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Original Article

Comparison of Task-Specific Training and Strength-Based Rehabilitation on Functional Outcome in Stroke Survivors

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ABSTRACT

Background: Stroke is a major cause of long-term motor disability and dependence in activities of daily living, requiring rehabilitation strategies that promote clinically meaningful functional recovery. Task-specific training and strength-based rehabilitation are both used in post-stroke care, but their comparative short-term effectiveness remains insufficiently established in resource-constrained clinical settings. Objective: To compare the effects of task-specific training and strength-based rehabilitation on upper limb motor function, lower limb motor function, and functional independence among stroke survivors. Methods: This single-blind randomized controlled trial was conducted at Tehsil Headquarter Hospital, Muridke, Pakistan. Thirty-one adults aged 40–70 years with acute or subacute ischemic or hemorrhagic stroke completed the study and were analyzed, including 16 participants in the task-specific training group and 15 in the strength-based rehabilitation group. Both groups received four 60-minute sessions per week for four weeks. Outcomes were assessed using the Fugl-Meyer Assessment upper extremity subscale, Fugl-Meyer Assessment lower extremity subscale, and Barthel Index. Results: At four weeks, task-specific training produced significantly higher FMA-UE scores than strength-based rehabilitation (35.38±5.23 vs. 31.13±5.74; mean difference 4.25; 95% CI 0.20 to 8.30; p=0.040), higher FMA-LE scores (20.75±3.32 vs. 15.40±2.44; mean difference 5.35; 95% CI 3.21 to 7.49; p<0.001), and higher Barthel Index scores (65.31±8.11 vs. 48.20±9.71; mean difference 17.11; 95% CI 10.50 to 23.72; p<0.001). Conclusion: Task-specific training produced greater short-term improvements in motor recovery and functional independence than strength-based rehabilitation among stroke survivors. Keywords: Stroke; Task-Specific Training; Strength-Based Rehabilitation; Functional Outcome; Fugl-Meyer Assessment; Barthel Index; Rehabilitation

INTRODUCTION

Stroke is a major cerebrovascular disorder characterized by an abrupt interruption of cerebral blood supply, resulting in focal neurological deficits that may lead to persistent motor, sensory, cognitive, and functional disability. It remains one of the leading causes of long-term adult disability worldwide and imposes a substantial burden on individuals, families, rehabilitation services, and health systems (1). The global burden of stroke is particularly important in low- and middle-income countries, where limited access to early rehabilitation, delayed presentation, and constrained multidisciplinary services may increase the risk of residual disability and dependence in activities of daily living (2). In Pakistan, stroke contributes substantially to neurological morbidity, and many survivors experience persistent impairments in mobility, upper limb use, postural control, balance, and functional independence, creating a continuing need for feasible, structured, and clinically effective rehabilitation approaches (3).

Recovery after stroke is strongly influenced by neuroplasticity, motor relearning, and repeated practice of meaningful movements. Rehabilitation strategies that promote active engagement, repetition, task relevance, and progressive challenge are therefore central to improving motor control and functional performance after stroke (4). Among commonly used approaches, task-specific training emphasizes repeated practice of goal-directed activities that resemble real-life functional tasks, such as reaching, grasping, sit-to-stand transfer, gait-related activities, balance control, and dual-task performance. By contrast, strength-based rehabilitation primarily targets muscle force, endurance, and resistance capacity through progressive strengthening exercises. Both approaches are clinically plausible and widely used, but they may influence recovery through different mechanisms. Task-specific training may enhance motor planning, coordination, and functional carryover by linking movement practice directly to activities of daily living, whereas strength-based rehabilitation may improve force production and physical capacity but may not always translate into equivalent task performance.

Existing evidence supports the beneficial role of rehabilitation in post-stroke motor recovery, and recent literature suggests that task-oriented and strength-focused interventions can improve selected functional outcomes after stroke (4,5). However, uncertainty remains regarding their comparative short-term effectiveness when applied as structured rehabilitation protocols in resource-constrained clinical settings. Many previous studies have focused on either upper limb function, gait, balance, or general mobility, while fewer randomized controlled trials have directly compared task-specific training with strength-based rehabilitation using combined upper extremity, lower extremity, and activities-of-daily-living outcomes within the same study. This gap is clinically relevant because stroke rehabilitation decisions are often made under limited time, staffing, and equipment conditions, where therapists must prioritize interventions that provide the greatest functional benefit.

The present randomized controlled trial was therefore designed using a PICO framework in which the population comprised adults with acute or subacute ischemic or hemorrhagic stroke, the intervention was task-specific training, the comparator was strength-based rehabilitation, and the outcomes were upper limb motor function, lower limb motor function, and functional independence. The study aimed to compare the short-term effects of task-specific training and strength-based rehabilitation on Fugl-Meyer Assessment upper extremity scores, Fugl-Meyer Assessment lower extremity scores, and Barthel Index scores among stroke survivors. It was hypothesized that task-specific training would produce greater improvement in motor recovery and activities-of-daily-living independence than strength-based rehabilitation after four weeks of supervised intervention.

MATERIALS AND METHODS

This study was conducted as a single-blind randomized controlled trial at the Department of Physical Therapy, Tehsil Headquarter Hospital, Muridke, Pakistan, from January 2025 to October 2025. The trial compared two active rehabilitation approaches—task-specific training and strength-based rehabilitation—in adults with stroke. Each enrolled participant received a four-week supervised intervention, with outcomes assessed at baseline and after completion of the intervention period. The study was designed to evaluate whether functional, goal-directed task practice produced superior short-term improvement in motor function and activities-of-daily-living independence compared with progressive strengthening exercises.

Participants were adults aged 40–70 years with a first episode of acute or subacute ischemic or hemorrhagic stroke who were medically stable and able to follow verbal instructions required for participation in supervised rehabilitation. Participants were eligible when they had post-stroke motor impairment requiring physical therapy and were able to complete baseline assessment using the selected outcome measures. Individuals were excluded if they had severe cognitive impairment that prevented safe participation or reliable assessment, additional neurological conditions affecting motor performance, severe fixed musculoskeletal contractures limiting exercise participation, or unstable cardiovascular status that made active rehabilitation unsafe. Stroke type, affected side, demographic characteristics, and baseline clinical status were recorded before allocation.

Potentially eligible stroke survivors attending the study setting were screened against the eligibility criteria. The eligibility of 45 individuals was assessed, of whom 6 were excluded before randomization because of refusal to participate, failure to meet inclusion criteria, or other screening-related reasons. Thirty-nine participants were randomized, with 19 allocated to task-specific training and 20 allocated to strength-based rehabilitation. During the four-week intervention period, 8 participants were discontinued or lost to follow-up. The final analysis included 31 participants who completed baseline and post-intervention assessments, comprising 16 participants in the task-specific training group and 15 participants in the strength-based rehabilitation group. Written informed consent was obtained from all participants before enrollment, and ethical approval was obtained from the institutional review board.

Randomization was performed using a computer-generated allocation sequence prepared through Randomization.org. Allocation was concealed using sealed envelopes until assignment. Participants were allocated to either the task-specific training group or the strength-based rehabilitation group after completion of baseline assessment. The trial used single blinding, with the outcome assessor blinded to group allocation. Because of the nature of the rehabilitation interventions, participants and treating therapists could not be blinded to treatment content. To reduce measurement bias, the same standardized outcome tools were used at baseline and after four weeks, and outcome assessment was performed according to predefined scoring procedures.

Both groups received supervised rehabilitation for four weeks, with four sessions per week and each session lasting 60 minutes. The task-specific training group received goal-oriented functional practice designed to mimic activities of daily living and clinically relevant motor tasks. Training included reaching tasks, grasp-and-release activities, sit-to-stand practice, gait training, balance exercises, functional transfers, and dual-task activities. Task difficulty was progressed by increasing movement complexity, increasing speed, reducing assistance, increasing repetitions, and advancing from simpler to more demanding functional activities according to participant tolerance and performance. The intervention emphasized active participation, repetition, functional relevance, and progressive challenge.

The strength-based rehabilitation group received structured strengthening exercises targeting major upper and lower limb muscle groups. Exercises included isotonic, isometric, and resisted movements using therabands, dumbbells, and ankle weights. Resistance intensity was prescribed at approximately 50–70% of one-repetition maximum, using 2–3 sets of 8–12 repetitions according to participant capacity and safety. Exercise load was progressed gradually by increasing resistance, repetitions, or exercise difficulty as tolerated. Sessions were supervised to ensure correct performance, safety, and adherence to the assigned protocol.

The primary outcomes were motor function of the upper and lower extremities measured using the Fugl-Meyer Assessment upper extremity subscale and lower extremity subscale. The Fugl-Meyer Assessment upper extremity score ranges from 0 to 66, and the lower extremity score ranges from 0 to 34, with higher scores indicating better motor recovery. Functional independence in activities of daily living was assessed as the secondary outcome using the Barthel Index, which ranges from 0 to 100, with higher scores indicating greater independence. Outcome measurements were obtained at baseline before intervention and after four weeks of supervised rehabilitation.

The main independent variable was intervention group, categorized as task-specific training or strength-based rehabilitation. Dependent variables were post-intervention Fugl-Meyer Assessment upper extremity score, Fugl-Meyer Assessment lower extremity score, and Barthel Index score, as well as within-group changes from baseline to four weeks. Baseline demographic and clinical variables included age, weight, height, sex, stroke type, and affected side. Baseline outcome scores were recorded to assess pretreatment comparability between groups. Height was also examined as a baseline characteristic because a statistically significant between-group difference was observed and because anthropometric differences may influence selected functional rehabilitation outcomes.

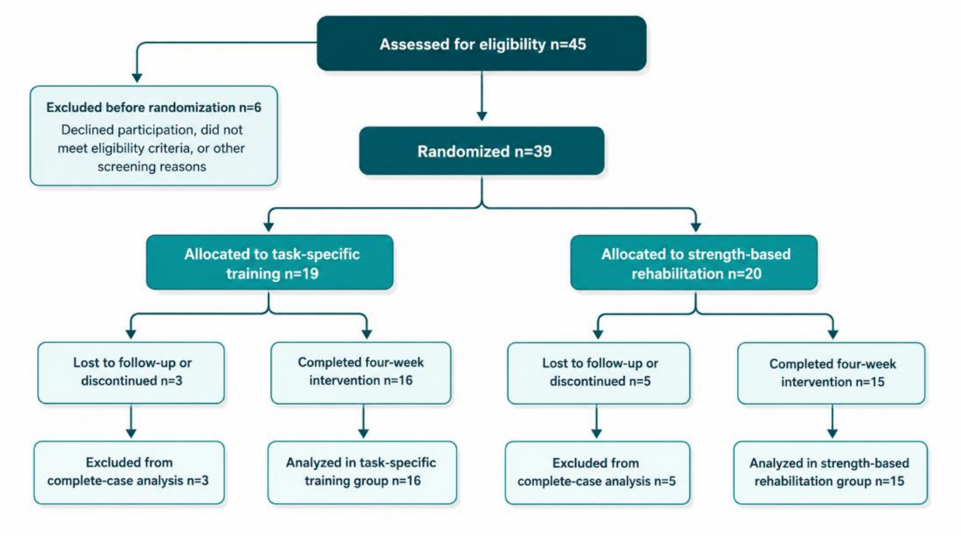

Figure 1 CONSORT Flowchart

Sample size was calculated using G*Power on the basis of the Barthel Index as the functional independence outcome, with 80% statistical power and a two-sided alpha level of 0.05. An allowance for attrition was included, and the final analyzed sample consisted of 31 participants who completed the four-week intervention and post-intervention assessment. Data were analyzed using SPSS version 26. Continuous variables were summarized as mean and standard deviation, while categorical variables were summarized as frequency and percentage. Normality of continuous data was assessed using the Shapiro-Wilk test. Baseline comparisons between groups were performed using independent-samples t-tests for continuous variables and appropriate categorical tests for frequency data. Within-group changes from baseline to four weeks were assessed using paired-samples t-tests. Between-group post-intervention differences were assessed using independent-samples t-tests, and change scores were interpreted as improvement from baseline to four weeks. Statistical significance was set at $p<0.05$.

To improve internal validity, random allocation, allocation concealment, blinded outcome assessment, standardized outcome measures, and equivalent treatment frequency and session duration were used. Bias was further minimized by assessing both groups at identical time points and by using the same scoring instruments for all participants. Missing outcome data occurred among participants who did not complete the four-week assessment; therefore, the final analysis was based on participants with complete baseline and post-intervention data. Data integrity was supported through standardized data recording, predefined outcome scoring, and verification of group-wise values before statistical analysis. Participant confidentiality was maintained throughout the study, and all collected data were used only for research purposes.

RESULTS

Of the 45 stroke survivors assessed for eligibility, 6 were excluded before randomization because they declined participation, did not meet the eligibility criteria, or were excluded for other screening-related reasons. Thirty-nine participants were randomized, with 19 allocated to the task-specific training group and 20 allocated to the strength-based rehabilitation group. During the four-week intervention period, 8 participants were discontinued or lost to follow-up. The final complete-case analysis included 31 participants, comprising 16 in the task-specific training group and 15 in the strength-based rehabilitation group.

Table 1 summarizes the baseline demographic and clinical characteristics of the two groups. The mean age was similar between the task-specific training and strength-based rehabilitation groups, with a between-group mean difference of 0.49 years (95% CI: −3.61 to 4.59; p=0.450). Body weight was also comparable, with a mean difference of 0.78 kg (95% CI: −8.47 to 10.03; p=0.860). However, height differed significantly between groups, with the task-specific training group having a lower mean height than the strength-based rehabilitation group by 14.23 cm (95% CI: −24.10 to −4.36; p=0.004), representing a large standardized difference. Baseline distributions of sex, stroke type, and affected side were not statistically different between groups, although the task-specific training group had a higher proportion of female participants.

Table 1. Baseline Demographic and Clinical Characteristics of Participants

Variable	Task-Specific Training Group (n=16)	Strength-Based Rehabilitation Group (n=15)	Difference / Comparison	95% CI	p-value
Age, years, mean±SD	57.56±5.77	57.07±5.40	0.49	−3.61 to 4.59	0.450
Weight, kg, mean±SD	84.25±11.30	83.47±13.62	0.78	−8.47 to 10.03	0.860
Height, cm, mean±SD	155.44±13.05	169.67±13.76	−14.23	−24.10 to −4.36	0.004
Sex, male/female, n	4/12	7/8			0.210
Stroke type, ischemic/hemorrhagic, n	7/9	8/7			0.630
Affected side, right/left, n	12/4	12/3			0.720

Baseline outcome scores were comparable between the two groups across all functional measures, as shown in Table 2. The baseline FMA-UE score was 25.81±4.32 in the task-specific training group and 26.00±4.47 in the strength-based rehabilitation group, with a negligible mean difference of −0.19 points (95% CI: −3.42 to 3.04; p=0.906). Baseline FMA-LE scores were also nearly identical, with a mean difference of 0.05 points (95% CI: −1.91 to 2.01; p=0.965). Similarly, baseline Barthel Index scores differed by only 0.81 points (95% CI: −6.43 to 8.05; p=0.817), indicating comparable baseline functional independence before intervention.

After four weeks, participants in the task-specific training group demonstrated significantly higher motor and functional scores than those in the strength-based rehabilitation group. The post-intervention FMA-UE score was 35.38±5.23 in the task-specific training group compared with 31.13±5.74 in the strength-based rehabilitation group, yielding a between-group mean difference of 4.25 points (95% CI: 0.20 to 8.30; p=0.040) and a moderate-to-large standardized effect size (Hedges' g=0.76). The post-intervention FMA-LE score showed a larger treatment separation, with the task-specific training group scoring 20.75±3.32 compared with 15.40±2.44 in the strength-based rehabilitation group. The mean difference was 5.35 points (95% CI: 3.21 to 7.49; p<0.001), with a large standardized effect size (Hedges' g=1.78). Functional independence also favored task-specific training, with a Barthel Index score of 65.31±8.11 compared with 48.20±9.71 in the strength-based rehabilitation group. The between-group mean difference was 17.11 points (95% CI: 10.50 to 23.72; p<0.001), corresponding to a large standardized effect size (Hedges' g=1.87).

Table 2. Between-Group Comparison of Motor Function and Functional Independence at Baseline and Four Weeks

Outcome	Time Point	Task-Specific Training Group (n=16), mean±SD	Strength-Based Rehabilitation Group (n=15), mean±SD	Difference	95% CI	Hedges' g	p-value
FMA-UE	Baseline	25.81±4.32	26.00±4.47	−0.19	−3.42 to 3.04	−0.04	0.906
FMA-UE	4 weeks	35.38±5.23	31.13±5.74	4.25	0.20 to 8.30	0.76	0.040
FMA-LE	Baseline	13.38±2.22	13.33±2.99	0.05	−1.91 to 2.01	0.02	0.965
FMA-LE	4 weeks	20.75±3.32	15.40±2.44	5.35	3.21 to 7.49	1.78	<0.001
Barthel Index	Baseline	44.94±7.08	44.13±11.69	0.81	−6.43 to 8.05	0.08	0.817
Barthel Index	4 weeks	65.31±8.11	48.20±9.71	17.11	10.50 to 23.72	1.87	<0.001

Within-group changes from baseline to four weeks are presented in Table 3. Both interventions were associated with statistically significant improvement across all outcomes, but the magnitude of improvement was consistently greater in the task-specific training group. The FMA-UE score improved by 9.56 points in the task-specific training group, increasing from 25.81±4.32 at baseline to 35.38±5.23 at four weeks (p<0.001), whereas the strength-based rehabilitation group improved by 5.13 points, from 26.00±4.47 to 31.13±5.74 (p=0.038). The FMA-LE score improved by 7.38 points in the task-specific training group compared with 2.07 points in the strength-based rehabilitation group, with both within-group changes reaching statistical significance. The largest separation was observed for functional independence, where the Barthel Index increased by 20.38 points in the task-specific training group compared with 4.07 points in the strength-based rehabilitation group. These findings indicate that although both rehabilitation approaches improved motor and functional outcomes over four weeks, task-specific training produced greater short-term gains across upper limb recovery, lower limb recovery, and activities-of-daily-living independence.

Table 3. Within-Group Changes in Motor Function and Functional Independence from Baseline to Four Weeks

Outcome	Group	Baseline, mean±SD	4 Weeks, mean±SD	Mean Improvement	p-value
FMA-UE	Task-Specific Training	25.81±4.32	35.38±5.23	+9.56	<0.001
FMA-UE	Strength-Based Rehabilitation	26.00±4.47	31.13±5.74	+5.13	0.038
FMA-LE	Task-Specific Training	13.38±2.22	20.75±3.32	+7.38	<0.001
FMA-LE	Strength-Based Rehabilitation	13.33±2.99	15.40±2.44	+2.07	<0.001
Barthel Index	Task-Specific Training	44.94±7.08	65.31±8.11	+20.38	<0.001
Barthel Index	Strength-Based Rehabilitation	44.13±11.69	48.20±9.71	+4.07	0.038

Overall, the results demonstrate that task-specific training was associated with superior four-week outcomes compared with strength-based rehabilitation. The most pronounced between-group difference was observed in functional independence, where the task-specific training group exceeded the strength-based rehabilitation group by 17.11 Barthel Index points at four weeks. Lower extremity motor recovery also showed a large treatment effect, with a 5.35-point advantage for task-specific training on FMA-LE. Upper extremity recovery favored task-specific training by 4.25 points, with the lower boundary of the 95% confidence interval remaining above zero. These findings support the short-term effectiveness of task-specific training for improving clinically relevant motor and functional outcomes among stroke survivors, while also showing that strength-based rehabilitation produced measurable but smaller improvements over the same intervention period.

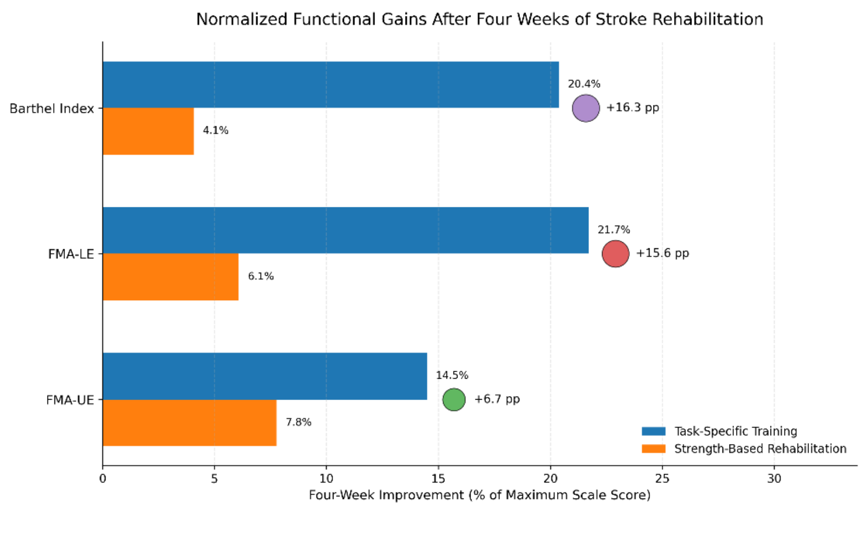

Figure 2 Normalized Functional Gains After Four Weeks of Stroke Rehabilitation

When improvements were standardized against the maximum score of each clinical scale, task-specific training demonstrated consistently greater proportional gains than strength-based rehabilitation across all outcomes. The largest normalized improvement was observed for lower extremity motor recovery, where FMA-LE increased by 21.7% of the total scale range in the task-specific training group compared with 6.1% in the strength-based rehabilitation group, producing a 15.6 percentage-point treatment advantage. Functional independence showed a similarly large separation, with Barthel Index improvement reaching 20.4% of the full scale in the task-specific training group compared with 4.1% in the strength-based rehabilitation group, corresponding to a 16.3 percentage-point advantage. Upper extremity recovery also favored task-specific training, with FMA-UE improving by 14.5% of the total scale range compared with 7.8% after strength-based rehabilitation, yielding a 6.7 percentage-point advantage. These normalized outcome gradients indicate that the superiority of task-specific training was most pronounced for lower limb motor recovery and activities-of-daily-living independence, suggesting stronger functional carryover when rehabilitation practice directly targeted goal-oriented motor tasks.

DISCUSSION

This randomized controlled trial found that both task-specific training and strength-based rehabilitation improved upper limb motor function, lower limb motor function, and activities-of-daily-living independence among stroke survivors after four weeks of supervised rehabilitation. However, the magnitude of improvement was consistently greater in the task-specific training group across all measured outcomes. At four weeks, task-specific training produced higher FMA-UE, FMA-LE, and Barthel Index scores than strength-based rehabilitation, with the largest treatment separation observed for functional independence and lower extremity motor recovery. These findings support the clinical value of goal-directed, repetitive, functionally relevant motor practice in early post-stroke rehabilitation, while also showing that strength-based rehabilitation provides measurable but comparatively smaller short-term gains.

The superiority of task-specific training observed in this study is biologically and clinically plausible. Stroke recovery is strongly influenced by experience-dependent neuroplasticity, in which repeated, meaningful, and progressively challenging motor practice can promote cortical reorganization, motor relearning, and improved sensorimotor integration (4-6). Task-specific training directly exposes patients to functional activities that resemble daily life, including reaching, grasp-release, sit-to-stand transitions, gait-related practice, balance control, and dual-task activity. This type of training may improve not only muscle activation but also timing, coordination, postural adjustment, motor planning, and functional sequencing. The present findings are consistent with previous evidence suggesting that task-specific rehabilitation can improve post-stroke functional ability, particularly when training intensity and task relevance are sufficient to drive clinically meaningful motor adaptation (5,7).

The between-group differences were especially pronounced for lower extremity recovery and functional independence. The task-specific training group showed a 5.35-point advantage over strength-based rehabilitation on FMA-LE at four weeks, while the Barthel Index showed a 17.11-point advantage in favor of task-specific training. When improvements were standardized against the maximum score of each scale, task-specific training produced proportional gains of 21.7% for FMA-LE and 20.4% for the Barthel Index, compared with 6.1% and 4.1%, respectively, in the strength-based rehabilitation group. This pattern suggests that task-specific practice may have stronger functional carryover than strengthening alone, particularly for activities requiring coordinated lower limb control, transfer ability, postural stability, and integration of motor recovery into activities of daily living. These results are clinically important because improved ADL independence is a central rehabilitation goal after stroke and directly affects caregiver burden, discharge planning, and long-term participation.

Strength-based rehabilitation also produced statistically significant within-group improvement in all outcomes, confirming that progressive resistance and strengthening exercises remain useful components of stroke rehabilitation. The SBR group improved by 5.13 points on FMA-UE, 2.07 points on FMA-LE, and 4.07 points on the Barthel Index over four weeks. These changes support previous evidence that strengthening interventions can improve muscular force, mobility capacity, and selected impairment-level outcomes after stroke (8-10). However, the smaller functional gains observed in the SBR group indicate that gains in strength may not automatically translate into equivalent improvements in coordinated task execution or ADL independence. Stroke-related disability often reflects not only weakness but also impaired motor control, abnormal synergies, balance deficits, sensory-motor integration problems, and reduced task adaptability. Therefore, strengthening may be most effective when combined with task-oriented practice rather than used as an isolated rehabilitation strategy.

The findings also support a pragmatic rehabilitation model in which task-specific training is prioritized as the central functional recovery approach, while strength-based rehabilitation is used as an adjunct to address weakness, endurance limitations, and force-generation deficits. Evidence from rehabilitation literature increasingly suggests that combined or hybrid programs may produce broader benefits when strengthening is embedded within functional task practice rather than delivered separately from real-life movement goals (11-14). In resource-constrained clinical settings, this distinction is important because therapists often need to select interventions that provide the greatest functional return within limited treatment time. The present study suggests that when the primary goal is improvement in ADL independence and motor performance, task-specific practice may provide a more direct and clinically meaningful pathway to functional recovery.

Despite these promising findings, several limitations should be considered when interpreting the results. The study was conducted at a single center with a small final sample of 31 participants, which limits statistical power and generalizability. Although 39 participants were randomized, the final analysis was based on complete cases, and 8 participants were discontinued or lost to follow-up. This creates a potential risk of attrition bias, particularly because intention-to-treat analysis was not reported. The intervention period was limited to four weeks, so the durability of treatment effects after discharge or longer follow-up remains unknown. Baseline height differed significantly between groups, and although baseline motor and functional scores were comparable, this anthropometric imbalance may reflect underlying sex distribution differences or other baseline differences that could influence mobility-related outcomes. Future analyses should consider adjusted models, such as ANCOVA controlling for baseline score and relevant covariates, to strengthen causal interpretation.

Another important limitation is that participants and treating therapists could not be blinded because of the nature of the interventions. Although assessor blinding was used, performance bias cannot be excluded. The study also did not report adverse events, intervention adherence, therapist fidelity, or detailed progression criteria, which limits full reproducibility. In addition, the study did not report confidence intervals for within-group changes or adjusted treatment effects, and future trials should include effect estimates with precision measures for all primary and secondary outcomes. Larger multicenter randomized trials with longer follow-up, intention-to-treat analysis, standardized intervention fidelity monitoring, and prespecified adjustment for baseline imbalance are needed to confirm whether task-specific training maintains superior functional benefits over time.

Overall, this study provides clinically useful evidence that task-specific training may produce greater short-term improvements than strength-based rehabilitation in motor recovery and functional independence among stroke survivors. The results align with the principles of motor relearning and neuroplasticity, showing that rehabilitation focused on meaningful, repetitive, and goal-directed functional tasks may yield stronger carryover into daily activities than strengthening alone. While strength-based rehabilitation remains valuable for improving force production and physical capacity, the present findings support task-specific training as a preferred core component of post-stroke rehabilitation when the primary therapeutic aim is functional recovery and independence.

CONCLUSION

Task-specific training produced greater short-term improvements than strength-based rehabilitation in upper extremity motor function, lower extremity motor function, and activities-of-daily-living independence among stroke survivors who completed four weeks of supervised rehabilitation. Although both interventions resulted in statistically significant gains, the larger improvements observed in FMA-UE, FMA-LE, and Barthel Index scores suggest that goal-directed functional practice may provide stronger clinical carryover than strengthening exercises alone. These findings support the integration of task-specific training as a central component of stroke rehabilitation programs, particularly when the therapeutic goal is to improve functional independence; however, larger multicenter trials with longer follow-up, intention-to-treat analysis, and adjusted statistical models are required to confirm the durability and generalizability of these effects.

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