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Original Research Article

T Kick Performance After Eight Sessions of Side-to-Side Jump Training in Adolescent Female Pencak Silat Students

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Abstract

Adolescent pencak silat students need conditioning that supports repeated kicking while remaining practical for school training. This study examined changes in T-kick performance after eight sessions of side-to-side jump training among 11 female students aged 14–15 years from the Walet Puti extracurricular program at Darul Muttaqin Islamic Boarding School. A single-group pretest–posttest design was used. Participants were purposively selected from a population of 24 students. Performance was assessed using a 10-second target-kicking test before and after training. The reported means increased from 17.00 to 19.27, an absolute change of 2.27 and a relative increase of 13.35%. The original analysis reported t = 2.352. Assuming this statistic represents the stated paired comparison of 11 participants, statistical reconstruction gives t(10) = 2.352, a two-sided p = .041, an approximate 95% confidence interval of 0.12–4.42 for the mean change, and a standardized paired change of d_z = 0.71. These reconstructed estimates require verification against the individual paired observations. The findings indicate improved repeated T-kick test performance following the training period. However, the absence of a comparison group, incomplete intervention reporting, and unavailable individual data prevent a firm causal conclusion. Side-to-side jumping warrants further evaluation as a conditioning option alongside technical practice, using a controlled design and a fully specified training protocol.

Keywords: adolescent athletes; female athletes; pencak silat; plyometric training; repeated kicking

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1. INTRODUCTION

Pencak silat training in schools combines the development of sporting skills with participation in a culturally established movement practice. For adolescent students, the immediate training problem is often practical: how to improve a demanding technique with limited time, equipment, and access to specialist conditioning. These conditions make simple jumping exercises attractive, but convenience alone does not establish that an exercise improves a particular kick. Research must distinguish changes in a field test from changes in the physical capacities presumed to support that test. This distinction is especially relevant when an exercise program is evaluated in a small extracurricular group.

School sport also sits within a wider educational and public-health setting. The World Health Organization (WHO) calls for coordinated opportunities for physical activity, while UNESCO emphasizes investment in qualified teachers and inclusive physical education (UNESCO, 2024; WHO, 2022). Indonesia's sports legislation provides a national framework for sporting development, and the 2025–2029 development agenda places education, health, sporting achievement, and gender equality within its human-development priorities (Ministry of State Secretariat of the Republic of Indonesia, 2025; Republic of Indonesia, 2022). These policies explain the relevance of accessible school sport. They do not establish the effectiveness of a particular conditioning drill or turn a short performance study into evidence of population-level health benefit.

The T-kick requires a student to organize the supporting leg, trunk position, kicking action, and return to stance. Repeating the action against a target adds a coordination demand that differs from producing one fast kick. A score obtained within a fixed interval therefore reflects several interacting features, including technical consistency, recovery between kicks, and the ability to maintain the movement sequence. It should not automatically be described as foot velocity or reaction time. A repeated-kick count can be useful for coaches, provided that its scoring rules and limits are made explicit.

Plyometric training uses rapid transitions between muscle lengthening and shortening. An umbrella review identifies performance benefits across several populations, although findings differ by outcome and study quality (Kons et al., 2023). Reviews focused on combat sports report improvements in selected physical capacities after plyometric jump training, and a more recent martial-arts synthesis supports benefits for strength and power (Ojeda-Aravena et al., 2023; Yuan et al., 2025). These findings provide a reason to investigate jumping exercises in pencak silat. They do not demonstrate that every jumping drill transfers equally to repeated T-kicking, particularly in adolescent females.

Training transfer is a separate question from improvement in the trained exercise. A review of technical-skill outcomes suggests that plyometric training can benefit selected sporting skills, while identifying a continuing need for stronger sport-specific evidence (Deng et al., 2023). Neuromechanical accounts likewise emphasize that improved force production must be expressed through the coordination demands of the target action (Duchateau & Amiridis, 2023). Side-to-side jumps involve repeated lateral displacement and landing. Their relevance to the T-kick is therefore plausible but requires direct testing rather than inference based solely on movement direction.

Female adolescents warrant specific attention. Research guidance documents longstanding limitations in representing and characterizing female athletes (Smith et al., 2022). Recent syntheses of adolescent females and female team-sport athletes indicate that strength and plyometric interventions can improve selected jumping, sprinting, and change-of-direction outcomes (Lin et al., 2025; Luo et al., 2025). An age-focused review also reports benefits for explosive-performance outcomes in female adolescents (Chen et al., 2025). Nevertheless, most of these outcomes and sporting settings differ from a school-based pencak silat kicking test. Chronological age alone cannot capture maturation, prior training, or technical experience that may influence adaptation.

At Darul Muttaqin Islamic Boarding School, the original study identified difficulty performing T-kicks quickly and repeatedly. The reported training routine emphasized alternating right- and left-leg kicks, while targeted physical conditioning was limited. Eight sessions of side-to-side jump training were introduced to address this local problem. This article examines whether recorded T-kick test performance differed between pretest and posttest in 11 female students aged 14–15 years. The directional expectation was improvement after training; interpretation remains focused on within-group change because no comparison group was included.

2. METHOD

2.1 Participants

The study population comprised 24 students involved in the Walet Puti pencak silat extracurricular program at Darul Muttaqin Islamic Boarding School. Eleven female students aged 14–15 years were selected purposively. The available account does not describe the selection criteria beyond the participant characteristics reported here. Training age, belt level, competition experience, anthropometric measurements, biological maturation, and menstrual characteristics were not reported. Accordingly, the sample is described as students participating in school-based pencak silat rather than assigned an elite or developmental classification. Such classifications require training and performance information beyond membership of a sport program (McKay et al., 2022).

2.2 Research Design

A single-group pretest–posttest design was used. The same group completed the T-kick assessment before and after an eight-session training period. Side-to-side jump training was the intervention, and the recorded T-kick test score was the outcome. The study included no random allocation, parallel control group, or delayed retention assessment. The design permits a description of change over the training period but cannot separate the contribution of jumping from repeated testing, concurrent pencak silat practice, maturation, motivation, or other time-related influences.

The analysis used the sample size, session count, test description, means, normality statistics, and t statistic retained in the study report. Additional statistical quantities were reconstructed from these summaries. Individual observations were unavailable for an independent reanalysis, so the reconstructed estimates remain conditional on the reported paired t statistic.

2.3 Instruments

The performance measure was a target-based T-kick test conducted over 10 seconds. Equipment comprised a hand-held kicking target, a measuring tape, and a stopwatch. The reported protocol placed the target at 75 cm, with the supporting foot behind a line 50 cm from the target. The participant repeatedly kicked with the right leg and returned the kicking foot to the floor behind the line; the left leg was assessed separately. The report describes three attempts, with the best score retained. The account does not specify whether the three attempts were completed for each leg or across the assessment as a whole.

The fixed-duration procedure assesses repeated target contacts rather than the time required to complete a predetermined number of kicks. The outcome is therefore termed T-kick test performance, and the recorded numerical scale is retained without conversion to movement velocity. Whether the reported group means represent one leg or an aggregation of right- and left-leg scores is not documented. This ambiguity limits reproducibility and prevents a leg-specific interpretation.

The authors did not report a reliability coefficient, measurement-error estimate, familiarization record, or assessor-blinding procedure for this sample. Target-contact counts cannot establish kicking force, accuracy under competitive pressure, or the duration of a single kick. Recent work in young female athletes illustrates the value of examining force-time characteristics and test reliability as distinct measurement questions (Fahey et al., 2025). Those measurements were not part of the present study.

2.4 Procedures

Participants completed the pretest, undertook eight sessions of side-to-side jump training, and then completed the posttest. The intervention was described as repeated explosive jumps in a lateral direction. The study record does not specify whether the jumps used unilateral or bilateral take-off and landing, the displacement distance, the sets and repetitions, ground contacts, rest periods, weekly frequency, total duration in weeks, or progression. The eight sessions must therefore be understood as a session count rather than an eight-week intervention.

The account identifies separate personnel for target-height measurement, timekeeping, and target holding. It does not document recovery between test attempts, time of day, footwear, surface characteristics, standardized encouragement, or the interval between the final training session and posttesting. Attendance, concurrent training volume, fatigue, and adverse events were not reported. These details matter because exercise selection and accumulated exposure are substantive components of plyometric prescription (Chen et al., 2023; Dudagoitia Barrio et al., 2023). They cannot be retrospectively supplied from a general training recommendation.

2.5 Ethical Considerations

The participants were minors. The available study documentation does not establish whether ethics review, parental or guardian permission, and student assent were obtained. No approval identifier or retrospective claim of consent is therefore presented. This reporting gap prevents confirmation of the study's research-governance procedures. Any use of identifiable participant information or training photographs requires authorization appropriate to the students' age and the intended publication. The present article contains no individual participant identifiers or identifiable photographs.

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2.6 Data Analysis

Descriptive interpretation used the reported pretest and posttest means. Absolute change was calculated as posttest minus pretest, and relative change as the absolute change divided by the pretest mean, multiplied by 100. The original report used the Lilliefors test for the pretest and posttest distributions and reported a paired t statistic. The relevant normality assumption for a paired t test concerns the within-participant differences. Separate tests of the two measurement occasions do not establish that assumption, and the difference distribution could not be assessed without the paired observations.

We used a two-sided significance level of .05 for statistical reconstruction. With 11 paired participants, the degrees of freedom are 10, and the corresponding critical t value is 2.228. The reported t = 2.352 was retained rather than recalculated from unavailable observations. Conditional on that value being the correct paired statistic, its two-sided p-value was obtained from the t distribution. The standard error of the mean change was reconstructed as 2.27 divided by 2.352, and an approximate 95% confidence interval was calculated using the t critical value. Standardized paired change was calculated as $d_z = t/\sqrt{11}$.

These reconstructions use rounded source summaries and should be checked against the original paired scores. They are not an independent validation of the t statistic or its assumptions. Pretest and posttest standard deviations, individual response trajectories, and measurement error cannot be recovered from the available report. No homogeneity-of-variance test is required for this paired comparison.

3. RESULTS

3.1 Recorded Performance Change

Table 1 presents the reported means and the calculated changes. The group mean was higher at posttest. The relative change describes the increase in the group mean; it is not the proportion of participants who improved. Without individual scores, the number of responders and the consistency of change across students cannot be determined.

Table 1.

Reported T-kick test performance and descriptive change

Measure	Value	Status
Participants	11	Reported
Pretest mean	17.00	Reported
Posttest mean	19.27	Reported
Mean change	+2.27	Calculated
Relative mean change	+13.35%	Calculated

Note. The protocol describes repeated kicks in 10 seconds. The original report does not identify how right- and left-leg attempts were aggregated. Changes were calculated from the rounded means; no standard deviations or individual scores were available.

3.2 Distribution Checks and Paired Comparison

The original Lilliefors statistics were 0.1668 at pretest and 0.2283 at posttest, each below the reported critical value of 0.2490. These results describe the tests reported for the two occasion-specific distributions. They do not resolve the distribution of paired differences or the scoring ambiguity described in the method.

Table 2 separates the original t statistic from the quantities reconstructed for a paired sample of 11. Under the stated assumptions, the reconstructed two-sided test meets the .05 threshold. The confidence interval is wide, indicating substantial uncertainty around the size of the mean change. Its lower bound is close to zero, and the result depends on the validity of the original t calculation.

Table 2.

Reported test statistic and conditional statistical reconstruction

Quantity	Estimate	Basis
Paired t statistic	2.352	Reported
Degrees of freedom	10	n − 1
Two-sided critical t at α = .05	2.228	t distribution
Two-sided p value	.041	Reconstructed
95% CI for mean change	0.12 to 4.42	Reconstructed
Standardized paired change	0.71	t/√n

Note. Reconstruction assumes that t = 2.352 is the correct paired statistic for all 11 participants. The confidence interval uses the rounded mean change of 2.27. The standardized change is Cohen's d for paired differences, d_z. These estimates are approximate and have not been verified against individual data.

No evidence was available on retention, competition outcomes, injury incidence, or changes in leg strength, power, balance, and reaction time. Therefore, those outcomes are not included as study findings.

4. DISCUSSIONS

4.1 Interpretation of the Performance Change

The students' recorded T-kick test performance improved after the eight-session training period. This finding addresses a local coaching problem and provides a reason to investigate lateral jumping more closely. Its evidential value rests on the observed sequence of testing and training, rather than on a demonstrated causal effect. A repeated field test can improve through technical practice, familiarity with timing and target placement, greater effort,

or changes in how attempts are scored. These explanations remain possible in a design without a comparison group.

The reconstructed standardized paired change of 0.71 expresses the mean change relative to the variability of paired differences implied by the reported t statistic. It does not describe an advantage over usual training and should not be compared directly with a controlled meta-analytic effect as though the estimands were equivalent. Similarly, a statistically detectable difference does not establish a practically worthwhile improvement. That judgment would require a reliable scoring protocol, measurement-error estimates, and a defensible threshold for a meaningful change in performance.

The uncertainty is substantive. The approximate confidence interval ranges from a small positive mean difference to a considerably larger one. The test score's unclear aggregation across legs further restricts its interpretation. Coaches can regard the result as a promising observation in this group, while recognizing that the evidence does not yet quantify the benefit expected for another student or a different training setting.

4.2 Comparison With Recent Training Evidence

The direction of change is consistent with broader evidence that plyometric training can improve selected physical outcomes in combat-sport athletes (Ojeda-Aravena et al., 2023; Yuan et al., 2025). However, those reviews synthesize different martial arts, exercises, training durations, and assessment tasks. They support the general training rationale more strongly than they support this exact intervention. The present result concerns a timed repeated-kick task after eight reported sessions and should remain separate from evidence on maximal strength, jump height, or a single sport-specific movement.

A close contextual comparison is the JUMORA study of low-intensity plyometrics in young pencak silat athletes, which assessed standing broad-jump performance after six weeks (Maghribi & Putri, 2026). Its male sample and lower-limb power outcome show why the current female kicking result addresses a distinct question. The studies address related conditioning questions through different participants and measures.

Evidence from female adolescents strengthens the case for further testing but does not remove the need for sport-specific evaluation. A synthesis of strength and plyometric interventions reports improvements in jumping, sprinting, and change-of-direction performance in female adolescent team-sport athletes (Luo et al., 2025). A controlled study in youth female handball players likewise found improvements in several performance measures following a substantially longer program (Gaamouri et al., 2023). These outcomes involve rapid lower-limb actions, but neither directly validates the T-kick test used here.

Training accumulation also deserves attention. Reviews of female team-sport athletes and adolescent jumping performance indicate that duration, session number, and total contacts can influence how training responses are interpreted (Chen et al., 2023; Lin et al., 2025). Eight sessions cannot be equated with the more fully specified programs in those reviews. Because weekly frequency and contacts were not reported, the present study cannot identify a minimum effective dose or establish whether a longer program would produce a larger, smaller, or more durable change.

4.3 Possible Mechanisms and Limits of Transfer

Side-to-side jumping may provide repeated opportunities to organize landing, propulsion, and lateral displacement. These demands could support aspects of repeated kicking, particularly the transition back to a stable stance. Yet a plausible relationship between tasks is not evidence that the proposed mechanism occurred. The study did not measure muscle activation, tendon behavior, reactive strength, balance, or joint coordination. Improvements in those variables must remain explanatory possibilities rather than reported outcomes.

A review of muscle and tendon adaptations shows that plyometric training can alter selected structural and mechanical characteristics, but its included adult interventions and direct measurements differ from the present study (Ramírez-delaCruz et al., 2022). Likewise, evidence that plyometric jump training improves reactive strength does not establish that reactive strength mediated the observed change in kicking (Ramirez-Campillo, Thapa, et al., 2023). Research on maximal-strength adaptation in soccer provides another example of a physical capacity that can respond to jump training but requires its own assessment (Sanchez-Sanchez et al., 2024). A timed kicking test cannot substitute for any of these measurements.

Movement direction alone is also an incomplete account of transfer. A force-vector review found outcome-dependent differences between horizontally and vertically oriented training (Junge et al., 2023). A study comparing horizontal and vertical jumping in male soccer players reported improvements in both groups, with no clear between-group advantage (Nobari et al., 2023). These findings caution against assuming that lateral jumps are necessarily superior because a T-kick has a lateral component. Direction interacts with support conditions, force production, technique, and outcome-test characteristics.

Unilateral and bilateral exercise comparisons further suggest that benefits can depend on the assessed task (Zhang et al., 2025). Because the current intervention's take-off and landing configuration was not reported, it cannot be confidently classified within that literature. Transfer-oriented accounts of plyometric exercise emphasize the need to connect general physical adaptation with the coordination requirements of the sporting movement (Duchateau & Amiridis, 2023). For T-kicking, that connection requires direct technical practice and a clearly described conditioning stimulus.

4.4 Implications for School Coaching and Participation

The practical attraction of side-to-side jumping is that the exercise concept requires little equipment. A review of neuromuscular programs using minimal or no equipment supports the potential relevance of accessible conditioning, although its evidence was uncertain and came from different youth sporting populations (Muller et al., 2023). Practical guidance for female student athletes also emphasizes progressively integrating strength and plyometric work into school schedules (Talukdar et al., 2023). These sources support a careful development process, rather than assuming a simple exercise is automatically effective or safe for every student.

A coach considering lateral jumps should first establish controllable take-off and landing, adequate space, and the ability to maintain technique. Progression should reflect students' prior experience and observed movement quality. These are prospective practice recommendations, not a reconstruction of what occurred in the eight study sessions. Exact set, repetition, contact, and recovery prescriptions cannot be derived from this report. The original

study also cannot establish an absence of adverse effects because adverse-event monitoring was not documented.

Evidence from other female sports reinforces the importance of matching training to the intended outcome. Plyometric work has been investigated in young female middle-distance runners, whose performance demands differ markedly from repeated martial-arts kicking (Karahan et al., 2024). A Delphi study of elite coaches also shows that exercise pairing, load, rest, and training phase are deliberate programming decisions in more advanced conditioning (Luders et al., 2024). Its recommendations for complex contrast training should not be imported directly into this school program. The relevant lesson is the need to describe and justify the training prescription.

Beyond performance, providing girls with appropriate opportunities to participate in school sport aligns with UNESCO's emphasis on inclusive physical education and development goals on health, education, and gender equality (UNESCO, 2024; United Nations, 2024). Indonesia's human-development priorities offer a compatible national context (Ministry of State Secretariat of the Republic of Indonesia, 2025). The current study did not measure participation equity, enjoyment, health, or educational outcomes, so it cannot demonstrate progress toward those policy goals. Its contribution is narrower: a locally relevant performance observation that can inform the design of better school-based research.

4.5 Limitations and Directions for Further Research

The main limitations are the small purposive sample, single-school setting, absence of a control group, and incomplete description of both training and scoring. The t statistic could not be checked against participant-level observations, and normality of the paired differences remains unknown. The unresolved aggregation of right- and left-leg attempts means that the reported mean change cannot be attributed to a particular leg. Ethics, consent, attendance, and adverse-event documentation were also unavailable. These limitations reduce reproducibility and confidence in causal and practical conclusions.

Future research should compare a fully specified lateral-jump program plus usual technical practice with usual technical practice alone. Random allocation would strengthen inference where feasible. A preliminary reliability phase should establish how valid contacts are counted, whether legs are analyzed separately, how the best attempt is selected, and whether familiarization changes scores. Video-based scoring could assist assessor agreement. Retention testing would distinguish a persistent improvement from a transient posttest change, while attendance and adverse-event records would support an assessment of feasibility.

Participant characterization should include training history and performance level, using clearly defined classifications rather than an unsupported elite label (McKay et al., 2022). Maturation-related reviews indicate why age should be interpreted alongside developmental information (Chen et al., 2025; Ramirez-Campillo, Sortwell, et al., 2023). Research with adolescent females should also use proportionate, respectful procedures for any relevant maturation or menstrual information and avoid attributing unexplained variability to sex-specific mechanisms (Smith et al., 2022). Such improvements would help determine whether the present observation reflects a reproducible training benefit and for whom it is most useful.

5. CONCLUSIONS

Recorded T-kick test performance increased after eight sessions of side-to-side jump training in 11 female pencak silat students aged 14–15 years. Conditional reconstruction of the reported paired t statistic supports a positive within-group mean change, but individual data are needed to verify that analysis. The study provides preliminary support for investigating lateral jumping alongside technical practice. It does not establish a causal training effect, an optimal exercise dose, or improved competition performance. A controlled study with explicit scoring, training, and ethical procedures is needed before stronger recommendations can be made.

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