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Six-week explosive plyometric training improves shooting accuracy among youth grassroots soccer players

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ABSTRACT

This article aims to investigate whether a six weeks of explosive plyometric training would be a useful intervention for increasing shooting accuracy among youth grassroots athletes who are engaged in soccer. The intervention was a quasi-experimental design involving a one-group pretest-posttest study that was carried out on 18 male players of 14-16 years who were drawn from a community soccer school through purposive sampling. The test on shooting accuracy that was measured was the "Bobby Charlton" target method. This test was done before and at the end of the 18 sessions of plyometric exercises that were held three days a week. Data analysis was done through Lilliefors normality test, a homogeneity test, and paired-samples t-test at alpha of 0.05 and an estimated effect size using Cohen's dz. The average shooting accuracy increased from 52.78±14.87 (pretest) to 81.11±15.68 (posttest) with approximately a mean gain of 28.33 points (95%CI 20.85-35.81) corresponding to a 53.68% improvement. The change was statistically significant, $t(17)=7.99$, $p < .001$ with very large effect size, dz=1.88. Players who were in the "very good" and "good" category increased from 0% to 66.7%. These findings indicate that a six-week plyometric training program substantially improves shooting accuracy among youth grassroots soccer players, supporting its practical implementation in community-based soccer development.

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Introduction

Soccer is the most popular team sport on the planet, and the modern game demands faster transitions, higher physical outputs, and better goal conversion. Within this landscape, the ability to finish attacking sequences with accurate shots has become a key performance indicator. After all, chances are only meaningful when they turn into goals. Scoring depends on shooting with both enough speed and precise placement. A fast shot cuts down the goalkeeper's reaction time, while accurate placement puts the ball where the keeper can't reach it (Zhang & Li, 2023). That's why developing the neuromuscular qualities behind controlled, on-target finishing has become a priority all along the talent pathway, including grassroots academies that build the foundation for national player development. In this study, grassroots soccer refers to community-based youth development programs that emphasize participation, fundamental skill acquisition, and long-term athlete development rather than elite competition.

In the last five years or so, researchers have pretty much agreed that lower body explosive power is a trainable factor in kicking performance. Plyometric training, which uses the stretch-shortening cycle through fast eccentric-concentric muscle actions, has been repeatedly shown to be an efficient way to boost power related soccer skills (Markovic & Mikulic, 2010). One systematic review and meta-analysis found that plyometric training has a large positive effect on soccer kicking performance (Hedges' g = 0.979, 95% CI 0.606, 1.353, p <.001), and these benefits seem to hold across age, sex, and skill level (Zhang & Li, 2023). Other reviews indicate that programs lasting six to ten weeks, done two to three times per week, reliably improve lower limb explosive strength in adolescents (Bedoya et al., 2015; Capric et al., 2022).

Recent controlled trials have given us a clearer picture of how to get these adaptations in young players. Microdosed plyometric training improved reactive strength and acceleration in under 17 players without messing up their technical sessions (Liu et al., 2024). Plyometric jump training boosted fitness and reduced inter limb asymmetries in prepubertal players (Sammoud et al., 2024). Maturity stratified trials showed that post peak height velocity players might respond more strongly than less mature peers (Bouafif et al., 2026). Comparative work also showed that vertical and horizontal loading orientations produce partly different adaptations in adolescent players, which highlights how important exercise selection is (Kurt et al., 2023). Taken together, these studies establish plyometrics as an evidence based way to develop the explosive base in youth soccer.

But here's the thing: most studies focus on power outcomes like kicking speed, distance, jump height, and sprint acceleration. They don't really look at precision, which is what makes finishing successful. That's a problem because velocity and accuracy are not interchangeable. Biomechanical analyses show a speed accuracy trade off where joint and segment velocities drop when players aim for accuracy (Deniz & Kılcı, 2025). More accurate shooting seems to depend on maximal strength and reactive strength qualities that are different from the ones that govern raw shot speed. So an intervention that makes a player hit the ball harder doesn't automatically mean the ball will reach its target more often.

The research is also all over the place when it comes to whether general power training actually helps accuracy. Some interventions report clear gains in finishing precision after explosive loading, while core focused and combined programs improved kicking velocity without giving a parallel boost in accuracy (Zemkóva & Zapletalová, 2024). These mixed results reflect differences in populations, test protocols, how long the intervention lasted, and the specific exercises used. Mechanistically, accuracy depends heavily on support leg stability and inter segmental coordination, qualities that only some protocols target directly (Deniz & Kılcı, 2025). So the accuracy specific effects of plyometric training are still not well understood, especially outside well resourced elite settings.

There's another big gap too: context. Most controlled trials have been run with academy or semi professional groups in Europe and the Middle East, where infrastructure and coaching density are pretty high. Grassroots soccer schools in developing regions, which train large numbers of teens with limited equipment and staff, are rarely studied. Yet that's exactly the demographic where efficient, low cost interventions could make the biggest difference. Whether a simple, equipment light plyometric program can meaningfully sharpen finishing accuracy in those settings is an open and practically important question.

So our study tackles these gaps head on. We made shooting accuracy the main outcome we measured after a short plyometric program with grassroots youth players. Its novelty is threefold: first, it targets precision rather than power, directly testing whether stretch shortening cycle training transfers to on target finishing. Second, it places the intervention in an under resourced community academy, which extends external validity beyond elite labs. Third, it quantifies the practical size of changes using effect sizes, confidence intervals, and category shifts instead of just significance testing. Theoretically, it links neuromuscular power development to the coordination demands of accurate striking. Practically, it offers coaches a scalable, low equipment strategy for a decisive match skill. Therefore, the objective of this study was to determine whether a six-week plyometric training program significantly improves shooting accuracy among male grassroots soccer players aged 14–16 years. Based on previous evidence regarding stretch-shortening cycle adaptations, it was hypothesized that participants would demonstrate a statistically and practically significant improvement in shooting accuracy following the intervention. So the objective of this study was to determine the effect of a six week explosive plyometric training program on the shooting accuracy of youth grassroots soccer players, and we hypothesized a significant and practically meaningful improvement in on target finishing.

Method

Research design and participants

Quantitative analysis and control groups were not used since the experimental group was tested only before and after. All study participants had the same roles during the study as they used themselves as a reference. The sample was composed of 18 male young male players with ages between 14 and 16 playing in the youth club of a community center in Payakumbuh, West Sumatra, Indonesia. The players who were in good health physically during the study period and had at least one year of experience had been included. This study's intervention and evaluation were planned to be carried out during the club's regular practices program without disturbing their schedule; and the necessary consent was also granted from the players and their parents in line with the regulations of the institute for field research involving education.

Sampling and instrument

The U15-U16 cohort was chosen by the academy director (n = 18) through a form of selection where the selection is made on the basis of characteristics desired rather than random choice from a list -purposive sampling. Players who had shown up consistently with their training sessions, a good command of the fundamentals of the craft and of an age-range that was compatible with the demands of a plyometric program were included. The standard Charlton shooting test was adopted, which evaluates shooting accuracy. In this test, each player shoots four times, one preferred foot, from a distance of 16.5 m, toward a goal divided into different scoring zones, the ones on the top corners giving the highest values. The procedure of the shooting test was same for both pre and post tests and was carried out only by the assessors who had been adequately trained. To improve measurement consistency, two experienced soccer coaches independently evaluated all shooting attempts. Inter-rater reliability was assessed using the Intraclass Correlation Coefficient (ICC), yielding excellent agreement (ICC = 0.93).

Intervention program

The program was given for a total time of six weeks with 18 sessions of three each week and with the other technical trainings being held as well. Each session was devoted basically stretching-shortening cycle movements, like jumping squats and jumping from boxes, etc., combining a fast elongation phase and a rapid contraction stage, without making much time on the ground (Capric et al., 2022; Kurt et al., 2023). The level of difficulty was increased gradually from easier to harder during the course, and every session included standardized warming up and winding down parts of the session program.

Each training session lasted approximately 50–60 minutes and consisted of a 10-minute dynamic warm-up, 35–40 minutes of plyometric exercises, and a 10-minute cool-down. The exercises included squat jumps, tuck jumps, countermovement jumps, lateral hurdle jumps, standing long jumps, bounding drills, box jumps, and single-leg hops. Training volume progressed from three sets of eight repetitions during Weeks 1–2 to four sets of ten repetitions during Weeks 5–6 following the principle of progressive overload. Passive recovery of 90–120 seconds was provided between sets and approximately three minutes between different exercise stations.

Table 1. Six-week plyometric training protocol

Week	Exercise	Sets	Repetitions	Rest
1–2	Squat Jump	3	8	90 s
	Standing Long Jump	3	8	90 s
	Lateral Jump	3	8	90 s
3–4	Bounding	3	10	90 s
	Box Jump	3	10	90 s
	Tuck Jump	3	10	90 s
5–6	Depth Jump	4	8	120 s
	Single-leg Hop	4	8	120 s
	Reactive Jump	4	8	120 s

Data collection and statistical analysis.

The scores recorded by the subjects on the standardized sheets were obtained under identical experimental conditions. Parametric tests were used for data analysis as per the guidelines of the research institute. The Lilliefors test was used to check the normality of the data and homogeneity test for evaluating variance. Descriptive statistics were carried out to summarize the performance and paired-samples t-test was used to compare results before and after the intervention. Cohen's dz (mean difference / difference scores standard deviation; values above 0.2 indicate small effect, 0.5 moderate, and 0.8 large effect) was used to measure practical significance as well as a 95% confidence interval for the mean difference and change from baseline in percentages.

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Results and Discussions

Mean shooting accuracy increased from 52.78 (*SD* = 14.87) at pretest to 81.11 (*SD* = 15.68) at posttest (Table 2). The minimum score rose from 30 to 50 and the maximum from 70 to 100, indicating that improvement occurred across the full performance range rather than being driven solely by the highest or lowest performers.

Table 2. Descriptive statistics for shooting accuracy at pretest and posttest

Measure	n	Min	Max	M (SD)
Pretest	18	30	70	52.78 (14.87)
Posttest	18	50	100	81.11 (15.68)

Note. M = mean; SD = standard deviation. Scores represent Bobby Charlton shooting-test points.

Both distributions were normal and variances were homogeneous (Table 3), satisfying the assumptions for parametric analysis. The paired-samples t-test showed a statistically significant increase in shooting accuracy, $t(17) = 7.99$, $p < .001$, with a mean gain of 28.33 points and a 95% confidence interval of 20.85–35.81 that excluded zero (Table 3).

Table 3. Assumption checks: Lilliefors normality and homogeneity of variance

Test / group	Statistic	Critical	Decision
Normality – pretest	L = 0.138	0.200	Normal
Normality – posttest	L = 0.172	0.200	Normal
Homogeneity	F = 1.11	3.16	Homogeneous

Note. A Lilliefors statistic below the critical value indicates a normal distribution; F below the critical value indicates equal variances. $\alpha = .05$.

Table 4. Paired-samples t-test and effect size for the change in shooting accuracy

Comparison	Mean diff.	95% CI	t	df	p
Posttest – pretest	28.33	[20.85, 35.81]	7.99	17	<.001

Note. Cohen’s dz = 1.88 (very large; SD of differences = 15.04). The mean gain corresponds to a 53.68% improvement over baseline. The one-tailed critical t at df = 17 was 1.740.

Such a change is not only statistically reliable but is also considerable in practice. The within-subject effect size came out very large (Cohen's dz = 1.88) which is not only a large change but more than twice that, and it has even surpassed the estimates from some studies which were based on a large number of experiments on plyometric training related to kicking performance. After translation into performance categories (Table 5), it has been seen that not a single player belonged among the good or very good performance bands before the training, whereas 66.7% came into those bands after the training, and the share of the poor or very poor performers went from 66.7% down to 11.1%.

Table 5. Percentage improvement and category distribution

Category	Pretest n (%)	Posttest n (%)	Change
Very good / good	0 (0.0)	12 (66.7)	+66.7
Moderate	6 (33.3)	4 (22.2)	−11.1
Poor / very poor	12 (66.7)	2 (11.1)	−55.6

Note. Mean shooting accuracy improved by 28.33 points (53.68%). Percentages may not sum to 100 due to rounding.

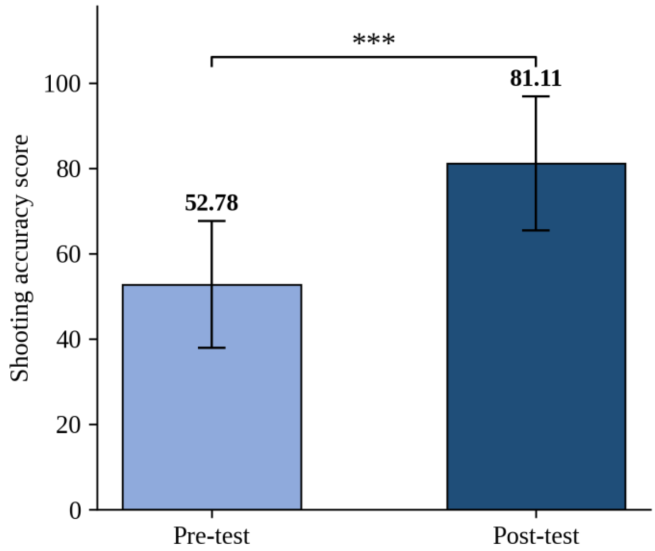

Figure 1. Mean shooting accuracy at pretest and posttest (error bars = SD; ***p < .001).

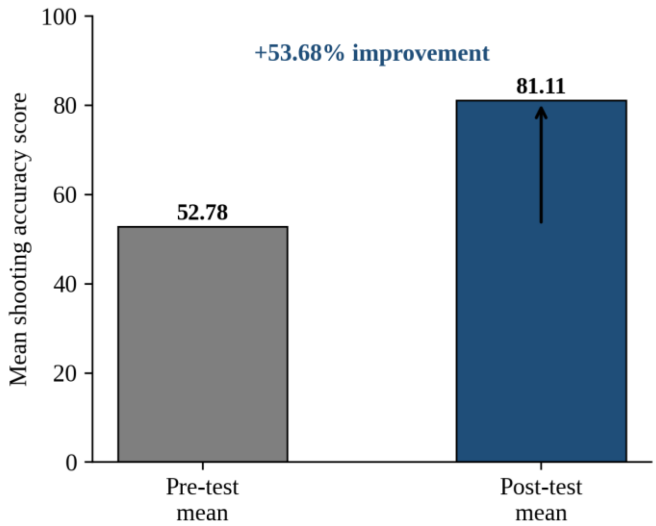

Figure 2. Percentage improvement in mean shooting accuracy from pretest to posttest.

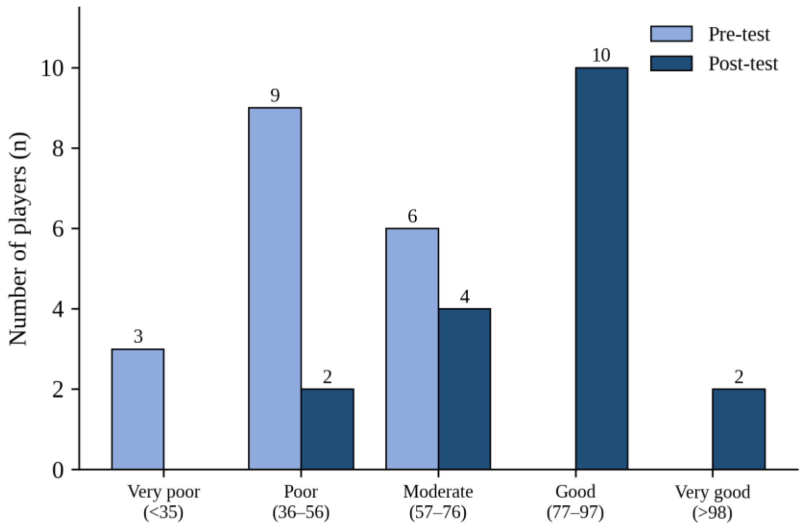

Figure 3. Distribution of players across performance categories at pretest and posttest.

Interpretation of findings

During the six-week program the players' shooting accuracy got much better on the whole which turned out to be statistically significant with mean scores going up over half a hundred percent and the effect size was really, really large (dz = 1.88). The change was actually from lowest to highest scores as well as the categorical distribution had a big, decisive shift, which implies, the players all together improved rather than just statistically it turned out this way. Most importantly, the result was accuracy rather than speed. Stretch-shortening-cycle training helped players more reliably control how the ball got to its target. That difference really matters because power and accuracy seem to be governed by different neuromuscular systems to a large extent.

Comparison with previous studies

The magnitude of improvement is consistent with, and at the upper end of, the international evidence. A meta-analysis reported a large pooled effect of plyometric training on soccer kicking performance (g = 0.979) that generalized across age, sex, and skill level (Zhang & Li, 2023), and broader syntheses confirm reliable lower-limb explosive gains in youth over six-to-ten-week programs (Bedoya et al., 2015; Capric et al., 2022; Markovic & Mikulic, 2010). The very large effect here is plausible in a one-group, low-baseline grassroots cohort. The results also align with youth trials showing robust adaptation around and after peak height velocity (Bouafif et al., 2026; Liu et al., 2024; Sammoud et al., 2024), and with evidence that vertical and combined jumping actions develop the qualities relevant to striking (Kurt et al., 2023). The accuracy-specific result adds to a more contested strand in which some programs improved kicking velocity without parallel accuracy gains (Zemkóva & Zapletalová, 2024).

The present effect size (Cohen's dz = 1.88) is substantially larger than the pooled effect reported in the recent meta-analysis by Zhang and Li (2023). This difference may be explained by the lower initial performance level of grassroots players, allowing greater relative improvement following structured neuromuscular training. Similar improvements have also been reported by Liu et al. (2024), Sammoud et al. (2024), Bouafif et al. (2026), and Kurt et al. (2023), although most previous investigations primarily focused on kicking velocity or explosive performance rather than shooting accuracy. Therefore, the present findings contribute novel evidence that plyometric training can also enhance precision-oriented technical performance.

Physiological and neuromuscular mechanisms

The improvements can be explained by well-established adaptations to plyometric loading. Plyometric training enhances stretch-shortening-cycle efficiency, storing elastic energy during the eccentric pre-stretch that is released in the subsequent concentric action, while a shorter amortization phase reduces energy dissipation and increases the rate of force development (Markovic & Mikulic, 2010). At the neural level, plyometrics increases motor-unit recruitment, firing frequency, and inter-muscular coordination, and modulates reflex excitability and activation strategies during rapid loading. Better-timed, more synchronized muscle actions support a repeatable, accurate kicking pattern and improve postural stability of the support leg. Reduced inter-limb asymmetries may improve postural control during kicking, thereby enhancing the consistency and precision of ball placemen, (Sammoud et al., 2024) is one manifestation of this improved control, plausibly contributing to more repeatable ball contact.

Biomechanical explanation

From the point of view of biomechanics, accuracy in shooting is to a great extent determined by the actions of a support leg together with those of the ball contact rather than by the simple fact of how fast the kicking leg comes through. The authors analyzing instep kicking have come to the conclusion that the support leg is responsible for regulating the speed and the spin of the ball as well as ensuring postural stability during a kick, and that the extension strength in the joints of the hip and knee combined with frontal plane control make a crucial difference in having a stable and accurate kick(Deniz amp; Kiilç, 2025). Plyometric loading enables precisely the kind of explosive and stiff qualities of the leg that is going down for the strike. In fact, these two attributes of stiffness and explosion are what a plant leg needs to be stable during a strike.

Practical and theoretical implications

For the practitioners, it can be said that a plyometric program, performed three times a week with very little equipment, improved accuracy of shooting to a major extent in just six weeks. This gives an alternative, easily available way to a crucial skill for resource-limited coaches. However, they should gradually increase workload, ensure sufficient recovery time and landing surfaces, consider the maturity level of each player (Bouafif et al., 2026), as well as complement the program with shooting technical practices. The findings, from a more general point of view, reinforce that stretch-shortening-cycle adaptations are transferable to gross power outputs as well as to precision-dependent tasks, accuracy as a consequence of lower-limb explosive and stabilizing capacity.

Practical and theoretical implications

For youth soccer coaches, implementing a structured plyometric program three times per week requires minimal equipment and can be integrated into regular technical sessions without substantially increasing training duration. Consequently, this approach is particularly applicable to community-based soccer academies operating under limited financial and infrastructural resources.

Limitations and future research

Several limitations have been identified that may temper the interpretation. The study is of a one-group nature and so a control group is missing. As a result, it is not possible to completely distinguish maturation, test familiarization, and on-parallel technical training from the intervention, which may have a bias on the size of the effect. The sample of the study was very minor (n = 18), from one center only, and confined to male U15-U16s only, and they didn't collect anthropological, physical, and kicking-speed data. The next research is a combination of randomized controlled trials with active control groups, female and mixed age groups in the subjects, the inclusion of a maturity assessment and biomechanical analysis of the support-leg mechanics.

Another limitation concerns the absence of biomechanical and physiological measurements such as kicking velocity, lower-limb strength, reactive strength index, and maturity status. Consequently, the mechanisms underlying the observed improvement could not be directly quantified. Future randomized controlled trials incorporating biomechanical analyses are recommended.

Conclusions

This study aimed to determine whether a six-week plyometric training program could improve shooting accuracy among youth grassroots soccer players. The findings demonstrated that the intervention significantly increased shooting accuracy, with a very large practical effect size and meaningful improvements across performance categories. The authors provide empirical support for the notion that cyclic shortening of the stretched phase training is related to finishing which demands precision, not just to pure power, most probably because of strengthening and the consequent stabilization of the leg which supports and hence, governs proper ball contact. From the practical side, it opens up a possibility of low-technical and low-equipment strategies for coaches with limited means in order to develop a critical match skill. However, the coaches should be cautious in the progress of the loading, and the program should be supplemented with technical shooting training. Due to the characteristics of the research single-group study and limited sample with only one site participating, it would be preferable to replicate the investigation with diverse randomized-controlled trials. Nonetheless, the currently presented evidence favors the incorporation of a gradual plyometric program in player-development programs at the grassroots level aiming at the improvement of finishing accuracy.

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