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Changes in Vertical Jump Performance Following a Four-Week Agility-Ladder Program in Amateur Football Players

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Abstract

Objectives: This study examined changes in lower-limb explosive performance after a four-week agility-ladder training program among Germa FC football players.

Materials and Methods: A one-group pretest-posttest design was used. Twenty players were purposively selected from a population of 25. Participants completed 12 supervised sessions over four weeks (three sessions per week). The 90-minute sessions included 45 minutes of ladder exercises comprising One-In Drill, Two-In Drill, Lateral Shuffle, In-In-Out-Out, Single-Leg Hops, and Icky Shuffle. Vertical jump height was measured before and after the program. Normality was assessed with the Shapiro-Wilk test, and scores were compared using a two-tailed paired-samples t-test at $\alpha = .05$.

Results: Mean vertical jump height increased from 43.65 ± 4.44 cm to 58.98 ± 6.01 cm. The mean improvement was 15.33 cm (35.12%), 95% CI [12.88, 17.78]. The paired comparison was statistically significant, $t(19) = 13.09$, $p < .001$, with a very large standardized within-participant effect (Cohen's dz = 2.92).

Conclusions: Vertical jump performance improved substantially during the four-week program. Because the intervention combined footwork and hopping exercises and the study lacked a control group, the improvement cannot be attributed exclusively to the agility ladder. Controlled trials should compare ladder-only, plyometric, combined, and regular-training conditions.

Keywords: agility ladder; explosive performance; football; lower-limb power; vertical jump

Introduction

Football performance depends on the ability to repeat explosive actions within an intermittent match environment. Accelerations, decelerations, jumps, sprints, and changes of direction contribute to decisive phases of play and require effective neuromuscular coordination and rapid force production. Lower-limb power is therefore relevant to heading, sprint initiation, tackling, shooting, and contesting aerial balls. Training strategies intended to develop this quality should provide sufficient mechanical stimulus while remaining compatible with technical and tactical practice.

Vertical jump height is commonly used as a field indicator of lower-limb explosive performance. Although jump height is not identical to mechanical power, it reflects the integrated outcome of force production, movement velocity, technique, and stretch-shortening-cycle function. Plyometric jump training has consistently improved jumping and sprinting performance in young male football players, with pooled effects reported across multiple controlled studies (Ramírez-Campillo et al., 2020). Multidirectional plyometric programs have also improved vertical jump height, change-of-direction performance, and postural control (Jlid et al., 2019, 2020).

Agility ladders are widely used because they are inexpensive and allow varied footwork sequences at high movement frequencies. They can challenge rhythm, coordination, balance, and movement accuracy. However, an important distinction is required between ladder footwork and plyometric loading. Conventional rapid stepping inside a floor ladder may involve limited force and displacement, whereas drills that incorporate unilateral or bilateral hops can provide a stronger stretch-shortening-cycle stimulus. Accordingly, any improvement in jumping after a mixed ladder program may reflect its hopping component rather than the ladder apparatus itself.

Evidence for agility-ladder training is mixed. Padrón-Cabo et al. (2020) found that ladder coordination training did not outperform regular football training for sprint, agility, or dribbling outcomes in youth players, questioning its use as a stand-alone fitness method. In contrast, Pramono et al. (2023) reported improvements in power, agility, and endurance when plyometric exercises were delivered through agility-ladder drills in adolescent

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volleyball players. This contrast suggests that program content, particularly the inclusion of jumps and hops, is more important than the equipment label.

Germa FC had used general physical training but had not evaluated a structured agility-ladder program for lower-limb explosive performance. The present program combined rapid footwork with single-leg hopping exercises over four weeks. This study therefore aimed to examine pre-to-post changes in vertical jump height following the program. It was hypothesized that posttest performance would exceed pretest performance. Given the absence of a control group, the study was designed to quantify within-player change rather than establish a definitive causal effect.

Materials and Methods

Study Design

This quantitative study used a pre-experimental one-group pretest-posttest design. Each participant completed a baseline vertical jump assessment, a four-week training program, and a post-intervention assessment. The design permits estimation of within-participant change but is vulnerable to testing, history, maturation, motivation, and concurrent-training effects.

Study Participants

The population consisted of 25 Germa FC players. Purposive sampling selected 20 players identified by the coaching staff as requiring improvement in lower-limb performance. The source manuscript did not report age, sex, playing position, training experience, competitive level, anthropometry, attendance, injury history, or explicit inclusion and exclusion criteria. These characteristics should be added before submission because they influence generalizability and training response.

Study Organization

The study was conducted at the Gerung Permai Village football field, Suralaga District, East Lombok, West Nusa Tenggara, from October to November 2025. The intervention comprised 12 sessions over four weeks, with three sessions per week. Each 90-minute session included an introduction (10 minutes), warm-up (15 minutes), agility-ladder work (45 minutes), cool-down (10 minutes), and closing activities (10 minutes). The exercise menu comprised One-In Drill, Two-In Drill, Lateral Shuffle, In-In-Out-Out, Single-Leg Hops, and Icky Shuffle. The source manuscript did not provide set-repetition schemes, work-to-rest ratios, progression rules, surface, footwear, or concurrent football-training load; these should be recovered from training records.

Lower-limb explosive performance was assessed with a wall-based vertical jump test. Standing reach was measured with the participant standing side-on to a wall and reaching upward without lifting the heels. The participant then performed a maximal vertical jump from a stationary position and marked the highest touch point. Jump height was calculated as the difference between the jump mark and standing reach. The same procedure was used at pretest and posttest. The source manuscript did not specify the number of trials, rest between trials, best-versus-mean scoring rule, assessor reliability, or familiarization; these details require confirmation.

Statistical Analysis

Means, standard deviations, minima, maxima, frequencies, and percentages were calculated. Shapiro-Wilk tests evaluated the distribution of pretest and posttest scores. A two-tailed paired-samples t-test compared measurement occasions at $\alpha = .05$. The mean paired change was reported with its 95% confidence interval. Cohen's dz was calculated as the mean paired difference divided by the standard deviation of the paired differences. Analyses were conducted using SPSS version 25. Homogeneity of variance was not treated as an assumption because the test concerns paired observations rather than independent groups.

Results

All 20 participants had pretest and posttest scores. Mean vertical jump height increased by 15.33 cm, from 43.65 ± 4.44 cm to 58.98 ± 6.01 cm, representing a 35.12% improvement relative to the pretest mean (Table 1). The minimum increased from 37.10 to 49.90 cm, and the maximum increased from 52.90 to 71.50 cm.

Table 1. Descriptive statistics for vertical jump height (n = 20)

Measurement	Mean (cm)	SD	Minimum	Maximum	Change (%)
Pretest	43.65	4.44	37.10	52.90	—
Posttest	58.98	6.01	49.90	71.50	35.12

The distribution shifted toward higher descriptive categories: 13 players were classified as poor and seven as moderate at pretest, whereas posttest scores comprised eight moderate, nine good, and three very good results (Table 2). These categories are retained from the source manuscript; their normative source should be cited before submission.

Table 2. Distribution of vertical jump categories

Category	Pretest, n (%)	Posttest, n (%)
Very good (>65 cm)	0 (0%)	3 (15%)
Good (56–65 cm)	0 (0%)	9 (45%)
Moderate (46–55 cm)	7 (35%)	8 (40%)
Poor (36–45 cm)	13 (65%)	0 (0%)
Very poor (<35 cm)	0 (0%)	0 (0%)

Shapiro-Wilk tests did not reject normality for the pretest (W = .964, p = .316) or posttest (W = .961, p = .268). The paired-samples t-test indicated a statistically significant improvement, t(19) = 13.09, p < .001. The estimated mean increase was 15.33 cm, 95% CI [12.88, 17.78], and Cohen's dz = 2.92, indicating a very large standardized within-participant change (Table 3).

Table 3. Paired-samples comparison of vertical jump height

Contrast	Mean change	SD change	95% CI	t	df	p	Cohen's dz
Posttest − pretest	15.33 cm	5.24	[12.88, 17.78]	13.09	19	< .001	2.92

Discussion

Vertical jump height improved substantially during the four-week training period. The 15.33-cm mean increase, narrow confidence interval, and large paired standardized effect show a clear within-sample change. Nevertheless, the result should be described as improvement following the program rather than proof that the agility ladder itself caused the change. The intervention combined rapid stepping with Single-Leg Hops, normal football training was not controlled, and no comparison group was included.

The hopping component provides a plausible physiological explanation. Repeated unilateral hops impose rapid eccentric-to-concentric muscle actions, potentially improving neural drive, intermuscular coordination, musculotendinous stiffness, and stretch-shortening-cycle efficiency. These mechanisms are consistent with evidence that plyometric jump training improves vertical jump performance in young male football players (Ramírez-Campillo et al., 2020). Multidirectional plyometric programs have similarly enhanced jump height and change-of-direction performance in football populations (Jlid et al., 2019, 2020).

The findings also resemble those of Pramono et al. (2023), who observed improvements in lower-limb power after a plyometric agility-ladder program. However, that study involved adolescent volleyball players and included a comparison condition, whereas the present study involved a local football club and lacked a control group. The agreement is therefore supportive but not confirmatory. More broadly, horizontal and vertical plyometric orientations can both improve football performance, although transfer depends on exercise direction, volume, and seasonal context (Nobari et al., 2023).

A critical comparison is provided by Padrón-Cabo et al. (2020), whose controlled study found no additional improvement in sprint, agility, or dribbling after ladder coordination training in youth football players. Their findings caution against assuming that fast footwork automatically develops sprinting or power. The contrast with the present result may be explained by the inclusion of Single-Leg Hops and other explosive actions in the Germa FC program. Accordingly, the intervention is more accurately interpreted as a mixed agility-ladder and plyometric program than as ladder footwork alone.

The magnitude of improvement was larger than is commonly reported in controlled plyometric literature. This may reflect low baseline performance, strong responsiveness to a novel stimulus, test familiarization, selection of players specifically considered to have weak lower-limb performance, or uncontrolled concurrent training. It may also reflect changes in jump technique rather than muscle power alone. Future studies should use a countermovement-jump protocol with a contact mat or force platform, report test-retest reliability, and include both jump height and mechanical power variables.

For practice, coaches may incorporate agility-ladder sessions when the program contains purposeful hops, progressive overload, adequate recovery, and technical supervision. Rapid stepping drills can serve coordination

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and warm-up goals, whereas power development requires exercises that generate sufficient ground-reaction force and displacement. Coaches should monitor landing quality, fatigue, pain, and training load and should avoid assuming that more complex foot patterns necessarily provide a stronger power stimulus.

The study is limited by its one-group design, purposive sample, small size, single-club setting, short duration, and incomplete participant description. Exercise dosage, progression, attendance, adverse events, and concurrent training were not reported. The wall-based jump protocol may be influenced by reach technique and assessor judgment, and no reliability evidence was provided for the study implementation. A randomized trial comparing ladder-only, plyometric-only, combined, and regular-training groups would clarify which training component produces the observed change.

Conclusions

Germa FC players demonstrated a significant improvement in vertical jump height after a four-week mixed agility-ladder program. Mean performance increased from 43.65 to 58.98 cm, with a mean gain of 15.33 cm and Cohen's dz of 2.92. The program may be useful as a supplementary conditioning strategy, particularly when it includes structured hopping exercises. Because the study lacked a control group and did not isolate the ladder and plyometric components, causal conclusions should remain cautious.

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Conflict of Interest

The authors declare no conflict of interest.

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