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# Rubber ball gripping exercise and hand muscle strength in patients with stroke

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**Abstract**

**Background:** Stroke frequently causes upper-extremity weakness that can restrict hand use and independence in daily activities. Repetitive hand exercise is a low-cost rehabilitation approach that may support motor recovery.
**Purpose:** To compare short-term hand muscle strength between patients with stroke who received rubber ball gripping exercise plus standard hospital therapy and those who received standard hospital therapy alone.
**Method:** This quasi-experimental two-group pretest-posttest study included 20 patients with stroke selected purposively from a population of 88 at Advent Hospital Bandar Lampung. Ten participants were included in each group. The intervention group performed rubber ball gripping exercise for 2 × 15 minutes per day for 3 consecutive days, while the control group received standard hospital therapy. Hand muscle strength was assessed using the Lovett scale (0–5), and posttest scores were compared using the Mann-Whitney U test.
**Results:** Mean hand muscle strength in the intervention group increased from 3.20 ± 0.422 at pretest to 4.20 ± 0.422 at posttest, whereas the control-group mean remained 3.20 ± 0.422. Posttest hand muscle strength differed significantly between groups ($p < 0.001$).
**Conclusion:** Rubber ball gripping exercise was associated with a greater short-term increase in hand muscle strength than standard hospital therapy alone in this small quasi-experimental sample. The findings should be interpreted cautiously because the group-assignment procedure, standard-care content, and longer-term outcomes were not fully reported.

**Keywords: Hand Muscle Strength; Rehabilitation; Rubber Ball Exercise; Stroke.**

## INTRODUCTION

Stroke remains a major global cause of death and disability, and upper-extremity motor impairment is a common source of persistent functional limitation (GBD 2021 Stroke Risk Factor Collaborators, 2024; Feigin, Brainin, Norrving, Martins, Pandian, Lindsay, Grupper, & Rautalin, 2025; Winstein, Stein, Arena, Bates, Cherney, Cramer, DeRuyter, Eng, Fisher, Harvey, Lang, MacKay-Lyons, Ottenbacher, Pugh, Reeves, Richards, Stiers, & Zorowitz, 2016). Weakness of the hand and arm can interfere with grasping, eating, dressing, bathing, and other activities of daily living.

Stroke rehabilitation, therefore, emphasizes repeated, task-oriented, and progressively challenging motor practice. Evidence from rehabilitation guidelines and systematic reviews supports structured upper-limb training, while the optimal intervention type and dose depend on patient characteristics and recovery stage (Langhorne, Bernhardt, & Kwakkel, 2011; Veerbeek, van Wegen, van Peppen, van der Wees, Hendriks, Rietberg, & Kwakkel, 2014; French, Thomas, Coupe, McMahon, Connell, Harrison, Sutton, Tishkovskaya, & Watkins, 2016; Stinear, Lang, Zeiler, & Byblow, 2020; Tenberg, Mueller, Vogt, Roth, Happ, Scherer, Behringer, & Niederer, 2023; Westlake, Akinlosotu, Udo, Goldstein Shipper, Waller, & Whitall, 2023).

The 2023 Indonesian Health Survey reported a physician-diagnosed stroke prevalence of 7.9 per 1,000 among people aged ≥15 years in Lampung Province (Ministry of Health of the Republic of Indonesia, 2024). Medical record data from the study site documented 972 stroke cases at Advent Hospital Bandar Lampung in 2024 and 614 cases from January to October 2025.

Repetitive gripping with a rubber ball is a simple approach intended to provide active hand practice and light resistance. Local studies have reported improvements in hand or upper-extremity strength after structured gripping exercise among patients with stroke (Nurartianti & Wahyuni, 2020; Azizah &

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Wahyuningsih, 2020; Kusuma, Utami, & Purwono, 2022; Sari, Ayubbana, & Sari, 2021; Siswanti, Hartinah, & Susanti, 2021).

Other Indonesian reports using gripping or range-of-motion approaches have described similar short-term improvements, although study designs, treatment doses, and outcome measures vary (Santoso, 2018; Rahmadani & Rustandi, 2019; Sholihany, Waluyo, & Irawati, 2021; Rismawati, Harista, Widyyati, & Nurseskasatmata, 2022; Sahfeni, 2022; Yuliyani, Hartutik, & Sutarto, 2023).

Because rubber ball gripping exercise had not been evaluated at Advent Hospital Bandar Lampung, this study compared post-intervention hand muscle strength between patients receiving rubber ball gripping exercise plus standard hospital therapy and those receiving standard hospital therapy alone.

## RESEARCH METHOD

This quantitative study used a quasi-experimental two-group pretest-posttest design and was conducted at Advent Hospital Bandar Lampung from January 28 to February 18, 2026.

The source population comprised 88 patients with stroke. Purposive sampling yielded 20 participants, with 10 included in the intervention group and 10 in the control group. The source report did not describe a random allocation procedure; participants were assigned to intervention and control groups as reported in the study records.

Inclusion criteria were a diagnosis of stroke with upper-extremity muscle weakness, consciousness and ability to communicate, willingness to participate, and age ≥18 years. Reported exclusion criteria were severe complications, impaired consciousness, or failure to complete the study procedures.

The intervention group performed the rubber ball gripping exercise for 2 × 15 minutes per day for 3 consecutive days. The control group received standard hospital therapy. Hand muscle strength was measured before and after the intervention using the Lovett muscle-strength scale (0–5). The specific components and dose of standard hospital therapy were not detailed in the source manuscript.

Participant characteristics were summarized using frequencies and percentages. Because the reported Lovett scores were non-normally distributed, the Mann-Whitney U test was used for the between-group posttest comparison. Normality was assessed using the Shapiro-Wilk test, and statistical significance was set at $p < 0.05$.

The study received ethical approval from the Health Research Ethics Committee of Universitas Mitra Indonesia. (Approval No. 017/KEP-RSABL/I/2026).

## RESEARCH RESULTS

**Table 1. Characteristics of participants by group (N = 20)**

| Characteristic | Intervention | Control |
|---|---|---|
| **Age group (n/%)** | | |
| 40–60 | 7/70 | 6/60 |
| >60 | 3/30 | 4/40 |
| **Gender (n/%)** | | |
| Male | 4/40 | 4/40 |
| Female | 6/60 | 6/60 |
| **Occupation (n/%)** | | |
| Housewife | 4/40 | 5/50 |
| Entrepreneur | 4/40 | 3/30 |
| Laborer | 2/20 | 0/0 |
| Civil servant | 0/0 | 2/20 |

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As presented in Table 2, mean hand muscle strength in the intervention group increased from 3.20 ± 0.422 at pretest to 4.20 ± 0.422 at posttest, whereas the control group's mean remained 3.20 ± 0.422 at both measurements.

**Table 2. Hand muscle strength before and after intervention**

| Measurement | n | Mean ± SD | Range |
|---|---|---|---|
| Intervention pretest | 10 | 3.20 ± 0.422 | 3–4 |
| Intervention posttest | 10 | 4.20 ± 0.422 | 4–5 |
| Control pretest | 10 | 3.20 ± 0.422 | 3–4 |
| Control posttest | 10 | 3.20 ± 0.422 | 3–4 |

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Shapiro-Wilk tests yielded $p < 0.001$ for all four measurements, indicating non-normal distributions of scores. The between-group posttest comparison was therefore performed using the Mann-Whitney U test.

**Table 3. Posttest hand muscle strength comparison by group (N = 20)**

| Group | n | Mean rank | *p* value |
|---|---|---|---|
| Intervention | 10 | 14.70 | <0.001 |
| Control | 10 | 6.30 | |
| Total | 20 | | |

Table 3 shows that the posttest mean rank was 14.70 in the intervention group and 6.30 in the control group. Posttest hand muscle strength differed significantly between groups ($p < 0.001$).

## DISCUSSION

The principal finding was a greater short-term increase in hand muscle strength in the intervention group than in the control group. After 3 days of rubber ball gripping exercise, the intervention-group mean Lovett score increased from 3.20 ± 0.422 to 4.20 ± 0.422, whereas the control-group mean remained 3.20 ± 0.422.

Repeated gripping provides active motor practice and light resistance, which is consistent with rehabilitation principles emphasizing repetition, task specificity, and progressive motor practice (Winstein et al., 2016; French et al., 2016; Stinear et al., 2020). The direction of the observed change is also consistent with local studies of rubber-ball gripping exercise after stroke (Nurartianti & Wahyuni, 2020; Kusuma et al., 2022; Sari et al., 2021; Siswanti et al., 2021).

Broader stroke-rehabilitation evidence indicates that repeated upper-limb practice can improve motor outcomes, although intervention effects depend on treatment dose, baseline impairment, training content, and outcome measure (Veerbeek et al., 2014; Tenberg et al., 2023; Westlake et al., 2023). The present study measured only short-term change on the Lovett scale and did not evaluate functional hand use or activities of daily living.

The posttest rank was 14.70 in the intervention group and 6.30 in the control group ($p < 0.001$). This between-group difference should be interpreted with caution because the sample size was small, purposive sampling was used, and the group assignment procedure was not fully described. The content of standard hospital therapy was also unspecified, limiting the attribution of the observed difference solely to the gripping exercise.

The intervention is simple and inexpensive, but feasibility alone does not establish long-term effectiveness. Future evaluation should include standardized exercise parameters, objective hand-grip or functional measures, clearly described usual care, and follow-up beyond the immediate post-intervention period.

## LIMITATIONS

This single-hospital study included only 20 participants and used purposive sampling. The group-assignment procedure and standard-care content were incompletely reported. The intervention lasted only 3 consecutive days, and outcomes were assessed with the ordinal Lovett scale without longer-

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term follow-up. Potential clinical confounders, adherence, assessor blinding, and functional independence outcomes were not reported.

## CONCLUSION

Rubber ball gripping exercise was associated with a greater short-term increase in hand muscle strength than standard hospital therapy alone among patients with stroke at Advent Hospital Bandar Lampung. The intervention-group mean increased from 3.20 ± 0.422 to 4.20 ± 0.422, while the control-group mean remained 3.20 ± 0.422; the posttest between-group comparison was significant ($p < 0.001$). These findings do not establish long-term effectiveness due to the small sample size and incompletely reported allocation and control procedures.

## SUGGESTION

Rubber ball gripping exercise may be considered as an adjunct to supervised stroke rehabilitation when clinically appropriate. Future studies should use larger samples, clearly described or randomized group allocation, standardized exercise and usual-care protocols, objective upper-limb outcomes, and longer follow-up.

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