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## ORIGINAL ARTICLE

### COMPARISON OF MULTIDIMENSIONAL HOME-BASED EXERCISE VERSUS RESISTANCE EXERCISE ON GRIP STRENGTH AND HAND FUNCTIONS IN ELDERLY POPULATION

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## ABSTRACT

**Background of the study:** In people aged 20-29 years old, average grip strength is 46 kg for men and 29kg for women. This decrease to 39 kg-23kg by the time when people reach 60 – 69 years of age. Aim & objective of the study is to study the comparative effects of multidimensional home-based exercise Vs resistance exercise to improve grip strength and hand functions in elderly population. **Methodology:** This experimental study of comparative type (pre and post) with 30 subjects the study was carried out at ACS medical college and hospital OPD for four weeks after the approval from institution of review board (IRB). there are selected for the study after getting consent for participation. the subjects were selected based on the inclusion and exclusion criteria and they assigned into two groups by simple randomized sampling method. The Group A (multidimensional home-based exercise) consists of 15 and the Group B (resistance exercise) consists of 15, the hand-held dynamometer is used as outcome measures. **Result:** Comparative study between Group A and Group B showed significant difference found in effectiveness in Right, Left hand power with P value <0.0001 on hand grip among elderly people. **Conclusion:** Comparative study between Group A and Group B showed significant difference found in effectiveness in Right, Left hand power with P value <0.0001 on hand grip among elderly people. Group B found more significant compare with Group A with mean difference of 4.800, 5.34 respectively on right and left hand by resisted exercise on hand grip among elderly people.

**Key words:** Hand grip; Elderly people; Hand function; Home based exercise; Resistance exercise

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## INTRODUCTION

India has around a hundred million elderly at present and expected to increase to 323 million constituting 20 percentage of the total at 2050. Approximately 88% of individuals older than 65 have at least one chronic health limitation and a number of older adults suffer from impaired functioning or well-being<sup>1-4</sup>.

Old age and disablement are the main determinants of health care use and health issues regarding the older population are becoming increasingly important. Ageing is characterized by a diminished function in multiple physiological domains, including the neuro musculoskeletal system e.g., loss of skeletal muscle mass, muscle strength, alterations in muscle quality, deterioration in joint mobility, neuromuscular coordination, balance<sup>4-7</sup>.

While ageing is an irreversible process, the effects of a sedentary lifestyle are very evident in most people due to inactivity. When physical capacity falls below the ability required for the performance of daily tasks, functional limitations and a loss of independence may occur<sup>8-11</sup>.

Approximately 20% of people between 65 and 75 years of Age need assistance performing activities of daily living (ADLs) and this increases to 48% in people older than 85. The first ADLs to be affected are climbing stair, shopping, rising out of chair or bed, house cleaning, washing and dressing oneself. As one's age increase the manual function and quantity of hand muscle strength are decreased and activity restriction in the geriatric age group will be present<sup>12-16</sup>.

## METHODOLOGY

This experimental study of comparative type (pre and post) with 30 subjects the study was carried out at ACS medical college and hospital OPD for four weeks after the approval from institution of review board (IRB). There are selected for the study after getting consent for participation. The subjects were selected based on the inclusion and exclusion criteria and they assigned into two groups by simple randomized sampling method. The Group A (multidimensional home-based exercise) consists of 15 and the Group B (resistance exercise) consists of 15, the hand-held dynamometer is used as outcome measures.

In this study lottery sampling methods were chosen to separate the groups in a clue card with 1 to 30 numbers printed in the cards, the cards were shuffled well and a card was drawn out by the subjects. If drawn cards contain odd number means the subjects assigned for Group A – multidimensional home-based exercise, if the drawn cards contain even numbers, it means the subject assigned for Group B- resistance exercise. Informed consent was obtained from the subjects.

**Intervention Duration:** Intervention made for this study was about 8 weeks along with alternative days about 30 minutes per day. The total study duration was about 4 months from February 2021 to May 2021.

**Inclusion Criteria:** Age group of 60 years, both male and female were selected for a study, Healthy individuals.

**Exclusion criteria:** Recent fractures in upper limb, Recent nerve injury in upper limb, Unstable cardiovascular, Metabolic disease, Muscular skeletal disease, Other chronic illness that might limit training or testing.

**Outcome measures:** Strengthening of hand grip and functional movements in elderly people using hand held dynamometer. Measurement Tool used for this study was w Handheld Dynamometer. Materials used in the study were hand gripper, putty clay, resistance ball, sand bag, water bottle.

Independent variable of the study was Multidimensional home-based exercise and Resistance exercise and Dependent variable was Hand held dynamometer to measure the grip strength.

### **Intervention:**

Group A: This group consists of 15 elderly people and home based exercise were given (transferring sand bags, crushing of papers, transferring water bottle, gripping the door lock, wringing out the wet cloths) group A exercises were given for 30 minutes per day and alternative days.

Group B: This group consists of 15 elderly people and resistance exercise were given (putty clay, resistance ball, hand gripper, elastic band exercises) group B exercises were given for 30 minutes per day and alternative days.

**Procedure:** A total of 30 subjects were divided as into 2 groups. Group A was taught by Multidimensional home-based exercise and Group B was taught by Resistance exercise for both hands, 3 days per week for total of 4 weeks. The study was conducted at ACS medical collage OPD, Subjects in Group A underwent home based exercises for hand and subjects in Group B underwent resistance exercises for hand for 4 weeks. Group A underwent 10 repetitions of each of the home-based exercises. In Group B resistance protocol, intrinsic muscle of hand is trained in four sets of 10 repetitions with hand gripper, rubber band bands, putty exercise and

squeezing wittiness with 2 minutes rest between the sets. Exercises will be performed three times a week in 1-hour session for 4 weeks, with sessions separated by 1 day of rest. Pre-test and post-test values of Hand grip strength was recorded using handheld dynamometer.

Group A: Multidimensional home-based exercise, is a system of exercise design to improve grip strength and hand functions in elderly populations.

The study design was Quasi-Experimental, Pre and Post-test study. Subjects aged 60-75 years old, both males and females, who were able to perform the exercise, and those who This study was conducted with getting approval from the institution. Ethical committee 20 subjects who met the inclusion and exclusion criteria were selected by random sampling. The subjects were allotted in to two groups based on lottery method. The study elapsing was 4 weeks.

Group B underwent resistance exercises for hand for 4 weeks. Group A underwent 10 repetitions of each of the home-based exercises. In Group B resistance protocol, intrinsic muscle of hand is trained in four sets of 10 repetitions with hand gripper, rubber band bands, putty exercise and squeezing wittiness with 2 minutes' rest between the sets. Exercises will be performed three times a week in 1-hour session for 4 weeks, with sessions separated by 1 day of rest. Pre-test and post-test values of Hand grip strength was recorded using handheld dynamometer.

### **Multidimensional Home-Based Exercise:**

**Group A:** Five sets of exercises are given with 10 repetitions and 2 minutes break in between the sets.

### 1. Carrying a plastic bottle of water transfer from one hand to another.

- The subject is allowed to be in sit in a comfortable position.
- Hand with the help of a bottle.
- The subject is asked to transfer the bottle from one hand to another.



**Figure 1.** Carrying a plastic bottle of water transfer from one hand to another.

### 2. Transfer sandbag from one hand to another.

- The subject is allowed to be in a sit in a comfortable position.
- hand with the help of resistance from a sandbag.
- The subject is asked to transfer the bottle from one hand to another.



**Figure 2.** Transfer of sandbag from one and to another

### 3. Crumple a sheet of a paper into a ball try to spread it back out into a flat piece of paper.

- The subject is allowed to be in a sitting position
- The subject is asked to crumple a piece of paper into a ball with both hands
- bring it to the original state without crumples.



**Figure 3.** Crumple a sheet of a paper into a ball try to spread it back out into a flat piece of paper.

### 4. Gripping the door lock.

- The subject is asked to stand near a door
- And hold the handle tightly,
- and pull it towards the body of the subject.



**Figure 4.** Gripping the door lock

### 5. wringing out the wet clothes.

- The subject is asked to wring a wet piece of clothes
- Preferably a towel and squeeze



- The towel tightly and bring back to the original position.



**Figure 5.** wringing out the wet clothes.

**Resistance Exercise:** Four sets of exercises are given with 10 repetitions and 2 minutes break in between the sets.

### 1.Hand gripper

- Hand grippers, are primarily used for testing
- increasing the strength of the hand this specific form of grip strength has been called crushing grip
- 10 repetitions and 2 minutes break in between the sets.

### 2. Squeezing resistance ball



**Figure 6** Squeezing of resistance ball.

- The squeeze ball targets muscles in the wrist, fingers, and thumb flexors.
- The rhythm of repetitive movement can increase grip strength, improving overall fine and gross motor skills.

- Within 2-3 seconds of squeezing the ball, it will return to its normal spherical shape and size.

### Elastic band



**Figure 7** Resistance band Exercise

When the rubber band contracts, it absorbs heat, making the area surrounding it ever so slightly cooler. this heat exchange affects the gripping strength of the rubber band and helps to create traction.

- place rubber band over the four fingers and thumb held in 5- fingers pinch position.
- spread fingers away from the thumb.
- spread index and middle fingers apart 10 times.
- 10 repetitions and 2 minutes break in between the sets.

### Putty clay

- The subject is asked to make small ball with the therapy putty , and
- then squeeze it between the thumb and the side of the fingers .
- pretend you are gripping a key in between the thumb and fingers .
- hold the tension for few seconds and then release.
- 10 repetitions and 2 minutes break in between the sets.

**Group A: Effects of Multidimensional Home-Based Exercise on hand grip among elderly people**

Group A Hand grip Power	Number of Pairs	Mean Difference	SD SEM	95% CI	df	t	P value	Sig. different (P < 0.05)
Right	15	2.467	1.114 0.287	1.850 to 3.084	14	8.576	<0.0001	****
Left	15	2.707	1.171 0.302	2.058 to 3.355	14	8.954	<0.0001	****

**Table 1:** Paired t Test for Right, Left hand power within the Group A

The above table 1 shows significant difference in Right, Left hand power within the Group A  $P < 0.0001$ .

**Group B: Effects of resistance exercise on hand grip among elderly people**

Group B Hand grip Power	Number of Pairs	Mean Difference	SD SEM	95% CI	df	t	P value	Sig. different (P < 0.05)
Right	15	4.800	0.94 57 0.24 42	4.276 to 5.324	14	19.66	<0.0001	****
Left	15	5.34	0.92 42 0.23 8	4.835 to 5.858	14	22.41	<0.0001	****

**Table 2:** Paired t Test for Right, Left hand power within the Group B

Hand Grip	Test	Group A Mean	Group B Mean	Df	t Value	P value	Sig. different (P < 0.05)
Right	Pre-Test	14.70	14.66	28	0.1497	0.882	No
	Post Test	15.75	18.98	28	12.56	<0.0001	****
Left	Pre-Test	13.04	13.63	28	2.211	0.0354	*
	Post Test	17.17	19.46	28	7.747	<0.0001	****

**Table 3:** Comparative unpaired t Test for Right, Left hand power between the Group A and B

The above table 3 shows no significant difference in Right, Left hand power between the Groups A and B

**Testing procedures:** Total 30 participants of elderly people included in the study based on specific selection criteria. The selection criteria consist of people who are above the age group of 60 and containing both male and female.

**Handheld Dynamometer:** Hand dynamometer is an evaluation tool that is used to measure isometric grip force (hand grip strength). some versions are use hydraulics to measure the force while others use electronic load cells.

- once the grip position is adjusted,
- the user holds the handle and squeezes the handle
- In this subject's Pre-test and post-test values of Hand grip strength in both Group A

## RESULTS

In Group A, Right, left hand power has increased with mean difference of 2.467, 2.71 by Multidimensional Home-Based Exercise with P

value >0.0001, on hand grip among elderly people.

In Group B, Right, left hand power has increased with mean difference of 4.800, 5.34 respectively by resisted exercise with P value >0.0001, on hand grip among elderly people,

Comparative study between Group A and Group B showed significant difference found in effectiveness in Right, Left hand power with P value <0.0001 on hand grip among elderly people. Group B found more significant compare with Group A with mean difference of 4.800, 5.34 respectively on right and left hand by resisted exercise on hand grip among elderly people.

## DISCUSSION

In this present study, there is a statistical significance on comparison of pre and post mean values of home-based exercise group on grip strength measurements of both hands. home based exercise concentrates more on the

day-to-day activities like wringing out the wet clothes, turn cards, gripping the door lock, etc. and not specific, training the wrist flexors and extensors like resistance exercises. Nelson showed that the minimally supervised functional exercises are safe and can improve functional performance in elderly individuals. Resistance exercises concentrates more on the flexion and extension activity of fingers with the hand gripper, putty clay, elastic band and squeezing ball<sup>17-19</sup>.

The comparison of pre and post mean values of resistance exercise group also shows statistically significant effect on grip strength measurements of both hands ( $p < 0.0001$ ).

Barry showed that older adults experience neural adaptation to resistance training and these adaptations will improve the functional movement capabilities of older individuals<sup>20-21</sup>.

While comparing the pre and posttest mean values of multidimensional home-based exercise (Group A) and resistance exercise (Group B), the resistance exercise group values are more than the functional task exercise group. This shows that the resistance exercises have better effect on improving grip strength in elderly population than the functional task exercise group. But there is no statistical significance on comparing the posttest mean values of hand grip strength and Michigan Hand Outcome Measure Questionnaire between both the functional tasks exercise (Group A) and resistance exercises (Group B). This inference may be due to a smaller sample size. But both exercise groups have some effect on improvement of grip strength and hand function in elderly ( $p < 0.0001$ ).

Though this study shows that there is no much difference between the functional tasks exercise and resistance exercises on hand function and grip strength, the individual effects of exercises are proved.

**Ethical Clearance:** Ethical clearance has obtained from Faculty of Physiotherapy, Dr. MGR. Educational and Research Institute, Chennai, Tamil Nadu, Reference number: No: B-36/PHYSIO/IRB/2020-2021, Dated: 09/03/2021.

**Conflict of interest:** There was no conflict of interest to conduct and publish this study.

**Fund for the study:** It was a self-financed study.

## CONCLUSION

Both Functional tasks exercise group (Group A) and Resistance exercise group (Group B) have some effect on improvement on hand function and grip strength in elderly population. Comparative study between Group A and Group B showed significant difference found in effectiveness in Right, Left hand power with P value  $< 0.0001$  on hand grip among elderly people. Group B found more significant compare with Group A with mean difference of 4.800, 5.34 respectively on right and left hand by resisted exercise on hand grip among elderly people.

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