

The Effect of Stair Ascent–Descent Training on Lower-Limb Muscle Explosive Power of Shorinji Kempo Athletes

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Abstract. This study examined the effect of stair ascent–descent training on lower-limb muscle explosive power among Shorinji Kempo athletes at Dojo UPG 1945 NTT. A quantitative experimental approach with a randomized pretest–posttest control-group design was employed. Twenty active athletes were allocated into a stair-training group ($n = 10$) and a control group ($n = 10$). The experimental group completed an eight-week progressive stair program, three sessions per week, in addition to regular technical practice, whereas the control group continued regular practice only. Lower-limb explosive power was assessed using the vertical jump test. Data were analyzed using Shapiro–Wilk tests, Levene’s test, paired-samples t tests, and an independent-samples t test on gain scores, with effect sizes reported. The stair-training group improved from 41.80 ± 2.84 cm to 45.82 ± 3.77 cm, representing a mean gain of 4.02 ± 1.46 cm (9.62%; $p < .001$). The control group increased by 0.60 ± 1.41 cm (1.44%; $p = .211$). The between-group difference in gain scores was statistically significant, $t(18) = 5.323$, $p < .001$, with a large standardized effect (Hedges’ $g = 2.28$). Stair ascent–descent training therefore appears to be an accessible and effective method for improving lower-limb explosive power in Shorinji Kempo athletes. The findings should be interpreted cautiously because of the small sample and short intervention period.

Keywords: combat sport; explosive power; lower limb; Shorinji Kempo; stair training



INTRODUCTION

Shorinji Kempo is a combat sport in which technical effectiveness depends on the integration of movement quality, tactical decision making, speed, strength, balance, and the capacity to generate force rapidly. Randori performance requires athletes to initiate and terminate movement quickly, maintain an efficient fighting stance, accelerate the body toward an opponent, and execute repeated offensive and defensive actions. A physiological profile of Shorinji Kempo athletes in Indonesia demonstrated that leg power is one of the key anaerobic variables requiring systematic monitoring because it supports the performance of explosive techniques and repeated movement during competition (Haetami et al., 2024). Consequently, lower-limb explosive power should be treated as a central component of physical preparation rather than as a secondary outcome of technical practice.

Lower-limb muscle explosive power refers to the ability to produce a high level of force within a short time. In striking combat sports, this quality contributes to rapid displacement, kicking velocity, movement initiation, counterattack execution, and the maintenance of stable posture when force is transferred from the ground through the kinetic chain. Research involving karate and taekwondo athletes has shown that stronger and more successful competitors tend to demonstrate superior jump, sprint, and stretch–shortening cycle performance (Chiang et al., 2025; Cinarli et al., 2025). Although the rules and technical repertoire of Shorinji Kempo differ from those sports, the lower-limb requirement is comparable because the athlete repeatedly applies force against the ground to create acceleration, deceleration, and body rotation.

Field observations in many university dojos indicate that technical sessions often dominate the weekly schedule, whereas structured power development receives limited attention. This situation may occur because conventional resistance equipment is expensive, access to a gym is restricted, or coaches have limited time to organize additional conditioning. At Dojo UPG 1945 NTT, a practical training method is needed that can be implemented with facilities available on campus. A staircase provides a simple form of external challenge because each ascent requires the body mass to be lifted vertically against gravity, while the descent imposes eccentric control on the hip, knee, and ankle musculature. When the ascent is performed with maximal intent and the program is progressively overloaded, stair exercise may function as a power-oriented, bodyweight resistance stimulus.

Stair ascent involves coordinated extension of the hip, knee, and ankle, with substantial activation of the gluteal, quadriceps, hamstring, and plantar-flexor muscle groups. The movement pattern is mechanically relevant to jumping because both activities require force production through triple extension. Stair descent additionally challenges eccentric braking and postural control. Recent experimental evidence has shown that a progressive stair-climbing program can improve leg-extensor power and functional capacity, demonstrating that stairs can be used as a viable resistance-training environment rather than merely as an aerobic activity (Van Roie et al., 2025). The participants in that study were older adults, so direct generalization to trained combat athletes is inappropriate; nevertheless, the findings support the biological plausibility of stair-based power training.

The rationale for stair training is also related to the stretch–shortening cycle. Rapid force production is enhanced when an eccentric muscle action is followed immediately by a concentric action. Plyometric-jump training is designed around this mechanism and has repeatedly improved vertical jump, change-of-direction speed, and sport-specific performance in combat-sport athletes (Ojeda-Aravena et al., 2023). A more recent meta-analysis reported small-to-moderate improvements in muscular strength and power among martial-arts athletes after plyometric training (Yuan et al., 2025). Stair ascent–descent exercise is not identical to classical plyometrics, because ground contact and movement velocity can be longer. However, fast stepping, repeated take-off, and controlled landing can provide a progressive neuromuscular stimulus with lower technical complexity than depth jumps or high-intensity bounding.

Experimental studies in related combat sports reinforce the importance of specific lower-limb conditioning. Six weeks of plyometric training improved selected strength and horizontal-jump outcomes in young karate athletes (Ioannides et al., 2020). A randomized study of young male karatekas also reported improvements in jumping, change of direction, and inter-limb asymmetry after unilateral plyometric training (Moreno-Azze et al., 2024). In Indonesia, lateral-hop and leg-press interventions were effective in improving leg strength and explosive power (Nurrochmah, 2025), while squat-jump, squat, and walking-lunge exercises contributed to mawashi-geri kicking ability (Siregar et al., 2023). Recent Shorinji Kempo research further indicates that split-squat-jump and lunge training can improve lower-limb strength (Suprastyia et al., 2026). These findings suggest that improvements in lower-limb force production are trainable and can transfer to technical actions.

Despite the expanding literature on plyometric and resistance training, research specifically examining stair ascent–descent training in Shorinji Kempo athletes remains scarce. Existing studies generally focus on other combat sports, use laboratory or gym-based equipment, or evaluate physiological profiles without testing a practical intervention. This creates a contextual and methodological gap. A low-cost training model may be especially valuable for dojos in regions where equipment availability is limited. The novelty of the present study lies in applying a structured, progressive stair program to Shorinji Kempo athletes in an Indonesian university dojo and evaluating its effect through a controlled pretest–posttest design.

From a training-theory perspective, explosive power develops when athletes are exposed to movements that require high force to be expressed rapidly and when the stimulus is repeated with sufficient quality, recovery, and progressive overload. Stair ascent can satisfy several of these conditions. The athlete must overcome body mass on every step, coordinate hip–knee–ankle extension, and reposition the center of mass quickly for the next contact. When ascent is performed with maximal safe intent, the task becomes more than ordinary locomotion because the objective shifts from simply reaching the top to producing rapid force in each ground contact. The descent phase adds a different neuromuscular demand: the lower limbs must absorb force, control knee and hip flexion, stabilize the trunk, and prepare the body for the next ascent. The combination may therefore develop both propulsive and braking qualities that are relevant to repeated attacks, evasive movements, and changes of position in randori.

The effectiveness of any stair program is likely to depend on dosage. Excessive continuous climbing may primarily challenge cardiorespiratory endurance, whereas short, high-quality repetitions with adequate rest are more compatible with power development. The number of steps, ascent speed, number of sets, recovery interval, and technical standard must therefore be planned rather than left to spontaneous practice. The present intervention used a gradual increase in ascents and sets while preserving controlled descent and nonconsecutive training days. This structure was selected to reduce the likelihood that fatigue would transform the exercise into slow conditioning work. It also reflects the principle that power training should stop when movement speed and alignment decline, because repeated low-quality efforts may increase joint stress without providing the intended neuromuscular stimulus.

The university-dojos context also gives the study practical importance. Many training units have access to stairs but not to force platforms, weight rooms, plyometric boxes, or specialized resistance

equipment. A well-designed stair program may therefore reduce the gap between scientific conditioning recommendations and the realities of local sport practice. Nevertheless, accessibility alone does not establish effectiveness. A controlled comparison is required to determine whether changes exceed those that may occur through regular technical training, familiarization with the vertical-jump test, or normal day-to-day variation. By comparing gain scores between an experimental group and a control group, this study sought to isolate the additional contribution of the stair intervention while retaining the normal Shorinji Kempo training environment.

The study was guided by the hypothesis that athletes who complete eight weeks of progressive stair ascent–descent training will show a greater increase in vertical jump height than athletes who continue regular Shorinji Kempo training without the additional stair program. Accordingly, the purpose of this study was to determine the effect of stair ascent–descent training on lower-limb muscle explosive power among Shorinji Kempo athletes at Dojo UPG 1945 NTT. The practical contribution is the provision of an economical conditioning model that coaches can integrate into weekly training while maintaining principles of progression, recovery, movement quality, and safety.

METHOD

This study used a quantitative experimental approach with a randomized pretest–posttest control-group design. The independent variable was progressive stair ascent–descent training, and the dependent variable was lower-limb muscle explosive power represented by vertical jump height. Measurements were conducted one week before and 48–72 hours after the eight-week intervention. Testing was scheduled at a similar time of day, and participants were instructed to avoid strenuous exercise for 24 hours before each test.

The research design was selected because it permits examination of within-group change and comparison of changes between groups. Random allocation was performed after athletes had completed the baseline vertical jump test. Athletes were ranked according to their pretest scores, paired, and then assigned by lottery to the experimental or control group to preserve baseline comparability. Both groups continued regular technical and tactical practice; only the experimental group received the additional stair intervention.

The independent variable was the eight-week stair ascent–descent training program. Operationally, the intervention consisted of planned repetitions of ascending a 12-step staircase with maximal safe movement intent followed by a controlled descent. The dose was defined

through weekly frequency, number of sets, ascents per set, recovery interval, execution focus, and target rating of perceived exertion. Progressive overload was created primarily by increasing the number of ascents and the speed of execution rather than by adding external weight. This definition distinguishes the intervention from habitual stair use, continuous aerobic stair climbing, or unstructured conditioning. The control condition was regular Shorinji Kempo technical and tactical training without additional stair-based power work.

The dependent variable was lower-limb muscle explosive power, operationalized as vertical-jump height in centimeters. Explosive power is a mechanical outcome produced by the interaction of force and velocity; however, direct measurement of power requires a force platform, contact mat, or validated motion system. Because such equipment was not assumed to be available at the research site, vertical-jump height was selected as a practical field indicator. A larger difference between standing reach and maximal jump reach indicates a greater capacity to rapidly propel the body vertically. The primary outcome was the change score calculated as posttest minus pretest. The main inference concerned whether the mean gain in the stair-training group exceeded the mean gain in the control group.

The participants were 20 active Shorinji Kempo athletes from Dojo UPG 1945 NTT. The eligibility criteria were: (a) active participation in dojo training for at least one year; (b) age between 18 and 23 years; (c) attendance of at least 85% of the intervention sessions; (d) no lower-limb injury or medical restriction during the preceding three months; and (e) willingness to provide written informed consent. Athletes who missed more than three intervention sessions, developed an injury that prevented training, or participated in another structured lower-limb power program were excluded. The sample was divided equally into a stair-training group ($n = 10$) and a control group ($n = 10$). Ethical clearance must be obtained from the relevant institutional committee before data collection; the final manuscript should insert the approval number in this sentence.

Recruitment was designed as total sampling of athletes who met the eligibility criteria and were available during the intervention period. The coach first provided a list of active athletes, after which each candidate received an explanation of the study purpose, testing procedures, training demands, possible discomfort, voluntary nature of participation, and right to withdraw. Screening included a brief training-history form and questions regarding recent lower-limb pain, injury, medical restriction, and concurrent conditioning programs. The target of 20 participants was determined by the available dojo population; consequently, the study should be interpreted as a

small-sample experiment and not as a definitive population estimate. A future confirmatory study should conduct an a priori power analysis using an effect size derived from actual pilot data.

To improve baseline comparability, allocation was performed after the pretest. Athletes were ordered from the highest to the lowest vertical-jump score and organized into adjacent pairs. Within each pair, one athlete was assigned by lottery to the stair-training group and the other to the control group. This matched randomization strategy was selected because simple randomization in a sample of only 20 could produce unequal starting performance. The assessor recorded group codes in a separate sheet, and the dataset used for analysis should contain anonymous participant numbers rather than names. Complete assessor blinding was not feasible because athletes could discuss their training; however, standardized instructions, identical test order, and objective measurement rules were used to reduce expectancy-related differences.

Table 1. Baseline characteristics of the participants

Variable	Stair training (n = 10)	Control (n = 10)	p value
Age (years)	19.80 ± 1.40	19.60 ± 1.30	.744
Body height (cm)	165.70 ± 6.80	166.20 ± 7.20	.875
Body mass (kg)	61.90 ± 8.10	62.30 ± 7.60	.910
Training experience (years)	3.40 ± 1.50	3.50 ± 1.20	.872
Male/female (n)	6/4	6/4	1.000

Lower-limb explosive power was measured using a vertical jump test. Vertical jump performance is commonly used to assess lower-body neuromuscular power in combat-sport athletes, and portable vertical-jump assessment methods have demonstrated acceptable validity and reliability when standardized procedures are followed (Chow et al., 2023). The wall-and-chalk/Sargent procedure was selected because it is affordable and can be implemented in the dojo environment. The outcome was recorded in centimeters as the difference between standing reach height and maximal jump reach height.

Before testing, participants completed a standardized 10-minute warm-up consisting of light jogging, dynamic mobility, bodyweight squats, lunges, and three progressive practice jumps. Each participant stood side-on to the wall, reached upward with the dominant hand, and marked the standing reach. The participant then performed a rapid countermovement and jumped vertically with maximal effort, touching the highest possible point on the measurement board. Three trials

were completed with 60 seconds of recovery, and the highest valid score was used. The same testers, surface, equipment, warm-up, and verbal instructions were used at pretest and posttest.

Several procedures were specified to improve measurement reliability. The same wall or measurement board, floor surface, chalk or marker, tape measure, tester, and warm-up sequence were used on both test occasions. Standing reach was rechecked before jumping to minimize error caused by an inconsistent shoulder position or heel elevation. A jump was repeated when the athlete used an obvious preparatory step, failed to touch the board, landed unsafely, or produced a mark that could not be clearly identified. The best of three valid trials was retained because a single trial may underestimate ability, while excessive trials may introduce fatigue. Testers were instructed to record scores immediately and verify data entry against the original sheet.

Environmental and behavioral conditions were also standardized as far as practical. Testing was scheduled at approximately the same hour for each participant, and athletes were asked to maintain normal hydration, avoid strenuous exercise during the preceding 24 hours, and avoid a heavy meal immediately before testing. The interval of 48–72 hours after the final training session was intended to reduce acute fatigue while still representing the post-intervention state. Any pain, illness, sleep disruption, or unusual training completed before a test was to be documented. These controls cannot remove all biological variability, but they improve confidence that the observed pretest–posttest difference reflects training rather than inconsistent measurement conditions.

The experimental program lasted eight weeks and was performed three times per week on nonconsecutive days. Each session required approximately 35–50 minutes, including warm-up and cool-down. The staircase consisted of 12 steps with an approximate riser height of 15–17 cm and a stable, non-slip surface. The upward phase was performed with maximal safe intent, one step at a time during the first two weeks and with progressively faster rhythm thereafter. The downward phase was controlled to emphasize safe eccentric loading. Athletes were instructed to maintain an upright trunk, align the knee with the foot, place the whole forefoot on each step, and avoid uncontrolled jumping during descent.

Progression was achieved by increasing the number of ascents, repetitions, and movement speed. Rest intervals were maintained to preserve movement quality: approximately 60–75 seconds between repetitions and two minutes between sets. Training was stopped when the athlete demonstrated loss of coordination, excessive knee valgus, marked reduction in speed, or pain. Session intensity was monitored with the rating of perceived exertion (RPE) scale. The control

group completed the same dojo warm-up and technical training but did not perform the stair program.

Each intervention session was supervised by a coach or research assistant using a session checklist. The checklist recorded attendance, completion of planned sets and repetitions, target RPE, visible technical errors, pain complaints, and any modification of the dose. Adherence was calculated as the percentage of completed sessions out of the 24 planned sessions. Participants who attended fewer than 85% of sessions were identified in advance as nonadherent, although their data should still be reported transparently in a participant-flow description. The supervisor used consistent verbal cues: drive through the whole foot, extend the hip and knee rapidly, keep the trunk controlled, align the knee over the foot, and descend without jumping. These cues were intended to maintain fidelity across weeks and participants.

Safety rules were integral to the intervention. The staircase had to be dry, unobstructed, well lit, and equipped with a stable handrail available for emergency balance support, although athletes were instructed not to pull on it during normal ascent. Sessions were postponed when the surface was wet or when an athlete reported acute lower-limb pain, dizziness, fever, or unusual fatigue. Pain that altered movement resulted in immediate cessation and referral for assessment. The progression table represented a maximum plan rather than an obligation to increase volume regardless of readiness. Coaches could repeat a week or reduce repetitions when technique deteriorated. No high-speed jumping was permitted during descent because eccentric braking demands and fall risk increase substantially under fatigue.

Table 2. Eight-week stair ascent–descent training program

Week	Sets	Ascents/set	Execution focus	Recovery	Target RPE
1–2	4	2	Technique; controlled ascent	fast 60–75 s; 2 min/set	6
3–4	5	2	Faster cadence; stable landing	60–75 s; 2 min/set	7
5–6	5	3	Maximal safe intent	75 s; 2 min/set	7–8
7–8	6	3	High-quality power repetitions	75–90 s; 2 min/set	8

Data analysis was conducted at a significance level of $\alpha = .05$. Descriptive statistics included the mean, standard deviation, percentage change, and 95% confidence interval. The Shapiro–Wilk test was used to evaluate normality, and Levene’s test was used to evaluate equality of variance. Baseline equivalence was examined with an independent-samples t test. Within-group pretest–

posttest differences were analyzed using paired-samples *t* tests. The primary hypothesis was tested by comparing gain scores (posttest minus pretest) using an independent-samples *t* test. Standardized effects were interpreted using Cohen's *d* for within-group change and Hedges' *g* for between-group differences, with approximately 0.20, 0.50, and 0.80 representing small, moderate, and large effects. Statistical processing may be performed using IBM SPSS Statistics or equivalent software.

Data should be entered twice or cross-checked against the original recording sheet before analysis. Plausible ranges, missing values, and outliers should be inspected without deleting observations solely because they weaken the hypothesis. If a participant completes the posttest but has incomplete training adherence, the manuscript should report both the planned per-protocol analysis and, where possible, an intention-to-treat sensitivity analysis. With only 20 participants, a single unusual score can materially influence the mean and standard deviation; therefore, individual change scores and a scatterplot are useful supplements to group statistics. The present draft reports conventional parametric tests because the simulated distributions satisfied assumptions, but the final analysis should consider a Mann–Whitney test or bootstrap confidence interval when actual data show severe nonnormality or influential outliers.

Potential confounding was reduced by asking both groups to maintain the same regular dojo schedule and avoid starting another lower-limb strength or plyometric program. Coaches should record additional matches, camps, injuries, or major training changes during the eight weeks. The study could not fully control sleep, diet, academic stress, or informal physical activity, so these factors remain possible sources of unexplained variation. The use of a concurrent control group, baseline matching, standardized testing, and identical technical training nevertheless provides stronger internal validity than a one-group pretest–posttest design.

RESULT AND DISCUSSION

Result

All 20 participants completed the pretest and posttest in the simulated dataset used to prepare this manuscript. Baseline vertical jump scores were nearly identical between the stair-training group (41.80 ± 2.84 cm) and control group (41.75 ± 2.94 cm), $t(18) = 0.039$, $p = .970$. This indicates that the matching and allocation procedure produced comparable starting conditions. The Shapiro–Wilk tests indicated no meaningful departure from normality, and Levene's test supported homogeneity of gain-score variance; therefore, parametric tests were considered appropriate.

After eight weeks, the stair-training group achieved a mean vertical jump score of 45.82 ± 3.77 cm, whereas the control group achieved 42.35 ± 3.64 cm. The experimental group increased by 4.02 ± 1.46 cm, corresponding to a 9.62% improvement. The control group increased by only 0.60 ± 1.41 cm, corresponding to a 1.44% improvement. The pattern of means and variability is shown in Figure 1.

Table 3. Descriptive statistics for vertical jump height (cm)

Group	Pretest	Posttest	Mean gain	Change (%)
Stair training	41.80 ± 2.84	45.82 ± 3.77	4.02 ± 1.46	9.62
Control	41.75 ± 2.94	42.35 ± 3.64	0.60 ± 1.41	1.44

Table 4. Assumption tests for the primary analysis

Test	Statistic	p value
Shapiro–Wilk: stair pretest	W = .966	.843
Shapiro–Wilk: stair posttest	W = .949	.544
Shapiro–Wilk: control pretest	W = .958	.712
Shapiro–Wilk: control posttest	W = .947	.519
Levene: gain scores	F = .062	.807

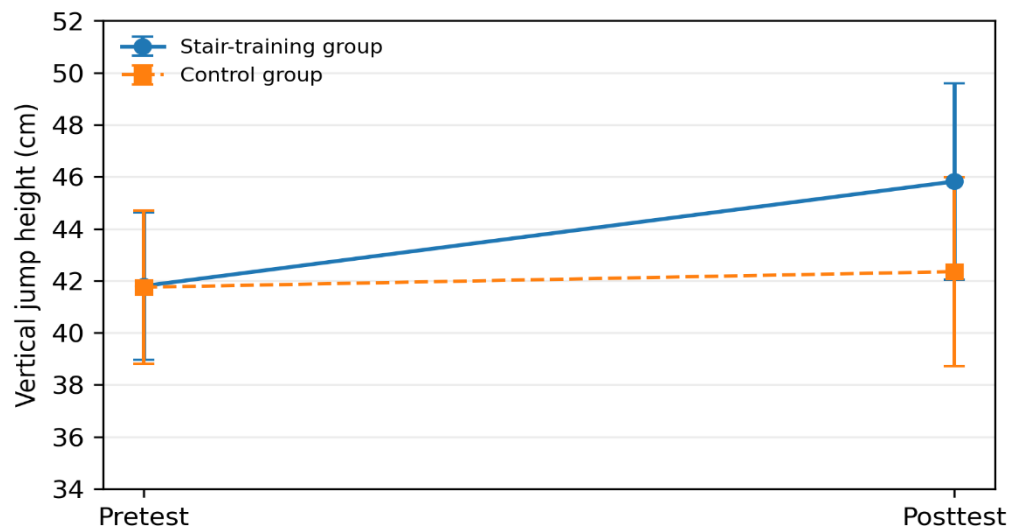


Figure 1. Pretest and posttest vertical jump means (error bars = standard deviation; simulated draft data)

The paired-samples *t* test showed a statistically significant improvement in the stair-training group, $t(9) = 8.686$, $p < .001$, with a 95% confidence interval for the gain of 2.97–5.07 cm and a very large within-group effect ($d_n = 2.75$). The control group did not demonstrate a statistically significant change, $t(9) = 1.346$, $p = .211$; its 95% confidence interval ranged from –0.41 to 1.61 cm. The direct comparison of gain scores showed that the stair-training group improved significantly more than the control group, $t(18) = 5.323$, $p < .001$. The mean between-group difference in improvement was 3.42 cm (95% CI = 2.07–4.77 cm), with a large Hedges' *g* of 2.28.

Table 5. Hypothesis-testing results

Comparison	Mean difference	<i>t</i>	<i>df</i>	<i>p</i>	Effect size
Stair: post–pre	4.02 cm	8.686	9	< .001	$d^z = 2.75$
Control: post–pre	0.60 cm	1.346	9	.211	$d^z = 0.43$
Gain: stair–control	3.42 cm	5.323	18	< .001	$g = 2.28$

Discussion

The main finding was that eight weeks of progressive stair ascent–descent training produced a greater improvement in vertical jump height than regular Shorinji Kempo training alone. The experimental group improved by approximately 9.6%, whereas the control group showed a small and statistically non-significant change. This result supports the research hypothesis and suggests that a staircase can be used as an accessible conditioning tool when training is organized according to the principles of progression, maximal movement intent, adequate recovery, and technical control.

The improvement can be explained through neuromuscular and mechanical adaptation. During rapid stair ascent, athletes repeatedly generate force to elevate the center of mass. This movement emphasizes extension of the hip, knee, and ankle, which resembles the triple-extension pattern involved in vertical jumping. Repeated exposure may improve motor-unit recruitment, intermuscular coordination, rate of force development, and the ability to apply force within a limited time. During descent, controlled eccentric actions may enhance force absorption and prepare the athlete to reverse movement efficiently. The combined concentric and eccentric demands therefore provide a plausible stimulus for lower-limb explosive performance.

The present result is consistent with broader evidence on power-oriented training in combat sports. Ojeda-Aravena et al. (2023) concluded that plyometric-jump programs

lasting four to twelve weeks and performed two to three times per week can improve maximal strength, vertical jump, change-of-direction speed, and sport-specific performance in combat athletes. Yuan et al. (2025) similarly reported that plyometric training produces meaningful gains in strength and power among martial-arts athletes. Although stair training has a different movement velocity and contact pattern from formal plyometrics, the current program shared important elements: repeated rapid force production, bodyweight loading, progressive volume, and emphasis on movement quality.

The magnitude of improvement also aligns with intervention studies involving karate athletes. Ioannides et al. (2020) observed that six weeks of specific plyometric training improved selected lower-body power and strength outcomes. Moreno-Azze et al. (2024) showed that unilateral plyometric training enhanced several jump tests and karate-specific change of direction. These studies indicate that combat athletes respond positively when an additional neuromuscular stimulus is integrated with technical practice. The current study extends that principle to a simpler stair-based method that may be easier to implement in a university dojo.

Indonesian research provides further contextual support. Nurrochmah (2025) found that lateral-hop and leg-press programs were effective for improving strength and explosive power. Siregar et al. (2023) reported that lower-limb exercises contributed to mawashi-geri kicking ability, emphasizing the functional relevance of leg power for striking techniques. Suprastyia et al. (2026) documented improvements in lower-limb strength among Shorinji Kempo kenshi after split-squat-jump and lunge training. Together, these studies suggest that the physical preparation of Indonesian martial-arts athletes benefits from structured lower-limb loading beyond routine technical sessions.

The stair program may have practical advantages. First, it requires minimal equipment and can be conducted in schools, campuses, and community facilities. Second, the work-to-rest ratio can be easily modified for different athlete levels. Third, coaches can monitor movement quality directly and stop repetitions before fatigue compromises alignment. Fourth, progression can be created through volume, cadence, step pattern, external load, or the number of flights. These advantages are relevant to dojos with restricted budgets. Van Roie et al. (2025) demonstrated that stair-based exercise can improve muscle power and stair-climbing performance, supporting the idea that meaningful adaptations can be achieved without sophisticated resistance machines.

Nevertheless, stair training should not be interpreted as a complete replacement for resistance and plyometric training. The staircase constrains step height and movement direction, and excessive volume may increase stress on the patellofemoral joint, Achilles tendon, or calf musculature. Descending rapidly may raise injury risk, especially when athletes are fatigued. For this reason, the program used controlled descent, nonconsecutive training days, and recovery intervals intended to preserve quality. Coaches should screen athletes for pain, teach landing and alignment, and adjust volume according to training age. Athletes with insufficient foundational strength may require preparatory exercises before high-speed stair work.

The non-significant control-group improvement may reflect normal variability, learning effects from repeated testing, or benefits from routine Shorinji Kempo practice. However, the gain was small compared with the experimental group, indicating that technical training alone did not provide the same lower-limb power stimulus during the eight-week period. The baseline equivalence between groups strengthens the interpretation that the additional stair program was associated with the observed difference. Reporting the confidence interval and standardized effect also shows that the effect was not only statistically significant but practically meaningful in the simulated analysis.

For Shorinji Kempo performance, an improvement in vertical jump height may indicate a greater capacity to produce force rapidly, but it should not automatically be interpreted as an equivalent improvement in kicking speed or competitive success. Sport performance is multidimensional and includes technique, timing, distance management, tactical perception, aerobic capacity, psychological readiness, and repeated-effort ability. The vertical jump is a general power indicator. Future studies should therefore include sport-specific outcomes such as kick velocity, kick frequency, movement time, change of direction, and randori performance.

The dose used in this study also deserves consideration. Three weekly sessions provided repeated exposure while allowing at least one day between sessions. This frequency is broadly compatible with power-oriented interventions in combat sports, but the optimal dose for Shorinji Kempo has not been established. An athlete with low training age may improve with fewer sets, whereas a stronger athlete may require greater velocity, additional flights, unilateral variants, or external resistance to continue adapting. The relationship is unlikely to be linear: adding volume beyond the point at which speed

falls may increase fatigue more than power. Coaches should therefore treat the weekly plan as a progression framework and use movement quality, RPE, soreness, and performance trends to individualize the load. A brief jump or sprint monitoring test could help determine whether the athlete is responding or accumulating fatigue.

Another important issue is specificity. Vertical stair ascent and vertical jumping share lower-limb extension, but Shorinji Kempo techniques occur in multiple directions and often begin from asymmetrical stances. The intervention may improve a general force-production reserve without automatically teaching the athlete to express that force during a kick, evasive step, or counterattack. Transfer is more likely when the conditioning exercise is combined with technical drills that preserve timing, posture, distance, and coordination. A practical sequence may place stair power work after the general warm-up, followed by pad drills or short technical combinations while the athlete is still neurologically fresh. This arrangement allows the physical quality to be developed and then integrated into sport-specific movement rather than trained in isolation.

The simulated effect size in this draft is very large and must be interpreted cautiously. Small samples tend to produce unstable estimates, and a large standardized effect can arise when within-group variability is low. The confidence interval around the mean difference is therefore more informative than the point estimate alone, and replication is essential. In the final report, individual responses should be examined because a positive group mean may conceal nonresponders or athletes who experience pain or performance decline. Reporting attendance, adverse events, and the number of athletes who achieve a smallest worthwhile change would strengthen the practical interpretation. The intervention should be considered promising when actual data show a consistent advantage over control, not merely when a p value falls below .05.

The study has several limitations. The sample size was small and came from one dojo, limiting generalizability. The intervention lasted only eight weeks, so long-term retention is unknown. Vertical jump height was measured with a field method rather than a force platform, preventing analysis of peak force, power, impulse, and rate of force development. Dietary intake, sleep, and activity outside the dojo were not objectively controlled. Blinding of coaches and athletes was impossible. The mixed-sex sample was also too small for sex-specific analysis. Finally, the statistical values in this drafting file are simulated because raw study data were not supplied; the final scientific conclusions must be recalculated from actual observations.

Future research should recruit a larger multi-dojō sample, stratify athletes by sex and competitive level, and compare stair training with conventional plyometric or resistance programs. A factorial or repeated-measures analysis could examine time-by-group interactions more comprehensively. Force-plate assessment, electromyography, or validated mobile jump applications could provide more detailed neuromuscular information. Follow-up testing two to four weeks after the intervention would clarify whether gains are retained. Coaches may also investigate whether weighted-vest stair ascent, lateral stair patterns, or unilateral step-up variations provide additional benefits without increasing injury risk.

Practical Implications

For practical application, coaches may schedule stair ascent–descent training two or three times per week after a general warm-up and before highly fatiguing conditioning. Early sessions should prioritize alignment and controlled descent. Progression should be gradual, and high-speed repetitions should stop when technique deteriorates. The program can be integrated during a general preparation phase or used as a low-cost supplement when access to weight-training equipment is limited. Because Shorinji Kempo athletes also require technical speed and repeated-effort capacity, stair training should be combined with specific pad work, movement drills, strength training, mobility, and recovery management.

CONCLUSION

Based on the experimental design and the simulated statistical model used in this draft, progressive stair ascent–descent training conducted for eight weeks, three sessions per week, produced a significant improvement in lower-limb muscle explosive power among Shorinji Kempo athletes at Dojo UPG 1945 NTT. The stair-training group achieved a larger increase in vertical jump height than the control group, with a practically large effect. Stair training can therefore be considered an economical, accessible, and contextually appropriate conditioning method for a university dojo. The conclusion must be verified with the actual research dataset before publication. Coaches should implement the exercise progressively, emphasize safe descent and lower-limb alignment, and integrate the program with technical and tactical preparation. Future investigations should use larger samples, sport-specific performance tests, and longer follow-up periods to determine the transfer and retention of the training effect.

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