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A rehabilitation program to improve the physical capability of seniors in a nursing home

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Abstract---The purpose of this study was to examine the benefits of implementing a rehabilitation program for seniors in a nursing home. A physical activity rehabilitation program study was conducted in a nursing home in Taiwan for eight weeks. Forty senior adults (20 males and 20 females) in a nursing home joined this study as human participants. All the participants were diagnosed by a licensed rehabilitation physician as having a mild physical disability. They were split into control and experimental groups. Both groups included 10 males and 10 females. The participants in the experimental group joined the rehabilitation program while the participants in the control group did not. The range of motion and handgrip strength of all the participants before and after this program was measured. The results showed that the joint range of motion (ROM) of the upper limbs, trunk, and lower limbs of the participants in the experimental group increased significantly after attending the program. The difference between all the ROM values of the participants in the control group did not change significantly during the 8-week period. Similar results were found for the grip strength. Overall, the rehabilitation program was effective in increasing mobility and slowing down the decline of sarcopenia in all joints. The benefits of implementing such a program were obvious. Index terms: disability, older adults, rehabilitation program, range of motion of joint.

Keywords--- disability, older adults, rehabilitation program, range of motion of joint.

Introduction

Aging is one of the global problems in health and safety. Aging may lead to dysfunction of body parts and hence disability. People with bodily disabilities have limited mobility and may have difficulty performing activities of daily living (ADL) [1-4] and may need assistance from others to for daily activities. Sarcopenia has been identified as a muscle disease [5-7]. Sarcopenia usually presents in a chronic manner and become more serious with age. Many seniors in nursing homes suffer from sarcopenia of different level. They may need assistance from caregivers. For people with sarcopenia, both their muscle strengths and range of motion (ROM) on bodily joints may be decreasing. Their physical capability may then be also decreasing. The ROM is the maximum angle of joint motion that can be achieved. People lose a certain amount of joint mobility as they are ageing. Gradual decline of the ROM is an alarming sign that human body is deteriorating. Even though it may not lead to an injury, loss of muscle mass for a period of time may lead to sarcopenia [7, 8].

It was found that ROM in older adults with mild disabilities is an important indicator of daily physical activity and grip strength may be adopted to indicate the physical capability of the upper limbs [9-12]. In this study, a physical activity rehabilitation program was implemented for senior adults with mild disabilities in a nursing home. The purpose was to quantify the benefits of such a program on those seniors.

Methods

Forty older adults (20 males and 20 females) in a nursing home in Taiwan joined our study as human participants. The age of male and female participants were 83.1 (± 5.9) and 84.3 (± 6.1) yrs, respectively. Ten male and ten female participants were assigned to each of the experimental and control groups, and all the participants signed a consent form. All the participants were informed that they could withdraw any time during the study without penalty. However, all of the participants have completed the program. This study has been reviewed and approved by a local ethic committee.

The participants in the control group lived a normal lifestyle in the nursing home. The participants in the experimental group received training in accordance with the rehabilitation program. This program involved 8 weeks of physical activity at a moderate intensity, three sessions per week (scheduled at regular times), with about 70 minutes per session and a one-minute break in each group. The program started with lower and upper limb mobility stretching, followed by seated knee raise, seated arm curl, seated stepping in place, seated hands touching one foot, and finally seated shoulder and arm stretching, and seated back and pectoralis major stretching. The rehabilitation was under guidance of both a licensed rehabilitation physician and a rehabilitation trainer.

The ROM values on the shoulder, elbow, wrist, hip, knee, and ankle were measured both before and after the 8-week period using a goniometer (GemRed,

China) (see Figure 1) [12]. In addition, the grip strengths of the dominant hand of the participants were also measured using a dynamometer (see Figure 2).



Figure 1. Goniometer and ROM measurement: (a) goniometer, (b) hip joint measurement; (c) Knee joint measurement.



Figure 2. Dynamometer for grip strength measurement

Descriptive statistics were performed. Pair-wised *t*-tests were performed to determine the pretest and posttest scores of the participants, with significance levels set at $\alpha=0.05$. The SPSS 20 software (IBM®, Armonk, New York, USA) was adopted for statistical analyses.

Results & Discussion

After completing the rehabilitation program, the all the ROM values of the joints tested of the participants in the experimental groups showed significant improvement ($p<0.05$). The ROM values for the male participants in the control group, however, did not change significantly. We, therefore, did not show their results. Table 1 shows the ROM values of the male participants in the experimental groups.

Table 1
Joint ROM values for male participants in the experimental group.

ROM (°)	Pre	Post
Shoulder FI*	140±12.	157±
	5	6.2
Shoulder Ex*	38±3.9	43±2.8
Shoulder Ab*	141±6.8	146±6.
		2

Shoulder Hor Fl*	115±9.1	125±7.2
Shoulder Hor Ex*	115±9.1	125±7.2
Elbow Fl/Ex*	122±11.7	140±9.1
Wrist Fl*	64±4.3	70±4.9
Wrist Ex*	60±2.6	67±2.3
Hip Fl*	68±9.8	76±10.6
Hip Ex*	17±3.1	26±3.0
Hip Ab/Pr*	33±3.2	42±1.5
Hip Ab/Ret*	10±2.1	17±2.3
Left Knee Fl*	97±7.61	114±8.49
Right Knee Fl*	93±8.36	115±8.20
Ankle plantar-Fl*	36±3.73	43±2.12
Ankle dorsi-Fl*	9±1.91	13±1.96

* $p < 0.05$; Fl: flexion; Ex: extension; Ab: abduction; Pr: protraction; Ret: retraction; Hor: horizontal.

Table 2 shows the ROM values of the female participants in the experimental groups. All the ROM values of the female participants increased significantly ($p < 0.05$) after attending the program. The ROM results of the females in the control group did not change significantly. We, therefore, did not show their results.

Table 2
Joint ROM values for female participants in the experimental group.

ROM (°)	Pre	Post
Shoulder Fl*	140±9.8	159±7.5
Shoulder Ex*	37±6.2	43±4.1
Shoulder Ab*	138±8.4	152±3.4
Shoulder Hor Fl*	116±6.6	125±5.0
Shoulder Hor Ex*	116±6.6	125±5.0
Elbow Fl/Ex*	110±10.4	142±5.0
Wrist Fl*	58±4.1	67±4.03
Wrist Ex*	60±2.4	68±1.79
Hip Fl*	60±11.64	72±8.09

Hip Ex*	18±2.9	26±2.14
	2	
Hip Ab/Pr*	33±2.5	41±3.31
	5	
Hip Ab/Ret*	10±1.4	18±2.07
	8	
Left knee Fl*	104±4.	119±2.80
	84	
Right knee Fl*	105±3.	121±2.57
	28	
Ankle plantar-Fl*	35±4.4	43±2.46
	2	
Ankle dorsi-Fl*	8±1.1	
	9	14±1.78

* $p < 0.05$; Fl: flexion; Ex: extension; Ab: abduction; Pr: protraction; Ret: retraction; Hor: horizontal.

For male participants, it was found that hip joint abduction/retraction has improved 10° to 17° ($p < 0.05$) after attending the program. Hip extension has increased 17° to 26° ($p < 0.05$). For females, hip abduction/retraction has increased 10° to 18° ($p < 0.05$). Knee right flexion has increased 105° to 121° ($p < 0.05$).

We compared the ROM values between male and female participants in the experimental group. It was found that shoulder abduction and adduction angle of female participants were significantly ($p < 0.05$) higher than that of their male counterpart. The hip abduction/retraction ROM values of females were also significantly ($p < 0.05$) higher than that of males. The knee flexion angle of the right leg of the female participants was also significantly ($p < 0.05$) higher than that of males. We did not found significant differences of any other ROM values of the post-tests data between male and female participants.

Table 2 shows the grip strength of the participants in the experimental groups after attending the program. The results of those in the control group were not shown as they were not significant before and after the 8-week period. For both male and female participants, the grip strengths after attending the program were significantly higher than those of before the 8-week period.

Table 2. Grip strength (kgf) of the participants in the experimental group

	before	after
Male*	7.13±0.54	8.58±0.61
Femal	6.03±0.83	7.56±1.06
e*		

* $p < 0.05$

After attending the rehabilitation program, the mean handgrip strength for males and females increased from 7.13 kgf to 8.58 kgf ($p < 0.05$) and from 6.03 kgf to 7.56 kgf ($p < 0.05$), respectively. The increase of the grip strength for both males

and females indicated that those who have attended the rehabilitation program have made improvements in their physical capability on the upper limbs.

In our study, all the participant in the nursing home have ADL disability status. This was characterized by slowed mobility and functional limitations of ROM [13, 14]. As the result of the intervention of the rehabilitation program, the ROM values of the bodily joints and grip strengths of the participants have improved. Owusu et al. [15] reported that handgrip strength is an indicator of overall muscle strength and hip and knee ROM had a significant effect on the functions of the lower limbs for seniors. The ROM values we have obtained before and after the 8-week program could explain the improvements of the bodily functions of the older adults joined in our study. Our results were consistent with those in the literature [15].

Many studies have also confirmed that low ROM is highly correlated with disabilities [16]. The ROM of the upper limbs is the main support for people with disabilities, which involves the muscle strength and function of the upper limbs needed for independent eating, dressing and finger movement [17]. The findings suggest that many senior adults with mild disabilities have a sedentary lifestyle with limited amount of physical activity. Progressive decline in exercise, resulting in decreasing muscle strength and restricted hip and knee flexion [18]. ROM limitation is, therefore, associated with sarcopenia [4, 5, 19]. In our study, we found some seniors were suffering osteoarthritis. Osteoarthritis may result in loss of muscle mass and sarcopenia [8]. We found this after examined their knee and hip joints ROMs. During the rehabilitation program, we focused on the seniors with ADL problems who could not perform independently. We had to be focused more on those seniors with severe knee atrophy and mild disabilities who experienced pains during rehabilitation extension because of fascia adhesions. Recent studies have confirmed that sarcopenia is often associated with osteoarthritis [19, 20]. In severe cases, osteoarthritis could lead to degeneration of synovial joints and result in pains and even disabilities [8].

Gym apparatus and machines have been commonly used for seniors to improve their muscle strength and aerobic capability. Using such apparatus and machines needs advises and instructions from professional coach. The rehabilitation program in the current study does not need gym machine and thus may be implemented more easily.

Conclusion

Ageing of senior population leads to reduction of muscle strength and ROM of body joints. These reductions reduce the capability of those seniors in performing daily activities. In order to mitigate the effects of ageing so as to maintain the capability of performing daily activity for seniors. We implemented an 8-week physical rehabilitation program in a nursey home for senior adults with mild disabilities. The results showed that our 8-week rehabilitation program was effective in increasing the ROM of all the bodily joints we measured. This program also resulted in increased grip strength and thus was effective in increasing the physical capability of upper limb. It should be noted that we applied only simple bodily exercise and motions in our program. More complicated exercises and

activities may be design in the future to check the effects of those activities on improving the physical capability of older adults. This study provides an example of successfully improving the mobility of bodily joints and grip strength of the older adults with mild disability.

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