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Experiences of Rubber Ball Grip Therapy After Non-Hemorrhagic Stroke: A Descriptive Qualitative Study

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Abstract

Background: Hand muscle weakness commonly persists among older adults after non-hemorrhagic stroke and contributes to activity limitations. Rubber ball grip therapy is a simple home-based exercise frequently used in low-resource settings, yet qualitative evidence exploring patients' perceived changes remains limited.

Objective: This study aimed to explore older adults' experiences and perceived changes in hand muscle strength following rubber ball grip therapy after non-hemorrhagic stroke.

Methods: A descriptive qualitative study was conducted with two older adults living in a rural area of East Nusa Tenggara, Indonesia. Participants performed rubber ball gripping therapy at home for seven consecutive days. Data were collected through in-depth interviews and field notes. Manual Muscle Testing (MMT) was used as a supportive observational measure to contextualize participants' narratives. Data were analyzed thematically.

Results: Responses to therapy varied. One participant showed an observable improvement in hand muscle strength (MMT grade 3 to 4) accompanied by perceived ease of movement and increased functional confidence. The other participant demonstrated no change in muscle strength (MMT grade 2) and reported persistent fatigue and limitation. Baseline physical condition, daily activity level, motivation, and family support influenced perceived outcomes.

Conclusion: Older adults experience rubber ball grip therapy differently after non-hemorrhagic stroke. Individual and contextual factors play a crucial role in shaping perceived benefits of simple home-based hand exercises.

Keywords
Stroke Rehabilitation; Hand Strength; Grip Strength; Exercise Therapy; Aged

Introduction

Stroke remains a leading cause of long-term disability worldwide and represents a major public health challenge, particularly among older adults. Ischemic stroke accounts for approximately 80–85% of all stroke cases and frequently results in persistent motor impairments due to damage to corticospinal and sensorimotor pathways.[1,2] These impairments often manifest as muscle weakness, reduced coordination, and impaired voluntary control of the upper extremities, with the hand being one of the most affected body parts. Hand dysfunction after stroke significantly limits the performance of daily activities such as gripping, holding objects, and self-care tasks, thereby reducing independence and quality of life in older stroke survivors.[3,4]

From the perspective of the International Classification of Functioning, Disability and Health (ICF), non-hemorrhagic stroke is conceptualized as a health condition that triggers a cascade of impairments, activity limitations, and participation restrictions, which are further influenced by personal and environmental factors.[5] In older adults, age-related physiological changes, including sarcopenia, reduced neuromuscular plasticity, and decreased functional reserve, may exacerbate post-stroke motor deficits and slow recovery.[6,7] Consequently, restoration of hand muscle strength and functional use of the affected upper limb is a key goal of post-stroke rehabilitation, particularly in the aging population.

Hand rehabilitation after stroke commonly involves repetitive task-oriented exercises aimed at stimulating neuromuscular activation and promoting adaptive neuroplasticity. Theoretical and experimental evidence suggests that repeated voluntary muscle contraction enhances motor unit recruitment and supports experience-dependent neural reorganization.[8] Simple hand exercises, such as rubber ball gripping therapy, have therefore been widely introduced in clinical and community-based rehabilitation programs. This intervention is inexpensive, easy to perform, and feasible for home-based use, making it particularly suitable for older adults living in rural or low-resource settings where access to formal rehabilitation services is limited.[9–11] Quantitative studies have reported improvements in grip strength and hand function following ball-based hand exercises among stroke survivors.[12,13] However, these studies primarily emphasize measurable outcomes and provide limited insight into how patients perceive functional changes in their daily lives.

In rural areas of low- and middle-income countries, including regions of eastern Indonesia, stroke survivors often face substantial barriers to accessing structured rehabilitation services.[14] As a result, recovery frequently depends on self-managed or family-supported home-based exercises. Environmental constraints, limited professional supervision, and variability in family support may influence both engagement with therapy and perceived outcomes. In such contexts, understanding patients' subjective experiences becomes essential for evaluating the practical relevance and acceptability of simple rehabilitation interventions.

Despite the growing body of quantitative evidence on hand exercise interventions after stroke, qualitative research exploring older adults' lived experiences and perceived changes in hand function remains scarce. Previous qualitative studies in stroke rehabilitation have highlighted that motivation, emotional responses, social support, and perceived meaning of recovery play crucial roles in shaping rehabilitation engagement and outcomes.[15,16] However, little is known about how older adults interpret changes in hand muscle strength following simple, low-intensity exercises such as rubber ball gripping therapy, particularly within rural and home-

based rehabilitation settings. To date, most existing studies have not adequately captured how individual physical condition, habitual activity level, and contextual factors interact to shape perceived benefits or limitations of such interventions.

Addressing this gap is important for developing patient-centered rehabilitation strategies that are responsive to real-world conditions. Qualitative exploration allows for a deeper understanding of how older stroke survivors experience rehabilitation, how they make sense of functional changes, and which factors facilitate or hinder engagement with therapy. Such insights are particularly valuable for physiotherapists working in community and rural settings, where individualized and context-sensitive approaches are essential.

Therefore, this study aimed to explore older adults' experiences and perceived changes in hand muscle strength following rubber ball grip therapy after non-hemorrhagic stroke. By adopting a descriptive qualitative approach, this study seeks to provide contextualized insights into how simple home-based hand exercises are experienced by older stroke survivors and how individual and environmental factors shape perceived rehabilitation outcomes.

Methods

This study employed a descriptive qualitative design to explore older adults' experiences and perceived changes in hand muscle strength following rubber ball grip therapy after non-hemorrhagic stroke. A qualitative approach was deliberately chosen to capture participants' subjective interpretations of functional change as embedded within their daily routines and social contexts, rather than to quantitatively evaluate the effectiveness of the intervention. The reporting of this study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist to enhance transparency, methodological rigor, and completeness of qualitative reporting.

Data collection and analysis were primarily conducted by a physiotherapy lecturer with a clinical background in neurological rehabilitation and community-based physiotherapy. Although the researcher had prior professional experience working with older adults after stroke, no therapeutic or personal relationship existed with the participants before the commencement of the study. Acknowledging that the researcher's professional background could influence data interpretation, reflexivity was actively maintained throughout the research process. Reflexive strategies included continuous self-reflection, the maintenance of analytic memos, and regular discussions within the research team to challenge assumptions and ensure that interpretations were grounded in participants' narratives rather than researchers' expectations. During interviews, the researcher adopted an open, non-directive stance, allowing participants to articulate their experiences in their own words, thereby enhancing credibility and minimizing potential bias.

Participants were recruited using purposive sampling from Talibura Village, East Nusa Tenggara, Indonesia. Inclusion criteria comprised individuals aged 55 years or older with a physician-diagnosed non-hemorrhagic (ischemic) stroke, residual hand muscle weakness affecting daily activities, the ability to communicate verbally and provide informed consent, and a stable medical condition during the study period. Individuals with severe cognitive impairment, acute medical instability, or musculoskeletal conditions unrelated to stroke that could interfere with hand movement were excluded. Two participants were included to allow for contrastive case comparison, a common strategy in descriptive qualitative research that facilitates in-depth exploration of similarities and differences across cases with varying baseline characteristics. Participant characteristics, including age, sex, side of hemiparesis, stroke duration, cognitive status, comorbidities, and level of daily activity, were documented to support the transferability of the findings.

The study was conducted in a rural, home-based setting in Talibura Village, East Nusa Tenggara, where access to formal rehabilitation services is limited. Participants performed the intervention independently in their homes, reflecting real-world rehabilitation conditions in low-resource rural environments. Family members were present during daily activities and provided informal assistance when needed. This contextual information was considered essential for understanding participants' engagement with the therapy and their perceptions of functional change.

The intervention protocol was described in accordance with the Template for Intervention Description and Replication (TIDieR) checklist. A soft elastic rubber ball with an approximate diameter of 6–7 cm and low-to-moderate resistance was used, with resistance selected based on participants' initial hand strength and comfort to ensure pain-free execution. Initial instruction was provided by the researcher, a licensed physiotherapist, while daily exercise sessions were performed independently by participants with informal supervision from family members. Participants were instructed to perform the exercise in a seated position with the shoulder adducted, the elbow flexed at approximately 90 degrees, the forearm in a neutral position, and the affected hand resting comfortably. They were asked to grip the rubber ball maximally within a pain-free range, hold the contraction for three to five seconds, and then relax. Each session lasted approximately 10–15 minutes and was performed twice daily over seven consecutive days. Exercise intensity was tailored to individual tolerance by emphasizing submaximal, pain-free contractions, with progression achieved through gradual increases in repetitions and grip-hold duration without altering ball resistance. Adherence and safety were monitored through daily visits and non-participant observation by the researcher, with field notes used to document participants' performance, perceived difficulties, and environmental factors influencing implementation.

Data were collected through in-depth, semi-structured interviews, field notes, and observational measures. Interviews were conducted before and after the seven-day intervention period using an interview guide designed to explore experiences of hand weakness, perceptions of change, difficulties encountered during therapy, motivation, and social support. Each interview lasted approximately 30–45 minutes, was conducted in the local language, audio-recorded with participants' permission, and transcribed verbatim. Manual Muscle Testing (MMT) was performed before and after the intervention as a supportive observational measure to contextualize participants' narratives. MMT was not intended as a primary quantitative outcome but was used to document observable changes in hand muscle strength that could enrich the interpretation of subjective experiences. Field notes were maintained throughout the study to capture non-verbal cues, environmental context, and researchers' reflections.

Qualitative data were analyzed using descriptive thematic analysis. The analytic process involved familiarization with the data through repeated reading of transcripts, initial coding of meaningful units related to experiences, perceptions, and contextual factors, grouping codes into preliminary themes, and subsequently reviewing, refining, and defining final themes to ensure coherence and internal consistency. Analysis was conducted collaboratively by the research team to enhance analytic rigor, with discrepancies in coding or interpretation resolved through discussion until consensus was reached. Integration of interview data with field notes and MMT observations supported triangulation and strengthened analytic depth.

Trustworthiness was addressed through strategies targeting credibility, dependability, and confirmability. Credibility was enhanced through prolonged engagement, the use of verbatim quotations, and triangulation of data sources, including interviews, observations, and MMT findings. Dependability was supported by transparent documentation of methodological decisions and

analytic procedures, while confirmability was strengthened through reflexive journaling and team-based analysis to ensure that findings were grounded in participants' accounts rather than researchers' assumptions.

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for this minimal-risk qualitative study was formally reviewed by the institutional authority of STIKes St. Elisabeth Keuskupan Maumere, and written informed consent was obtained from all participants prior to data collection. Participants were fully informed about the study objectives, procedures, voluntary nature of participation, and their right to withdraw at any time without consequence. Confidentiality and anonymity were ensured through the use of pseudonyms and restricted access to identifiable data.

Results

The results of this descriptive qualitative study were derived from in-depth interviews, supported by observational data from Manual Muscle Testing (MMT) and field notes collected over a seven-day rubber ball grip therapy period. Findings are presented using a contrastive case comparison approach to highlight similarities and differences between participants with distinct baseline conditions and therapy responses. Participant characteristics are presented first, followed by observable muscle strength changes and qualitative themes emerging from the interviews.

Two older adults with a history of non-hemorrhagic stroke participated in this study. Both participants were male and cognitively intact, but differed markedly in stroke duration, functional status, and daily activity level. Detailed participant characteristics are presented in Table 1.

Table 1. Participant Characteristics

Participant	Age (years)	Sex	Stroke Duration (years)	Stroke Type	Side of Hemiparesis	Comorbidities	Cognitive Status	Daily Activities
P1	61	Male	8	Ischemic	Right	None	Cognitively intact	Cooking, sweeping, washing
P2	59	Male	3	Ischemic	Left	None	Cognitively intact	Bedridden

As shown in Table 1, Participant 1 remained physically active in household tasks despite chronic stroke, whereas Participant 2 was largely bedridden and dependent on assistance for daily activities.

Observable hand muscle strength was documented using Manual Muscle Testing (MMT) as a supportive measure before and during the intervention period. Changes in MMT scores over the seven-day therapy period are summarized in Table 2.

Table 2. Observable Hand Muscle Strength Changes (Manual Muscle Testing)

Participant 1

Day	Before Therapy	After Therapy
1	3	3
2	3	3
3	3	4
4	3	4
5	3	4
6	3	4
7	3	4

Participant 2

Participant 2 demonstrated no observable change in hand muscle strength throughout the intervention period, with MMT remaining at grade 2 on all seven days. As shown in Table 2, Participant 1 exhibited an observable increase in hand muscle strength from MMT grade 3 to grade 4 beginning on day 3 and maintained this level through day 7. In contrast, Participant 2 showed stable but unchanged muscle strength across the same period.

Qualitative Findings

Thematic analysis of interview transcripts and field notes yielded **four main themes**, reflecting participants' experiences and perceived changes during rubber ball grip therapy. An overview of themes and contextual factors is presented in **Table 3**.

Table 3. Overview of Qualitative Themes and Contextual Factors

Theme	Participant 1	Participant 2
Perceived change in hand strength	Felt hand "lighter" and easier to move	No perceived improvement
Physical response to exercise	Increased ease of finger movement	Rapid fatigue and discomfort
Activity level	Regular household activities	Prolonged bed rest
Motivation and support	High motivation, family encouragement	Limited motivation, minimal assistance

Narrative descriptions of each theme, supported by verbatim quotations, are presented below.

Theme 1: Perceived Improvement in Hand Strength and Functional Sensation

Participant 1 reported a clear subjective perception of improvement in hand strength after performing rubber ball grip therapy regularly. This perception was characterized by a sensation of lightness and increased ease of finger movement, which corresponded with observable MMT changes. "*After squeezing the ball every day, my hand feels lighter and stronger. I can move my fingers more easily than before*." (Participant 1) Field notes indicated that Participant 1 appeared more confident when using the affected hand to hold household objects during daily activities.

Theme 2: Absence of Perceived Improvement and Persistent Limitation

In contrast, Participant 2 did not perceive any improvement in hand strength following the intervention. This experience aligned with the absence of observable changes in MMT scores. Participant 2 described persistent weakness, fatigue, and discomfort during exercise. "*I still feel weak. When I squeeze the ball, my hand gets tired quickly and sometimes hurts*." (Participant 2) Observational notes documented limited active movement of the affected hand and prolonged periods of inactivity.

Theme 3: Influence of Baseline Physical Condition and Activity Level

Differences in baseline physical condition and habitual activity level emerged as prominent contextual factors. Participant 1 remained engaged in daily household activities, whereas Participant 2 reported spending most of the day in bed. "*I keep using my hand for cooking and cleaning, so I try to keep exercising*." (Participant 1) "*I mostly stay in bed, so it's hard to move my hand often*." (Participant 2) These contrasting experiences were consistently reflected across interviews and field observations.

Theme 4: Motivation and Social Support as Facilitators and Barriers

Motivation and family support influenced participants' engagement with therapy. Participant 1 described encouragement from family members, which helped maintain exercise adherence. Participant 2 reported limited assistance and reduced motivation. "*My family reminds me to exercise, so I don't forget.*" (Participant 1) "*Sometimes no one helps me, so I stop when I feel tired*." (Participant 2) Field notes indicated that family presence facilitated regular exercise practice for Participant 1, whereas lack of assistance contributed to early cessation of exercises for Participant 2.

Summary of Results

Using a contrastive case comparison approach, the results demonstrate heterogeneous experiences of rubber ball grip therapy among older adults after non-hemorrhagic stroke. Observable changes in hand muscle strength and perceived functional improvement were present in one participant but absent in the other, with differences closely aligned to baseline physical condition, activity level, motivation, and available social support. These findings provide an empirical foundation for subsequent interpretation and discussion.

Discussion

This descriptive qualitative study explored older adults' experiences and perceived changes in hand muscle strength following rubber ball grip therapy after non-hemorrhagic stroke. The findings demonstrate heterogeneous responses to the same simple home-based intervention, highlighting that perceived benefits were closely shaped by individual physical condition, habitual activity level, motivation, and social support. By integrating participants' narratives with observational data, this study provides contextualized insights into how rehabilitation is experienced in rural, low-resource settings.

One participant reported perceived improvement in hand strength and functional sensation, accompanied by observable changes in Manual Muscle Testing (MMT), whereas the other participant experienced no perceived or observable improvement. This contrast aligns with prior evidence indicating that recovery after stroke is highly individualized and influenced by baseline functional status and engagement in daily activity.[15,16] Quantitative studies have shown that repetitive hand exercises can improve grip strength and neuromuscular activation in stroke survivors; however, such improvements are not uniformly observed across individuals.[3,17] The present findings extend this evidence by illustrating how patients interpret and give meaning to functional change in everyday life.

Participant 1's perceived improvement was characterized not only by increased hand strength but also by a subjective sense of lightness, ease of movement, and confidence during daily activities. These experiential outcomes are consistent with qualitative studies reporting that stroke survivors often value functional ease and confidence more than numerical strength gains.[16,18] In contrast, Participant 2's lack of perceived improvement was associated with persistent fatigue, discomfort, and severe physical deconditioning. Prolonged immobility and reduced habitual activity are known to accelerate muscle atrophy and limit responsiveness to low-intensity exercise, particularly in older adults.[19,20] The findings suggest that simple hand exercises may be insufficient to elicit perceptible change in individuals with severe deconditioning without prior preparatory or assisted interventions.

The findings can be meaningfully interpreted through Roy's Adaptation Model, which conceptualizes individuals as adaptive systems responding to internal and external stimuli across physiological, self-concept, role function, and interdependence modes.[21] In this study, rubber ball grip therapy functioned as a focal stimulus, while participants' baseline physical condition, aging-related changes, motivation, and emotional responses acted as contextual stimuli shaping adaptation outcomes.

For Participant 1, relatively preserved physical capacity and continued engagement in daily activities appeared to support adaptive responses within the physiological mode, reflected in improved hand movement and observable strength changes. Concurrently, positive perceptions of progress and confidence suggested adaptation within the self-concept mode, reinforcing motivation to continue exercising. Family encouragement further supported the interdependence mode, facilitating adherence and engagement. In contrast, Participant 2 experienced multiple maladaptive contextual stimuli, including prolonged immobility, fatigue, and limited support, which constrained adaptive responses across these modes. The absence of perceived improvement reflects an adaptive outcome shaped more by contextual limitations than by the intervention itself.

By explicitly linking experiential themes to Roy's Adaptation Model, this study demonstrates how rehabilitation outcomes emerge from dynamic interactions between the individual and their environment rather than from the intervention alone. This theoretical integration strengthens the qualitative interpretation and underscores the value of patient-centered frameworks in community-based rehabilitation research.

Motivation and family support emerged as salient factors influencing participants' engagement with therapy. Participant 1 described reminders and encouragement from family members, whereas Participant 2 reported minimal assistance and reduced motivation. Previous qualitative studies have consistently identified motivation and caregiver involvement as critical determinants of rehabilitation adherence and perceived recovery after stroke.[22,23] Social support not only facilitates practical assistance but also reinforces patients' self-efficacy and emotional adaptation. In rural contexts, where professional supervision is limited, family members often play a pivotal role in sustaining rehabilitation practices. The present findings reinforce the importance of incorporating family education and support strategies into community-based physiotherapy programs.

The findings have several implications for physiotherapy practice, particularly in rural and low-resource settings. First, simple and low-cost interventions such as rubber ball grip therapy are feasible and acceptable, but their perceived benefits depend on individual readiness and contextual support. Physiotherapists should conduct comprehensive assessments of baseline physical condition, activity level, cognitive status, and social environment before prescribing such exercises. Second, for older adults with severe deconditioning or prolonged immobility, staged rehabilitation approaches may be necessary, beginning with assisted or preparatory movements prior to active resistance exercises. Third, integrating patients' narratives and perceptions into clinical decision-making can enhance patient-centered care and improve alignment between therapeutic goals and lived experience.

A key strength of this study is its adherence to COREQ guidelines and its integration of qualitative interviews with observational data, allowing for a nuanced understanding of rehabilitation experiences. The use of contrastive case comparison enhanced analytic depth by highlighting how similar interventions can yield different experiential outcomes.

However, several limitations should be acknowledged. The small sample size (n = 2) limits transferability and precludes generalization beyond the cases studied. The short intervention duration (seven days) may not have been sufficient to capture longer-term adaptations, particularly in participants with severe physical limitations. Additionally, MMT was used solely as a supportive observational measure rather than a primary quantitative outcome, restricting objective comparison of strength changes. These limitations are inherent to descriptive qualitative research but should be considered when interpreting the findings.

Future studies should explore similar interventions using larger qualitative samples and longer follow-up periods to capture evolving adaptation processes over time. Combining qualitative approaches with robust quantitative measures may further elucidate how perceived changes align with functional outcomes. Research focusing on family involvement and community-based support strategies may also enhance understanding of how to optimize rehabilitation in rural settings.

Conclusion

This descriptive qualitative study highlights that older adults experience rubber ball grip therapy differently following non-hemorrhagic stroke. The findings demonstrate that perceived changes in hand muscle strength and functional use are not uniform and are strongly influenced by individual physical condition, habitual activity level, motivation, and available social support. While one participant reported improved hand movement and functional confidence alongside observable changes in muscle strength, the other experienced persistent limitation and fatigue with no perceived improvement. These contrasting experiences emphasize that rehabilitation outcomes cannot be attributed to the intervention alone but emerge from complex interactions between personal and contextual factors.

The integration of participants' narratives with observational findings underscores the value of qualitative approaches in capturing dimensions of recovery that are often overlooked by quantitative measures alone. Perceived ease of movement, confidence in using the affected hand, and the ability to engage in daily activities were central to how participants evaluated their rehabilitation experience. Such experiential outcomes are particularly relevant in rural and low-resource settings, where rehabilitation programs rely heavily on simple, home-based exercises and family support.

From a clinical perspective, the findings suggest that physiotherapists should adopt individualized and context-sensitive approaches when prescribing simple hand exercises for older adults after stroke. Comprehensive assessment of baseline functional status, daily activity patterns, and social environment is essential to align therapeutic strategies with patients' capacities and expectations. For individuals with severe deconditioning, preparatory or assisted interventions may be required before introducing active resistance exercises.

Overall, this study contributes qualitative insight into community-based stroke rehabilitation and supports the need for patient-centered frameworks that recognize variability in recovery experiences. Future research should further explore how personal and environmental factors shape adaptation to rehabilitation over time.

Author Contribution

Dewa Agung Gina Andriani: Conceptualization; Methodology; Data curation; Formal analysis; Writing—original draft.
Asri Sulastyaningrum: Methodology; Formal analysis; Writing—review & editing; Supervision.
Data curation; Writing—review & editing.
All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Conflict of Interest Statement

The authors declare **no conflict of interest**.

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Ethics Statement

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical review for this minimal-risk qualitative study was formally undertaken by the institutional authority of STIKes St. Elisabeth Keuskupan Maumere. Written informed consent was obtained from all participants prior to data collection. Participants were informed of the study objectives, procedures, voluntary nature of participation, and their right to withdraw at any time. Confidentiality and anonymity were strictly maintained throughout the research process.

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