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Development of Supportive-Educative Range of Motion Exercise for Post-stroke Patients: A Pilot Study

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Abstract

The purpose of this pilot study was to assess of home care intervention on post-stroke related outcome of range of motion and muscle strength. Sample in 40 participants were divided into the intervention group and control group and included in this study according to the following criteria: post-stroke period of <12 months with hemiparesis, age of ≥ 18 years, and willingness to participate in the study. The intervention was carried out by nurses by providing education for 2 consecutive days and mentoring for 5 consecutive days, while the control group was given standard care and measured using a grip track, handheld dynamometer, and goniometer examination on June to September 2019. For the intervention group, paired t-test analysis confirmed a significant increase in the mean upper extremity muscle strength before (35.770 ± 46.063) and after (51.073 ± 50.866) the 7 day intervention ($p = .002$), whereas the control group showed a value 36.570 ± 33.684 and then 31.400 ± 31.760 $p = .256$ and lower extremity strength before (3.627 ± 1.585) and after (4.365 ± 1.698) the 7-days intervention ($p = .000$), whereas the control group showed a value 3.657 ± 1.671 and then 4.043 ± 1.849 $p = .013$. Almost all the items assessed from Range of Motion (ROM) in the upper and lower extremities showed a significant increase ($p < .05$). Supportive-educative ROM exercise significantly contributed to an increase in the average muscle strength and ROM in post-stroke patients.

Keywords

supportive-educative, range of motion, post-stroke, muscle strength, home setting, self-care

Introduction

Stroke is the third leading cause of death globally after coronary heart disease and cancer, and approximately 5.5 million individuals (10%) worldwide die of stroke annually.[1] It is predicted that, in 2030, the death rate due to stroke will reach 200 million.[2] The annual mortality rate due to stroke approaches 133 000.[3] In Indonesia, the mortality rate due to stroke has increased. In 2013, the mortality rate reached 7%,[4] and in 2018, it was 10.9%.[5] In addition, stroke has an impact on the body leading to 5 functional inabilities, that is, (1) paralysis or issues in controlling movement, (2) sensory disturbances, including pain, (3) issues in speaking or understanding language, (4) issues in thinking and memory, and (5) emotional disorders.[6]

Stroke affects an individual's ability to control movement, limitations or impairments with communication, continence, activity of daily living, cognitive performance and emotional disturbances, and sensory or pain disorders.[7] Furthermore, the disturbance in controlling movement or activity is caused by the presence of lesions in the motor cortex.[8] Approximately 85% of patients with stroke will have motor dysfunction, such as paralysis and paresis in the extremities,[9] walking with body support,[10] and limited range of motion (ROM).[11] This results in the tendency to use healthy limbs, leading to disability and impaired motor function.[12,13] Restoration of motor function requires a long time[14] and it is difficult to conduct in hospitals, especially if the patient resides in remote areas that are inaccessible by public transportation. Therefore an active role of community nurses is necessary to minimize the long-term side effects of stroke.

Community health nursing involves the active role of public health nurses and can minimize the disability and/or inability of patients through promotive, preventive, and

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rehabilitative approaches by ensuring access to required health services and involving clients as partners in the planning, implementation, and evaluation of nursing services.[15,16] Most patients who receive home health care can prevent side effects after hospital discharge.[17] Requiring attention is the harmful effect of stroke that results in disability and/or inability to perform daily needs independently (self-care deficit).

Self-care deficit (inability to meet daily needs) caused by impaired motor function results in patients' dependence on others for their daily needs; therefore, patients with stroke are in dire need of assistance in the form of supportive-educative programs from healthcare workers.[18-20] Supportive-educative intervention is part of the concept of nursing self-care from Orem, which aims to develop health behavior and status, in turn allowing patients to be responsible for their own health.[21] One intervention to help patients with stroke cope with impaired motor function is ROM exercise.[22] The Fungl-Meyer Lower extremity sensorimotor score in the intervention group were significantly higher than the control group after 30-month home-based exercise rehabilitation.[23]

ROM exercises improve joint motion and function and increase muscle mass and tone.[24] ROM exercises are also beneficial in improving physical and mental health in patients with stroke; reducing pain, cramps, dizziness, and stress; and relaxing the body.[25] The results of the study conducted at the RSUP Dr. M. Djamil, Padang, Indonesia, showed that nurses only teach families right and left sloping mobilization to prevent decubitus in patients with stroke.[26] Other studies[27] suggested that providing a 7-week supportive-educative program significantly improves dietary control, exercise, medication use, stress management, and personal hygiene behavior in patients with type 2 Diabetes Melitus (DM) compared with the group that did not undergo a supportive-educative program.[28] also reported that using a self-care model that involved 30 en 45 minutes training sessions could improve all dimensions of quality of life in patients with migraine. Similar to research from Braga and Pinto[29] the training program for caregivers of amyotrohic lateral sclerosis needs total duration for each training program were 2 full days + 1 half day in the weekends. A study conducted by Oupra et al[30] showed that providing education and support to caregivers of stroke survivors for 3 months can reduce caregiver tension and improve their quality of life. Many educative-supportive programs have been conducted for patients with chronic diseases, such as DM, to determine the regularity of their diet and treatment.[28,31] In patients with Tuberculosis, a study has also been conducted and proven using educative-supportive programs to achieve more optimal healing.[32] Therefore, the researcher aims to assess the effectiveness of supportive-educative ROM exercises on health outcomes in patients with stroke in home care settings because the healing process of patients with stroke requires a special approach to achieve maximum outcomes compared with health education in general, so a method of guidance or assistance and learning support for patients is needed, in the form of an educative-supportive approach to change patients' behavior, to be independent and optimal in their care through the teaching, guiding, and supporting stages.[33,34]

Materials and Methods

This pilot study with quasi-experimental and control group pretest–posttest research design involved 40 respondents (20 respondents in the intervention group and 20 in the control group) from June to September 2019 receiving post-stroke home care service in Majene Regency, which is one of the provincial capitals of Eastern Indonesia. In general, stroke affects the elderly Moreover, people having difficulties in accessing health facilities, that is, live in remote areas, not well connected by public transport, living in mountainous areas, unavailability of transportation due to low economic class makes patient transportation all the more difficult. Also, in cases where the houses are on stilts, it renders mobilization of patients with stroke difficult (must be carried down the stairs), besides that, their motivation is low because even though they are out of the hospital, they feel no change. The inclusion criteria for the respondents were as follows: post-stroke period of <12 months with hemiparesis, age of ≥ 18 years and have primary caregiver at home. The exclusion criteria were as follows: refusal to participate in this study; stroke with hemiplegia on the face or limb fracture; conditions that could affect the intervention process, such as speech and visual impairment and hearing loss; and inability to read and speak in Bahasa. The dropout criteria were nonparticipation in the education and mentoring program at a maximum of 2 times, resignation from being a respondent before completion of the assessment process, and death.

We measured the following variables: upper leg strength (griptrack) and lower leg strength (handheld dynamometer), and ROM (goniometer examination). These 3 variables were measured twice, that is, before and after the intervention and tests were conducted using the GripTrack commander, handheld dynamometer, and goniometer. However, this study did not measure the caregiver's knowledge and ability to conduct ROM in patients with stroke.

GripTrack Commander Inspection Procedures

The measuring instrument was used to assess the strength of the upper limb muscles objectively. This instrument shows the results of the strength of the grip contained on the screen so that researchers can see changes in muscle strength in patients. The GripTrack Commander (Japanese media) was used to measure the grip strength with subjects in a sitting position and their shoulders in an upright position, elbows bent to 90°, and forearms and wrists in the middle position. This instrument has been recommended by the American Society of Hand Therapists.

The accuracy of this device was calibrated from a factory that meets the standards of the National Institute of Standards and Technology; when turned on, the tool will automatically turn to zero and calibrate itself.[35] This tool has been previously used to determine the strength of normal grip in children aged 6 to 12 years in Saudi Arabia[36] and grip strength and nutritional risk in hospitalized patients with gastrointestinal and liver diseases[37] and provide physiological and psychological examinations for the development of indicators of the daily life in the elderly population.[38]

Examination Procedure Using the Handheld Dynamometer (HHD; μTAS MT-1 or μTAS F-1; Anima Inc., Tokyo, Japan)

This instrument was used to measure objectively the strength of the lower limb muscles and displayed the results of the strength of the muscles of the lower limbs, which was assessed in units of Newtons or kilograms. The application of this device was easier than that of the isokinetic dynamometer. The handheld dynamometer is a tool to measure muscle strength that is most appropriate in the clinical field.[39] The reliability of the tool has been tested with excellent results. More consistent measurement results can be used to detect subtle changes in ankle dorsiflexor muscle strength[40] and measure the muscle strength of the upper extremity.[41] Additionally, this tool has been used in measuring the strength of lower limb muscles in patients with type 2 DM.[42]

Goniometer Examination Procedure

The manual goniometer is also a measurement instrument that measures motion by placing it on a fulcrum device. It was certified by the International Standards of Measurement and calibrated by the manufacturer. This tool was previously used in several studies for ROM.

Supportive Education Procedures in Patients With Stroke

This study collected data from home visit that was previously conducted at Majene district hospital. The intervention was performed in 2 stages, that is, providing education and mentoring. Education was imparted for 2 consecutive days for duration of 45 minutes per day. The participants in this stage were patients and their families, because the family can provide support, care and motivation.[43] The supportive-educative approach on the first day was applied using picture booklet media, which is based on the results of discussions with experts in their field (1 physician of stroke nursing and 1 physiotherapist). The content of the booklet was as follows: definition, signs and symptoms, cause of stroke, understanding ROM, benefits, and ROM procedures with each movement accompanied by pictures. The booklet was also accompanied by a logbook to facilitate evaluation of the progress of movement of patients with stroke. A study suggested that providing information using picture booklets has been proven effective and economical in controlling an individual's condition and can help respondents improve their physical and psychological function.[44]

The booklet given to respondents contained signs and symptoms of stroke, causes, complications, risk factors and post-stroke patient care, benefits of ROM, contraindication of ROM, and ROM implementation procedures, using presentation methods, questions and answers, demonstrations, and guidance for 45 minutes. A logbook was provided as a daily record of daily ROM implementation. A log book was maintained to record and report the activities and to check the progress of the upper and lower extremity strength and range of motion. The application of paper-based home exercises (logbooks) was no worse than the use of advanced technology based on tablets in post-stroke patients.[45] Other studies also used logbooks as evaluation materials for post-stroke patients at home.[41] On the second-day meeting, a ROM exercise demonstration was held for 45 minutes for patients with stroke.

The second stage of intervention was mentoring. Mentoring was performed for 5 consecutive days in the morning through home visits by researchers, whereas standard care was implemented in the control group. All study end points were assessed at 7 day after intervention (Figure 1) using the same test sequence. The mentoring session was done in the morning because patients started the activities in the morning, thus it was easy to demonstrate ROM exercise and the methods used at this mentoring stage on the third to sixth meetings, assistive and supportive approaches (providing encouragement to patients with stroke by giving praise and a thumbs up) and demonstration of ROM exercise were conducted. Furthermore, on the seventh-day educational evaluation, question and answer techniques were provided.

Statistical Analysis

A t-test was used for hypothesis testing to determine changes in the mean before and after treatment with a significance level ($p < .05$).

Results

Characteristics of Respondents

The average age of the respondents was 57.40 ± 10.349 years, and the average duration of stroke was 6.60 months with standard deviation of ± 3.283, whereas in the control group, the average age of the respondents was 55.15 ± 10.064 years, and the average duration of stroke was 7.25 ± 3.007 months. There were more male respondents (n = 11, 27.5%) in the intervention group and less in the control group (n = 5, 12.5%) 11 respondents (27.5%)

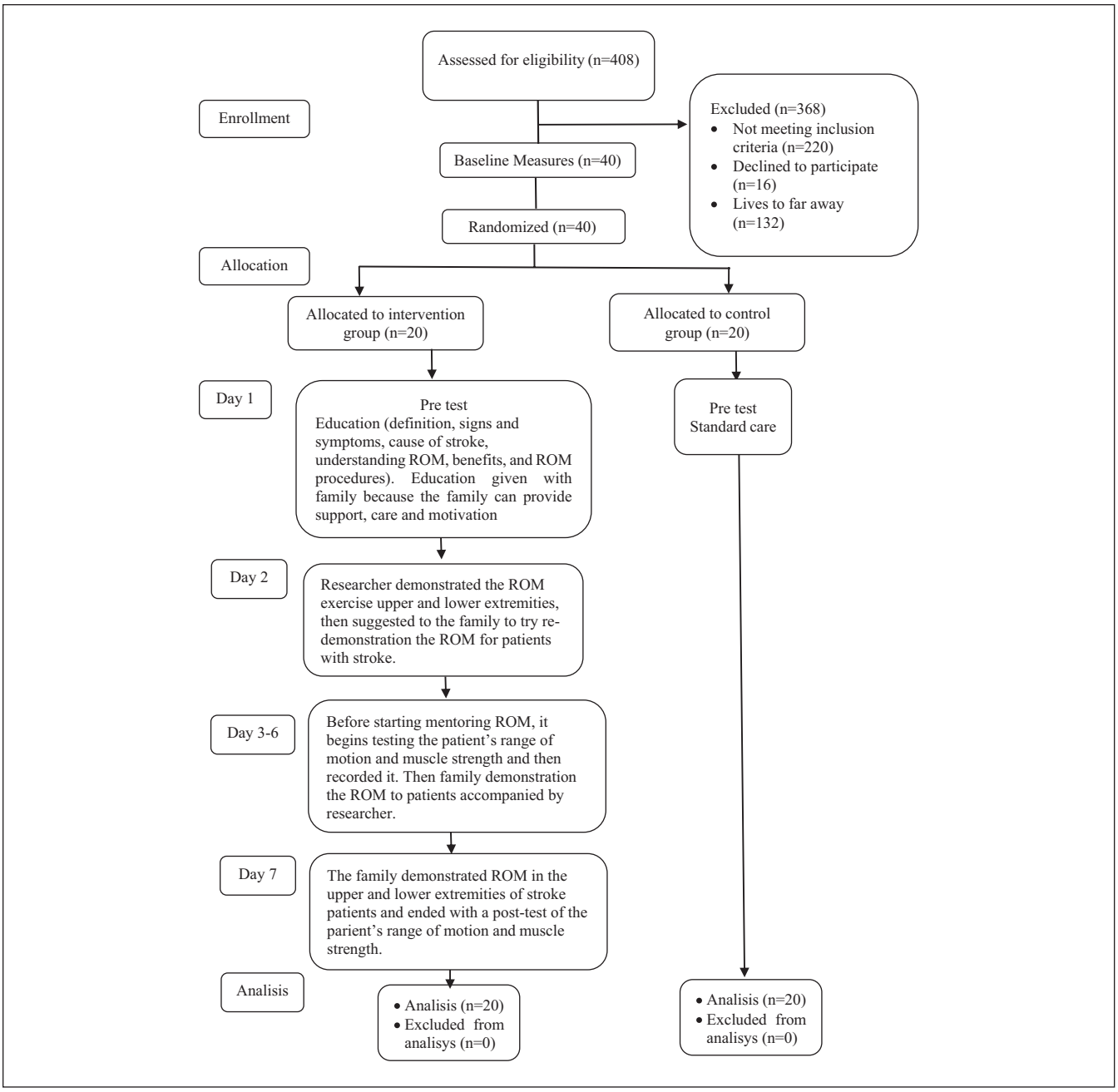

Figure 1. Flowchart of the respondents.

had paralysis on the right side in the intervention group, and 10 respondents (25%) had paralysis in the control group. There were 16 respondents (40%) with a history of hypertension, whereas in the control group, all respondents had a history of hypertension, 2 respondents (5%) had a history of DM in the intervention group and 5 (12.5%) in the control group, 13 (32.5%) in the intervention group with history of hypercholesterolemia and gout in the intervention group, whereas in the control group, 16 respondents (40%) had a history of hypercholesterolemia and 14 (35%) had gout disease, 5 (12.5%) with obesity similar to that obtained in both the intervention group and control group, 2 (2%) with family history of stroke in the intervention group, and 5 (12.5%) with smoking history in the intervention group, whereas in the control group, 3 respondents (7.5%) had smoking history. None of the respondents had a history of alcohol consumption (n = 40, 100%) in both the intervention group and control group, consumption of fatty foods (n = 7, 17.5%), whereas in the control group (n = 13, 32.5%), and fried foods (n = 13, 32.5%) the same number in both the intervention group and control group (Table 1).

Table 1. Frequency Distribution Based on the Demographic Characteristics of Patients with Stroke.

Characteristics	Intervention group	Control group
Age (mean ± SD) (Year)	57.40 ± 10.349	55.15 ± 10.064
Duration of Stroke (mean ± SD) (Month)	6.60 ± 3.283	7.25 ± 3.007
Sex		
Male, n (%)	11 (27.5)	5 (12.5)
Female, n (%)	9 (22.5)	15 (37.5)
Side of the body with paralysis		
Right, n (%)	11 (27.5)	10 (25)
Left, n (%)	9 (22.5)	10 (25)
History of hypertension		
No, n (%)	4 (10)	0 (0)
Yes, n (%)	16 (40)	20 (50)
DM		
No, n (%)	18 (45)	15 (37.5)
Yes, n (%)	2 (5)	5 (12.5)
Hypercholesterolemia		
No, n (%)	7 (17.5)	4 (10)
Yes, n (%)	13 (32.5)	16 (40)
Gout		
No, n (%)	7 (17.5)	6 (15)
Yes, n (%)	13 (32.5)	14 (35)
Obesity		
No, n (%)	15 (37.5)	15 (37.5)
Yes, n (%)	5 (12.5)	5 (12.5)
Family history of stroke		
No, n (%)	18 (45)	20 (50)
Yes, n (%)	2 (5)	0 (0)
Smoking history		
No, n (%)	15 (37.5)	17 (42.5)
Yes, n (%)	5 (12.5)	3 (7.5)
No Alcohol consumption, n (%)	20 (50)	20 (50)
Fatty food consumption		
No, n (%)	13 (32.5)	7 (17.5)
Yes, n (%)	7 (17.5)	13 (32.5)
Fried food consumption		
No, n (%)	7 (17.5)	7 (17.5)
Yes, n (%)	13 (32.5)	13 (32.5)

Muscle Strength Variable

The upper limb muscle strength in patients with stroke before the intervention in the form of educative-supportive ROM was 35.770 ± 46.063, and after daily intervention for 7 days, there was an increase in the mean value to 51.073 ± 50.866 and, the *t*-test results obtained a significant increase in muscle strength with a significant value of 0.002 in the intervention group, whereas in the control group, the values before daily intervention were 36.570 ± 33.684 and those after daily intervention were 31.400 ± 31.760, with a significance of 0.256. The difference between the intervention group and control group before the intervention in the form of educative-supportive ROM was $p = .950$, and after 7 days, it was $p = .151$.

As for the lower limb strength in patients with stroke, the mean values before and after the intervention were 3.627 + 1.585 and 4.365 ± 1.698, respectively, with a significant value of 0.000, indicating a significant increase in muscle strength of the lower limbs in patients with stroke patients in the intervention group, whereas in the control group, the values before intervention were 3.657 ± 1.671 and those after intervention were 4.043 ± 1.849, with a significance of 0.013. The difference between the intervention group and control group before the intervention was $p = .954$, and after 7 days, it was $p = .569$ (Table 2).

ROM Variable

Statistically, almost all ROMs in the upper and lower extremities (shoulder flexion, shoulder extension, shoulder abduction, shoulder adduction, shoulder rotation, shoulder outside rotation, elbow flexion, elbow extension, arm supination, wrist flexion, wrist extension, wrist abduction, wrist adduction, finger flexion, finger extension, finger hyperextension,

Table 2. Changes in the Average Muscle Strength Before and After Intervention in Patients with Stroke in Majene Regency.

	Pre intervention			Post intervention				
	Intervention group	Control group		Intervention group	Control group			
Muscle strength	Mean ± SD	Mean ± SD	*p*-value[a]	Mean ± SD	Mean ± SD	*p*-value[a]	*p*-value[b] intervention	*p*-value[c] control
Upper extremity	35.770 ± 46.063	36.570 ± 33.684	.950	51.073 ± 50.866	31.400 ± 31.760	.151	.002	.256
Lower extremity	3.627 ± 1.585	3.657 ± 1.671	.954	4.365 ± 1.698	4.043 ± 1.849	.569	.000	.013

[a]Independent *t*-test.
[b]Paired *t*-test for intervention group.
[c]Paired *t*-test for control group.

thumb flexion, finger abduction, pelvic flexion, pelvic extension, pelvic abduction, pelvic adduction, pelvic rotation, pelvic outer rotation, dorsiflexion of the ankle, plantar flexion of the ankle, and toe flexion) show significant results ($p < .05$), except for arm pronation ($p = .156$), thumb extension ($p = .080$), knee flexion and knee extension ($p = .083$), and toe extension ($p = .352$) in the intervention group, whereas in the control group, all ROMs in the upper and lower extremities showed no significant result ($p > .05$). The intervention group and control group before the intervention showed no difference in all ROMs in the upper and lower extremities, and after the intervention, there was a difference in shoulder flexion ($p = .034$), shoulder extension ($p = .034$), shoulder abduction ($p = .038$), shoulder adduction ($p = .017$), finger hyperextension ($p = .012$), dorsiflexion of the ankle ($p = .022$), plantar flexion of the ankle ($p = .007$), and toe flexion ($p = .008$), except for shoulder rotation, shoulder outside rotation, elbow flexion, elbow extension, arm supination, arm pronation, wrist flexion, wrist extension, wrist abduction, wrist adduction, finger flexion, finger extension, thumb flexion, thumb extension, finger abduction, pelvic flexion, pelvic extension, pelvic abduction, pelvic adduction, pelvic rotation, pelvic outer rotation, knee flexion, knee extension, and toe extension (Table 3).

Discussion

This study aimed to determine the development of educative-supportive range of motion exercises for post-stroke patients in the home care setting. Development of educative-supportive range of motion exercises for post-stroke patients. Showed significant results on the strength of the upper and lower limb muscles, which presented a significant increase after the intervention of educative-supportive ROM and 7 day mentoring in a home care setting. A survey reported that one of the top 3 interventions used by 82% of practitioners of post-stroke home program was in the form of muscle strength training with ROM.[46] Increased lower limb muscle strength has a positive correlation with the ability to walk and comfort in patients with stroke,[47] whereas the upper extremity strength affects health-related quality of life (HRQoL) associated with self-care, usual activities, pain discomfort, and anxiety or depression.[48] Although it is known to have an impact on HRQoL, post-stroke patients' compliance with home exercise programs (HPEs) is still not ideal.[49] Some of the most common barriers to HPE compliance in post-stroke patients include low motivation, lack of caregiver support, and frustration and pain.[46] The educative-supportive approach is known to change the patient's behavior to be independent and optimal in their care through the teaching, guiding, and supporting stages[33] so that the provision of educative-supportive and mentoring ROM training by therapists and caregivers is recommended as an additional intervention while undergoing the HPE. This is consistent with the role of nurses in the community in improving the independence of the family and in providing care for family members after stroke.[50]

This study also showed a significant increase in ROM in the shoulders, elbows, arms, wrists, fingers, pelvis, and ankles. Other studies on ROM exercise interventions reported an increase in the ROM of upper limb extension, but the increase was not significant.[51] However, another finding related to the results of this study is the significant increase in ROM in the upper extremity after exercise therapy interventions, physical therapy, and health education guidance in post-stroke patients,[52,53] so we assume that ROM exercises combined with an educative-supportive approach and mentoring for 7 consecutive days increase the ROM significantly. Another factor that influenced the results of this study is the accuracy and precision of the ROM measurements, in which a study reported significant differences by 3 assessors with different levels of experience and expertise,[54] but in this study, only 1 assessor conducted the measurements. Further research related to the accuracy and precision of the caregiver as an appraiser is needed to validate the measurement results. Strategies are needed to implement educative-supportive interventions for post-stroke patients, at home care agencies in Indonesia and globally by increasing the role (involvement) and support of caregivers so that patients are more motivated to participate all programmed sessions.

Recommendation

The value of upper and lower extremity muscle strength and ROM can be quantified objectively using griptrack, handheld dynamometer, and a goniometer examination employed in the current study. From the findings, it has observed a change in muscle strength and ROM after an intervention for 7 consecutive days. The mood of patients with stroke often changes; therefore, sometimes, they need to wait until their

Table 3. Difference in Mean Increase in Range of Motion Before and After the Intervention in Patients with Stroke in Majene Regency.

	Pre intervention			Post intervention				
	Intervention group	Control group		Intervention group	Control group			
Range of motion	Mean ± SD	Mean ± SD	*p*-value[a]	Mean ± SD	Mean ± SD	*p*-value[a]	*p*-value[b] intervention	*p*-value[c] control
Shoulder flexion	142.50 ± 24.693	141.30 ± 26.142	.882	153.95 ± 20.379	137.85 ± 25.629	.034	.000	.054
Shoulder extension	142.50 ± 24.693	141.30 ± 26.142	.882	153.95 ± 20.379	137.85 ± 25.629	.034	.000	.054
Shoulder abduction	133.55 ± 29.373	133.45 ± 29.929	.992	149.50 ± 22.282	130.70 ± 32.077	.038	.006	.087
Shoulder adduction	30.60 ± 8.840	30.35 ± 8.425	.928	34.70 ± 5.583	29.05 ± 8.451	.017	.001	.155
Shoulder rotation	67.70 ± 29.647	68.75 ± 27.577	.908	71.70 ± 25.394	68.50 ± 30.478	.720	.018	.955
Shoulder outer rotation	63.70 ± 21.492	63.85 ± 16.791	.981	71.55 ± 20.109	59.90 ± 17.773	.060	.005	.235
Elbow flexion	125.95 ± 12.111	127.35 ± 12.326	.719	132.65 ± 9.756	127.95 ± 11.288	.167	.000	.762
Elbow extension	125.95 ± 12.111	127.35 ± 12.326	.719	132.65 ± 9.756	127.95 ± 11.288	.167	.000	.762
Arm supination	73.20 ± 27.169	66.75 ± 30.876	.487	78.20 ± 20.096	67.50 ± 29.580	.189	.018	.330
Arm pronation	75.90 ± 29.008	70.35 ± 30.662	.560	80.50 ± 20.384	69.70 ± 30.706	.189	.156	.222
Wrist flexion	66.05 ± 17.370	66.75 ± 20.084	.907	73.15 ± 15.267	63.65 ± 18.537	.085	.000	.189
Wrist extension	70.85 ± 15.174	6750 ± 21.120	.568	77.25 ± 10.882	67.05 ± 21.010	.061	.003	.529
Wrist abduction	12.50 ± 9.157	13.55 ± 5.346	.660	16.70 ± 7.787	13.30 ± 5.141	.111	.000	.330
Wrist adduction	17.90 ± 10.682	17.50 ± 10.324	.905	21.35 ± 10.449	16.95 ± 8.550	.153	.000	.555
Finger flexion	76.90 ± 22.504	72.25 ± 18.099	.476	80.55 ± 19.702	69.75 ± 17.204	.073	.047	.171
Finger extension	76.90 ± 22.504	72.25 ± 18.099	.476	80.55 ± 19.702	69.75 ± 17.204	.073	.047	.171
Finger hyperextension	20.70 ± 10.322	18.20 ± 9.468	.430	25.05 ± 9.660	17.20 ± 9.209	.012	.009	.330
Thumb flexion	54.25 ± 18.373	56.00 ± 18.750	.767	57.55 ± 20.626	54.50 ± 18.560	.626	.030	.581
Thumb extension	35.15 ± 17.021	33.80 ± 12.664	.778	40.30 ± 11.775	33.55 ± 12.584	.088	.080	.908
Finger abduction	59.35 ± 9.653	57.00 ± 12.917	.518	60.35 ± 8.756	56.00 ± 14.198	.251	.035	.330
Pelvic flexion	81.75 ± 19.426	80.30 ± 19.186	.814	87.40 ± 20.009	78.50 ± 22.061	.189	.000	.314
Pelvic extension	81.75 ± 19.426	80.30 ± 19.186	.814	87.40 ± 20.009	78.50 ± 22.061	.189	.000	.314
Pelvic abduction	22.10 ± 7.115	23.20 ± 4.991	.575	24.70 ± 6.522	22.90 ± 5.721	.359	.000	.681
Pelvic adduction	22.10 ± 7.115	23.20 ± 4.991	.575	24.45 ± 6.992	22.40 ± 5.500	.309	.000	.107
Pelvic rotation	20.40 ± 9.955	21.65 ± 5.153	.621	23.45 ± 8.947	20.20 ± 7.818	.229	.000	.475
Pelvic outer rotation	16.65 ± 8.780	16.15 ± 9.010	.860	20.35 ± 6.923	15.60 ± 9.213	.073	.000	.652
Knee flexion	126.10 ± 4.919	125.75 ± 4.940	.824	127.60 ± 4.285	123.70 ± 10.569	.134	.083	.270
Knee extension	126.10 ± 4.919	125.30 ± 6.088	.650	127.60 ± 4.285	123.45 ± 10.719	.116	.083	.371
Foot dorsoflexion	9.10 ± 7.622	9.75 ± 5.748	.762	12.50 ± 5.296	8.65 ± 4.880	.022	.000	.244
Foot plantar flexion	14.45 ± 7.584	14.55 ± 7.200	.966	19.35 ± 9.218	12.25 ± 6.340	.007	.002	.250
Toe flexion	35.50 ± 4.989	35.00 ± 5.130	.756	37.10 ± 4.077	32.80 ± 5.473	.008	.041	.073
Toe extension	42.40 ± 11.445	41.95 ± 11.852	.903	43.40 ± 11.609	41.90 ± 10.862	.675	.352	.951

[a]Independent *t*-test.
[b]Paired *t*-test for intervention group.
[c]Paired *t*-test for control group.

mood is stable. The present study recommends a sustained ROM intervention needs educative-supportive for better results than only ROM. Further research with larger sample size and with RCT design is recommended

Conclusion

The effectiveness of the educative-supportive approach on the health outcomes of patients with stroke, increases the muscle strength of the upper and lower extremities and joint ROM in patients with stroke effectively.

ROM therapy is more effective if accompanied by an educative-supportive approach on an ongoing basis by involving the family, which leads to better results obtained and should be conducted at the home of the patient or respondent so that they can be directly evaluated and facilitated by the respondents along with a community nurse who could always monitor and provide motivation in stroke patients, particularly those with self-care deficits.

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Author Contributions

IM conceived and designed the study, conducted research, provided research materials, and collected andorganised the data. ELS and AMI analysed and interpreted the data. ELS, IM, AMI and S wrote the initial and final drafts of the article. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Declaration of Conflicting Interests

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Ethical approval

This study obtained an ethical clearance from the Faculty of Medicine of Hasanuddin University (Makassar, Indonesia) under number 450/UN4.6.4.5.31/PP36/2019.

Concent

Measurements were conducted after obtaining informed consent from the respondents, namely, at the first meeting (pre) and first weekend (post).

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Availability of Data and Material

All data are available from the corresponding author upon reasonable request.

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