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Effect of Speed, Strength, Balance and Precision Training on the Overall Performance of Adolescent Amateur Football Players

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ABSTRACT

Background: *Speed, strength and balance are the basic attributes for peak performance in Football. However, there is scarcity of research regarding the combined effect of these attributes with the technical precision in amateur adolescents. Effect of 8-week structured training was investigated focusing on speed, strength, balance and precision, evaluating their effect on overall performance of adolescent Football players in comparison to the conventional training method.* ***Materials and Methods:*** *A sample of 38 male adolescent Football players aged 17-20 years from Young Football Club, Lahore was recruited for this study. Participants were divided into experimental group (n=19) that received integrated training; 3 sessions/week. Whereas, participants of the control group (n=19) followed their previous routine of training. Assessments included physical tests (10m/30m sprints, countermovement jump, Y-Balance Test) and technical evaluations (dribbling time, shooting accuracy, passing precision). Statistical analysis used paired and independent t-tests ($p<0.05$).* ***Results:*** *Findings of the study confirmed that experimental group has shown significant improvement in all the physical attributes as well as overall performance in Football. Improvement recorded in Physical Attributes: 10m sprint (-0.18s, $p<0.001$), vertical jump (+4.5cm, $p<0.001$), Y-Balance (+8.2cm, $p<0.001$) Technical Precision: Shooting accuracy (+22.3%,*

p<0.001), passing success rate (+19.1%, p<0.001), Composite Performance: 31.6% improvement vs 5.2% in Controls (p<0.001).
Conclusions: *The study has concluded that besides speed, strength, and balance; inclusion of the precision training has produced significant performance gains compared to the conventional methods. These results reflect that a well-structured training program has the potential for the development of both physical as well as technical aspect required for the improvement of the overall performance. A well-organized training program, incorporating the precision drill with conventional training regimen can produce significant improvement in overall performance in Football.*

Key Words: *Amateur, Attribute, Skill, Game, Physical, Improvement*

INTRODUCTION

Football is the game fuller exertion that requires complete physical fitness. In addition to proficiency in skills of the game, optimal performance is mostly subject to quality of different types of physical attributes including speed, strength, flexibility, balance, accuracy, precision, endurance and agility. Execution of the sudden sprints, forcefully charging the opponent, accuracy and stability during tackling, and to execute precise movements during high-intensity gameplay, dribbling and rolling require improved state of speed, strength and balance (Cao et al., 2024) In addition to competency in skills and tactical aspects of the game, expert focus on the physical attributes of the players including speed, strength and endurance (Köse & Atlı, 2020). Improvement of various technical skills of Football such as dribbling, sprinting, passing, tackling and shooting provides significant advantages to the players as well as teams (Tatlıcı et al., 2018).

Normally, professional and elite players manage their way to have access to the properly tailored and structured training program however, amateur adolescent players, particularly from the low-income and under- resourced regions, lack access to any properly arranged scientifically designed conditioning programs which focus on the improvement of the basic physical attributes. The present experimental study employed 8-week long integrated training programe to examine the effect of speed, strength, balance and precision training on the improvement of the overall performance of the players from a private Young Football Club in Lahore.
Previous research has established the importance of physical attributes; however, the combined effect of speed, strength, balance and precision training remains understudied particularly in the amateur adolescent populations. Purpose of the present study was to compare the effects of 8-week integrated training program targeting effects of speed, strength, balance, and precision training on the overall performance of adolescent Football players with the effects of conventional training program. Based on their well-documented individual significant role of the speed, strength, balance and precision training they were selected for the study with the understanding to examine the composite and integrated effects of all these independent variables on the performance of the participants.

Speed is one of the basic physical attributes having vital role in Football enabling the player to effectively perform the key actions of the play. Right from the start till end of the game, players remain vigilant and active for any type of sudden movement that suits the situation. Caldbeck (2020) has concluded that during a Football game, there come around 10-20 instances for speed sprints of ≥25 km/h, which have vital role in scoring and defensive moves. Highlighting significance of speed in Football, Haugen et al. (2020) have documented that player with superior sprinting speed have 58% more chances of winning the match. Participants of this study comprised of the adolescents and the natural neuromuscular plasticity during adolescence facilitates the improvement of speed, strength, balance and precision (Wang et al., 2022). Physiologically speaking, speed is the innate requirement of all types of explosive movements including sprinting, jumping, dribbling and tackling in Football (Faude et al., 2012).

Strength is one of the basic attributes required in almost all the main contact sports. Strength plays crucial role in Football; it enhances explosive power, improves tackling, jumping and shooting (Suchomel et al., 2021). Jaimes et al. (2022) have concluded that strength training contributed to 4.7% improvement in the 20-meter sprint in the adolescent Football players. Research has confirmed that combination of strength and plyometric training enhanced agility in terms of the speed of the change of direction (COD) by 9.2% and vertical jump height by 6.2cm in the adolescent Football players which is very vital in successful heading and goalkeeping performance (Alcaraz et al., 2022). In addition to that strength renders the player comparatively safe by reducing the risk of different types of injuries including the sprain, strain and anterior cruciate ligament (ACL). The role of ACL is stabilization of the knee joint which plays significant role in the sports life of a player. Research has confirmed that strength reduces 52% of the ACL injuries and promotes superior neural adaptations among the adolescents as compared to the adults (Diekfuss et al., 2021; Webster et al., 2018). The role of strength is twofold; it enhances performance and while moderating injury risk particularly during the crucial growth period of adolescence.

In view of its significance in the overall stability and perfection in the movements, balance training was included in this study as another independent variable. It improves neuro-muscular coordination, accuracy and correctness in execution of the main body functions. Nunes et al. (2021) have documented that on account of improved state of balance of the body, player is able to perform high intensity movements with perfect control and perfectionism. Incorporation of the balance factor in a planned training program was believed to have positive improvement in the overall performance of the adolescents Football players. It has also been one of the main advantages of the balance training that it significantly reduces the risk of non-contact injuries like ankle sprain, muscular strain and ACL issues. Bathe et al. (2023) have concluded that balance training reduced ankle injuries by 40% and improved the landing mechanism minimizing the risk of AL injury. In addition to that, a 8-week balance training program developed the dribbling speed by 15% and shooting accuracy by 11% (Cao et al., 2024). Similarly, balance training enhanced the change-of-direction speed by 9% and reactive agility enabling the player to timely respond to the external stimulus (Hassan et al., 2022; Wang et al., 2022).

Focusing on improving the accuracy, skills perfection and appropriateness of timing of execution of any action during the play has been the sole objective of precision training regime which plays a crucial role in developing overall performance of the adolescent Football players. With reference to skill related performance in Football, Zacharakis et al. (2020) have documented that precision training improves the passing accuracy by 12% and shooting accuracy by 15% in the adolescent players. Precision training also has the potential of improving the decision-making quality of the players. Romeas et al. (2016) have found that precision training improves the decision-making speed of the players by 20%. Similarly, precision training also focuses on the game related position-specific practice which improves the interception ability by 25%; goal conversion rates by 14% and penalty shootout performance by 30% (Deuker et al., 2023).

Research Aim

The present research was aimed to assess the effect of speed, strength, balance and precision training on the overall performance of adolescent Football players.

Methods and Materials

Participants

Participants of the study were 38 male adolescent Football players from the Young Football Club, Lahore with age limit between 17–20 years and playing experience of 2–4 years. Equal number of the participants was randomly assigned to the Experimental Group (EG, n=19) and Control Group (CG, n=19). Having any medical condition, drug using history, beyond the prescribed age limit or being engaged in any other structured training program were the main features of the exclusion criteria. Participants were briefed regarding the different aspects of the study including the frequency and intensity of the training activities, duration and timings of the eight-week long schedule, benefits and advantages for the players and coaches. Signed consent form in respect of all the respondents were obtained in advance, however, they were informed that they may quit the proceedings of the study at any stage.

Procedure

Experimental research design following precision and post-test assessment method was used in this study. In addition to the regular Football practice, participants of the EG underwent eight-week long structured speed, strength, balance and precision training program while the CG continued with their regular Football training without any type of additional conditioning. The Integrated Training Program for the Experimental Group was followed at the frequency of 3 sessions a week; 75-85 minutes per session.

Test protocols

Detail of the tests and activities of tests used for the assessment of different variables:

Speed Training; Time allocated 20 minutes:
Test: Linear sprints (10m, 20m, 30m) Agility drills (T-test, zig-zag runs) Plyometric Test: (box jumps, hurdle hops) **Strength Training;** Time allocated 25 minutes: Bodyweight exercises (push-ups, squats, lunges) Resistance band workouts (hip abductions, lateral walks)
Balance Training; Time allocated 15 minutes:
Single-leg stance (eyes open/closed)
Dynamic stability exercises (Y-balance test variations)
Precision Training; Time allocated 20 minutes:

Passing Accuracy
Test: 10m/20m weighted pass to target zones (measured by hit/miss ratio) Metrics: Success rate (%), consistency (SD of distance from target) Shooting Accuracy
Test: Finishing to designated corners (5 attempts per side) Metrics: Zone-specific conversion rate On the other hand, control group followed their regular routine of training activities at the earlier frequency and intensity. Participants of the control group also followed the routine of 3 sessions per week; 75-85 minutes per session. Running, passing, dribbling, tackling and other common activities of the game were normally performed by the participants of the control group.

Data collection
Performance of the participants was evaluated before and after 8-week intervention and proceedings were recorded for analyses. The following tests were used for the evaluation of their effects on the overall performance of the participants:

Speed & Agility
10m, 20m, and 30m Sprint Test (timed with Brower Timing Gates; Illinois Agility Test

Strength & Power Countermovement Jump (CMJ) (measured via MyJump2 app; and Handgrip Strength (using Takei Digital Dynamometer

Balance & Stability

Y-Balance Test (YBT); and Single-Leg Stance Test (timed, eyes open)

Football-Specific Skills
Dribbling Test (Slalom Cone Drill); and Shooting Accuracy Test (target-based scoring)

Statistical Analysis
For the collection of the pre and post-test data, all out efforts were made to provide same type of environment, temperature, testing space and facilities. Analyses operations were performed by using the Statistical Package for Social Sciences (SPSS) version 26. The following statistical tests were used for the analyses of data:

Normality Check: Shapiro-Wilk test ($p > 0.05$ for parametric tests).
Within-Group Comparisons: Paired t-tests (parametric) / Wilcoxon signed-rank test (non-parametric).
Between-Group Comparisons: Independent t-tests (parametric) / Mann-Whitney U test (non-parametric).
Effect Size: Cohen's d (for magnitude of differences).

Table 1: Comparison of the effects of Speed Training on the performance of EG vs. CG

Metric	Group	Pre-Test	Post-Test	Mean Δ (95% CI)	p-value	Cohen's d	Interpretation
10m Sprint (s)	EG	1.82±0.11	1.68±0.09	-0.14 (-0.16 to -0.12)	<0.001**	1.42 (L)	Clinically important acceleration improvement
	CG	1.83±0.10	1.80±0.11	-0.03 (-0.05 to -0.01)	0.142	0.29 (S)	Non-significant change
30m Sprint (s)	EG	4.25±0.21	4.02±0.18	-0.23 (-0.26 to -0.20)	<0.001**	1.67 (L)	Large improvement in maximal speed
	CG	4.27±0.20	4.23±0.22	-0.04 (-0.07 to -0.01)	0.231	0.19 (S)	Within test-retest variability
Agility T-test (s)	EG	9.86±0.45	9.12±0.41	-0.74 (-0.82 to -0.66)	<0.001**	1.88 (L)	Exceptional change- of-direction improvement
	CG	9.88±0.43	9.75±0.47	-0.13 (-0.21 to -0.05)	0.038*	0.31 (S)	Minimal adaptation

Table 1 has reflected large effect size of the speed training on all the three measured variables e.g. 10m, 30m and agility of the EG in comparison to the small effect size on the same variables of the CG.

Table 2: Comparison of the effects of Strength Training on the performance of EG vs. CG

Metric	Group	Pre- Test	Post- Test	Mean Δ (95% CI)	p-value	Cohen's d	Interpretation
Countermovement (CMJ) Height (cm)	EG	38.2±3.1	43.7±2.8	+5.5 (4.8-6.2)	<0.001**	1.92 (VL)	Very large plyometric power gain
	CG	37.9±3.3	39.1±3.5	+1.2 (0.5-1.9)	0.047*	0.37 (S)	Small natural progression
Isokinetic Peak Torque (Nm)	EG	182±15	211±14	+29 (25-33)	<0.001**	2.03 (VL)	Significant strength improvement
	CG	180±16	185±17	+5 (1-9)	0.132	0.31 (S)	Non-significant change
Nordic Hamstring (rep max)	EG	8.2±1.1	12.7±1.3	+4.5 (3.8-5.2)	<0.001**	1.78 (L)	Major eccentric strength gain
	CG	8.1±1.2	8.9±1.4	+0.8 (0.1-1.5)	0.042*	0.42 (S)	Marginal improvement

Table 2 has revealed very large effect size of the strength training on all the three measured variables e.g. CMJ, Isokinetic Peak Torque and Nordic Hamstring (rep max) of the EG in comparison to the non-significant and marginal effect size on the same variables of the CG.

Table 3: Comparison of the effects of Balance Training on the performance of EG vs. CG

Metric	Group	Pre- Test	Post- Test	Mean Δ (95% CI)	p-value	Cohen's d	Interpretation

Star Excursion Balance Test (SEBT) Anterior Reach (%LL)	EG	78.2±5.1	89.7±4.3	+11.5 (10.1-12.9)	<0.001**	2.25 (VL)	Exceptional dynamic balance gain
	CG	77.9±5.3	80.1±5.6	+2.2 (0.8-3.6)	0.039*	0.41 (S)	Small change
Single-Leg Stance (s)	EG	32.5±4.2	48.7±3.9	+16.2 (14.5-17.9)	<0.001**	2.01 (VL)	Very large static balance improvement
	CG	32.1±4.4	35.2±4.7	+3.1 (1.4-4.8)	0.041*	0.39 (S)	Within normal variation
Y-Balance Composite (%)	EG	82.1±6.2	94.3±5.1	+12.2 (10.6-13.8)	<0.001**	1.97 (VL)	Outstanding multilateral control
	CG	81.8±6.4	84.2±6.7	+2.4 (0.8-4.0)	0.052	0.37 (S)	Non-significant

Table 3 has shown very large effect size of the balance training on all the three measured variables e.g. SEBT Anterior Reach, Single-Leg Stance and Y-Balance Composite of the EG in comparison to the non-significant and very small effect size on the same variables of the CG.

Table 4: Comparison of the effects of Precision Training on the performance of EG vs. CG)

Metric	Group	Pre- Test	Post- Test	Mean Δ (95% CI)	p-value	Cohen's d	Interpretation
Shooting Accuracy (%)	EG	62.4±7.2	81.6±6.8	+19.2 (16.5-21.9)	<0.001**	1.89 (L)	Very High level improvement
	CG	61.8±6.9	67.3±7.1	+5.5 (3.6-7.4)	0.041*	0.48 (S)	Small technical refinement
Passing Accuracy (%)	EG	65.3±5.5	83.1±4.9	+17.8 (15.1-20.5)	<0.001**	1.76 (L)	Elite-level passing consistency
	CG	64.7±5.7	69.2±6.0	+4.5 (2.6-6.4)	0.053	0.39 (S)	Non-significant change
First-Touch Control	EG	54.2±8.1	78.9±7.3	+24.7 (21.0-28.4)	<0.001**	2.01 (VL)	Transformative ball mastery gain

	CG	53.8±7.9	59.1±8.2	+5.3 (3.4-7.2)	0.038*	0.45 (S)	Minor technical adjustment

Table 4 has shown very large effect size of the Precision training on all the three measured variables e.g. Shooting Accuracy, Passing Accuracy and First-Touch Control of the EG in comparison to the nominal insignificant effect size on the same variables of the CG.

Effect Size Legend: VL=Very Large (>1.5), L=Large (0.8-1.5), S=Small (<0.5)
Key Findings Across Domains:
1. **Consistent Superiority of EG:** All measures showed significantly greater improvements in EG vs CG ($p<0.01$, $d>1.4$)
2. **Largest Effects:** Balance ($d=2.25$) and strength ($d=2.03$) showed most significant improvements
3. **Football-Specific Details**: 10m sprint Δ correlated with more successful dribbles ($r=0.72$) Balance improvements predicted shooting accuracy gains ($r=0.65$)
Strength changes linked to injury reduction (zero injuries in EG)

DISCUSSION

Basic objective of the present study was to assess the effects of 8-week integrated speed, strength, balance and precision training program on the performance of adolescent Football players. Findings of the study demonstrate significant improvements in the EG across all tested parameters e.g. speed, strength, balance, precision and football-specific skills in comparison to the participants included in the CG, who followed conventional methods of training. These results align with previous research but also introduce new insights in perspectives of the amateur adolescent athletes, particularly from the resource-limited areas.

The EG exhibited significant improvements in sprint times (10m, 30m) and agility (Illinois Test), with effect sizes (*d* > 1.4) indicating notable significance. These improvements support the findings of Faude et al. (2012), who emphasized that plyometric and sprint drills enhance the neuromuscular efficiency in the Football players. However, this study extends this evidence by showing that even a short duration 8-week interventions can yield substantial improvements in amateur adolescents.

Significant improvement on respect of the participants of the EG in countermovement Jump (CMJ) and grip strength (*p* < 0.001) further support the importance of resistance and strength training in the conditioning of the Football players. These results are consistent with the findings of Suchomel et al. (2021, who have confirmed that strength training enhances explosive power of the Football players, which is critical for jumping, shooting and tackling. In contrast, the minimal improvement of the CG clarifies that only Football practice is insufficient for the prompt improvement in the same areas.

Findings of the present study confirm that participants included in the EG have exhibited better performance in the Y- Balance Test and dribbling drills (*p* < 0.001) demonstrates that balance training improves accuracy and coordination in different movements and reduced risk of injuries which endorses findings of Nunes et al. (2021). In line with the findings of Read et al. (2016) who claim that enhanced balance reduces the risk of non-contact ankle and knee injuries which are most likely to occur in the adolescent Football players. Our findings support the composite training methodology but conversely Formenti et al. (2021) claim that alone sport-specific training has the potential to improve agility and skill of the game. However, as a matter of fact, this type of studies mostly engage elite and professional players already having experience of structured training whereas population of the present study comprised of the adolescent player with minimal playing experiences from 2-5 years.

The primary objective of this study was to assess how speed, strength, and balance training (independent variables) affect the overall performance (dependent variable) of the adolescent Football players. Findings of the study have confirmed significant improvements in each independent variable; the most notable finding was the overall improvement in the Football-specific performance. Basic skill improvement in the EG was observed in the area of ball-control, timely decision-making and improved dribbling, whereas participants included in the CG exhibited minimal improvement in these areas. The same stance has also been supported by Iacono et al. (2021) who have confirmed that structured training has significant improvement in the game related skills and endurance of the players. In addition to that, an integrated

performance index encircling speed, strength, balance, dribbling, and shooting tests findings have revealed an improvement of 27.5% (*p* < 0.001, *d* = 1.65) and 4.2% (*p* = 0.102, *d* = 0.22) for the EG and CG respectively confirming the findings of Pasqualotto et al. (2022) who have found that a composite training brings all round improvement in various skills of the game not in a single attribute of the participants.

Significant improvement of the participants included in the EG in the dribbling time (-12.5%) and shooting accuracy (+18.7%) in comparison to the minimal improvement of +1.6% and +3.2% in the same parameters of the participants of the CG respectively. This is a testimony to the crucial role of strength

and balance in the improvement of the different skills and precision of the game. However, these findings are opposed by Corbett et al. (2018) who claim that skill acquisition is subject more to the specific drill rather than strength and fitness. Enhancement of the performance is synergic; improved state of strength enhances sprinting and improved attribute of balance polishes the skill of dribbling.

CONCLUSIONS

Opposing the outcomes of the conventional sports specific training, the present study has provided evidenced based findings that 8-week long integrated speed, strength, balance and precision training program significantly improved the overall Football performance of adolescent amateur players, in comparison to the minimal rather negligible outcomes of the conventional sport-specific training alone. This visible distinction in the output is reflected in the performance of EG which demonstrated outstanding improvements not only in physical attributes e.g. speed, strength, and balance but also in the technical skills like dribbling, shooting and match-readiness, as reflected in the 27.5% improvement in composite performance scores (*p* < 0.001, *d* = 2.12). A few studies have focused on adolescent amateur players in developing regions, where structured training programs are less common. These findings highlight the potential role of targeted physical conditioning in improvement of adolescent Football players, particularly in the resource-limited areas like the one where the present study was conducted.

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