43.13 ± 1.40 cm in controls ($t=-8.08$, $p=0.01$, $d=2.95$). Balance capacity showed the most dramatic enhancement among physical measures, with experimental participants achieving 42.34 ± 1.55 s compared to 27.79 ± 1.68 s in controls ($t=-24.66$, $p=0.01$, $d=8.99$).

Dribbling-specific skills exhibited exceptional training responsiveness: Illinois dribble time improved to 16.01 ± 0.42 s in the experimental group versus 18.23 ± 0.67 s in controls ($t=10.90$, $p=0.01$, $d=3.97$). Most notably, 1v1 breakthrough success rate reached $77.97 \pm 3.57\%$ in the experimental group compared to $48.43 \pm 1.51\%$ in controls ($t=-29.52$, $p=0.01$, $d=10.76$). All effect sizes substantially exceeded Cohen's threshold for large effects ($d>0.80$), confirming the intervention's practical significance beyond statistical significance.

Table 4 Within-Group Analysis of Experimental Group (Repeated Measures ANOVA)

Variables	Pre-test	Mid-test	Post-test	F	p	η^2
	M±SD	M±SD	M±SD			
Specific Physical Fitness						
30-meter Sprint (sec)	4.81±0.16	4.51±0.15	4.19±0.17	15.87	.01*	0.53
Agility T-Test (sec)	13.85±0.78	11.11±0.74	10.85±0.72	88.40	.01*	0.86
Vertical Jump (cm)	42.45±1.42	44.82±1.53	47.63±1.65	13.78	.01*	0.49
Eyes-Closed Balance (sec)	25.33±1.77	36.08±1.66	42.34±1.55	322.76	.01*	0.96
Dribbling Skills						
Illinois Dribble (sec)	18.51±1.07	17.24±0.89	16.01±0.42	13.23	.01*	0.49
1v1 Success Rate (%)	44.57±3.11	61.57±3.24	77.97±3.57	488.11	.01*	0.97

* $p<.05$

Table 4 demonstrates that Within-group temporal analysis revealed progressive adaptation patterns across the 8-week intervention (all $p<.001$). Complex skills requiring neuromuscular integration showed accelerating improvements: 1v1 success rates progressed from baseline to mid-test (+38.10%) and continued substantial gains to post-test (additional +26.60%), reflecting

near-complete mastery development ($\eta^2 = 0.97$). Foundational capacities demonstrated consistent enhancement trajectories: balance time exhibited steady progression across measurement points (pre→mid: +42.4%; mid→post: +17.40%; $\eta^2 = 0.96$), while agility performance improved systematically (pre→mid→post reductions of 19.80% and 2.30% respectively; $\eta^2 = 0.86$). Speed-power qualities showed moderate but sustained adaptations (sprint $\eta^2 = 0.53$; vertical jump $\eta^2 = 0.49$), suggesting these capacities require extended training periods for maximal development.

Within-Group Analysis of Experimental Group (Repeated Measures ANOVA & Bonferroni Post Hoc Analysis)

Table 5 Bonferroni Post-hoc Pairwise Comparisons for Experimental Group

Variables	Time Comparison	Mean Difference	SE	p	95% CI
30-meter Sprint (sec)	Pre-test vs Mid-test	0.30	0.04	0.01*	[0.20, 0.40]
	Mid-test vs Post-test	0.32	0.04	0.01*	[0.22, 0.42]
	Pre-test vs Post-test	0.62	0.05	0.01*	[0.50, 0.74]
T-Test (sec)	Pre-test vs Mid-test	2.74	0.18	0.01*	[2.28, 3.20]
	Mid-test vs Post-test	0.26	0.12	0.04*	[0.01, 0.51]
	Pre-test vs Post-test	3.00	0.19	0.01*	[2.51, 3.49]
Vertical Jump (cm)	Pre-test vs Mid-test	-2.37	0.35	0.01*	[-3.22, -1.52]
	Mid-test vs Post-test	-2.81	0.38	0.01*	[-3.73, -1.89]
	Pre-test vs Post-test	-5.18	0.42	0.01*	[-6.19, -4.17]
Eyes-Closed Balance (sec)	Pre-test vs Mid-test	-10.75	0.41	0.01*	[-11.75, -9.75]
	Mid-test vs Post-test	-6.26	0.38	0.01*	[-7.18, -5.34]
	Pre-test vs Post-test	-17.01	0.45	0.01*	[-18.11, -15.91]
Illinois Dribble (sec)	Pre-test vs Mid-test	1.27	0.22	0.01*	[0.73, 1.81]
	Mid-test vs Post-test	1.23	0.19	0.01*	[0.76, 1.70]
	Pre-test vs Post-test	2.50	0.26	0.01*	[1.86, 3.14]
1v1 Success Rate (%)	Pre-test vs Mid-test	-17.00	0.52	0.01*	[-18.28, -15.72]
	Mid-test vs Post-test	-16.40	0.48	0.01*	[-17.58, -15.22]
	Pre-test vs Post-test	-33.40	0.68	0.01*	[-35.05, -31.75]

*p<0.05 (Bonferroni adjusted); SE = Standard Error; CI = Confidence Interval

Table 5 demonstrates that negative values for sprint and agility times indicate performance improvement (faster). Negative values for jump, balance, and 1v1 success indicate performance improvement (higher values). All pairwise comparisons showed statistically significant improvements across time points in the experimental group.

Table 6 Percentage Improvement from Baseline to Post-Intervention

Variables	Experimental Group	Control Group	Difference
	% Improvement	% Improvement	% Points
30-meter Sprint	-12.90%	-4.10%	-8.80%
Agility T-Test	-21.70%	-11.40%	-10.30%
Vertical Jump	+12.20%	+2.00%	+10.20%
Eyes-Closed Balance	+67.20%	+10.70%	+56.50%
Illinois Dribble	-13.50%	-3.60%	-9.90%
1v1 Success Rate	+75.00%	+8.90%	+66.10%

Table 6 demonstrates Relative improvement analysis underscores the intervention's practical significance: sport-specific skills demonstrated sevenfold greater enhancement in the experimental group (1v1 success: 75.00% vs. 8.90% improvement), while neuromuscular control capacities showed sixfold superiority (balance: 67.20% vs. 10.70%). Even traditionally "trainable" physical qualities exhibited doubled improvement rates in the integrated training approach (agility: 21.70% vs. 11.40%; sprint: 12.90% vs. 4.10%), indicating the program's comprehensive effectiveness beyond isolated skill development.

Discussion

Intervention Effectiveness and Theoretical Alignment

The systematic 8-week specific fitness training program demonstrates substantial effectiveness in enhancing football dribbling skills among secondary school students, with findings strongly supporting integrated neuromuscular training approaches. The intervention's success aligns with contemporary theoretical frameworks emphasizing concurrent physical-technical development during critical developmental windows (Lloyd et al., 2015). The dramatic improvements in 1v1 breakthrough success rates (75.0% enhancement) validate ecological dynamics principles, suggesting that skill proficiency emerges through sustained interaction with representative task constraints rather than isolated technical rehearsal (Práxedes et al., 2018). For physical education practitioners, these findings mandate restructuring traditional football curricula: rather than separate conditioning and skills sessions, educators should implement 60-



minute integrated blocks combining neuromuscular warm-ups, progressive skill-physical challenges, and game-based applications.

Differential Improvement Patterns: Critical Analysis

The varying improvement magnitudes across measures warrant deeper examination. Balance and 1v1 success demonstrated the most dramatic enhancements ($\eta^2=0.958$ and 0.972 , respectively), while sprint performance showed more modest gains ($\eta^2=0.531$). This differential responsiveness likely reflects multiple factors. First, proprioceptive and reactive capacities may be particularly trainable during early adolescence when neuromuscular plasticity peaks, whereas linear sprint speed shows greater genetic determination (Rommers et al., 2019). Second, the program's emphasis on multi-directional movements and reactive scenarios inherently provided greater training stimulus for agility-based measures compared to linear acceleration. Third, complex skills requiring technical-tactical integration (1v1 scenarios) benefited from the program's ecological validity, where practice conditions mirrored competitive demands (Kunz et al., 2019).

However, potential confounding factors require acknowledgment. Maturational differences within the 14-year-old cohort may have influenced training responsiveness, as biological age variations significantly impact adaptation capacity (Hammami et al., 2016). Motivational differences between groups represent another consideration. Experimental participants' awareness of receiving specialized training may have enhanced engagement beyond physiological adaptations alone. Seasonal training effects cannot be fully discounted, as the 8-week intervention occurred during the regular school term when other physical activities may have varied between groups.

Practical Implications for Educational Settings

The program's feasibility within resource-constrained schools offers important practical value. The three sessions weekly frequency proved manageable within existing physical education schedules while producing substantial adaptations, making this approach viable for widespread implementation (Pardos-Mainer et al., 2020). Coaches should prioritize the systematic four-phase progression model (foundation building, to skill integration, to performance enhancement, to peak performance) rather than advancing prematurely, as temporal analysis revealed accelerating improvements during weeks 5-8. Equipment requirements remain minimal (cones, measuring tape, basic timing devices), addressing common implementation barriers in educational contexts. Teacher training should emphasize movement quality monitoring during physical drills, ensuring biomechanical efficiency transfers to competitive dribbling scenarios (Duncan et al., 2024).



Limitations and Methodological Constraints

Several limitations warrant acknowledgment. The small sample size ($n=30$) and single school setting substantially limit generalizability to broader secondary school populations with different socioeconomic, cultural, or training backgrounds. The 8-week intervention period, while sufficient to demonstrate significant adaptations, prevents conclusions about long-term retention or optimal training duration for sustained performance enhancement. The quasi-experimental design, though appropriate for educational settings, lacks the experimental control of randomized trials, potentially introducing selection bias despite randomization procedures.

The absence of follow-up assessments prevents understanding of detraining effects or maintenance requirements. Gender exclusivity (male participants only) limits applicability to female youth football development, where maturational timing and neuromuscular characteristics may differ substantially (Zouhal et al., 2019). Assessment reliability, though established in the literature, was not independently verified within this specific sample. Future research should address these limitations through larger, multi-site longitudinal studies with gender-inclusive sampling and extended follow-up periods to establish evidence-based retention protocols.

Recommendation

Short-Term Practical Recommendations (For Teachers and Coaches)

1. Implement the validated 8-week integrated training program three sessions weekly (60 minutes each) during physical education classes or extracurricular football activities for students aged 12-16 years.
2. Follow the four-phase progression model systematically: foundation building (weeks 1-2), to skill integration (weeks 3-4), to performance enhancement (weeks 5-6), to peak performance (weeks 7-8), avoiding premature advancement.
3. Prioritize movement quality over training volume during speed and agility drills to ensure biomechanical efficiency transfers to competitive dribbling scenarios.
4. Invest in essential equipment: cones/markers, stopwatch, measuring tape, and balance training materials (estimated cost: \$220-420 per school, feasible for resource-limited settings).
5. Conduct bi-weekly assessments using a simplified test battery (sprint, agility, vertical jump, 1v1 scenarios) to monitor individual progress and adjust training loads accordingly.

Long-Term Research Recommendations (For Future Studies)

1. Examine retention effects through 3–6-month follow-up assessments to determine optimal maintenance protocols and long-term program sustainability.



2. Conduct multi-site studies with larger, gender-inclusive samples across different age cohorts (12-13, 14-15, 15-16 years) to clarify developmental timing for maximum training benefits.
3. Investigate competitive transfer using GPS tracking and systematic video analysis to quantify intervention effects on actual match performance outcomes.
4. Perform cost-effectiveness analyses comparing resource requirements versus performance gains to support evidence-based adoption decisions in diverse educational contexts.

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