

## Effect of 6 Weeks Resistance Training on TUG in Sarcopenic Individuals at Old Age Home

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### Abstract

**Background:** Sarcopenia is like a silent killer, characterized by shrinkage of skeletal muscles. The aging process involves numerous changes in body composition that affect health amongst which sarcopenia is of clinical and functional significance. It is an inevitable part of ageing and affects approximately 45% of older population. Over the period of time, Physiotherapy has become an integral part of geriatric care. However, there is limited evidence about effectiveness of short term Physiotherapy. Hence it was decided to investigate this with an intervention like progressive resistance exercises in sarcopenic individuals at old age home. The aging process involves numerous changes in body composition that affect health amongst which sarcopenia is of clinical and functional significance.

**Objective:** To find the effectiveness of the progressive resistance training on timed get up and go test and calf circumference measurement in sarcopenic individuals after 6 weeks.

**Methods:** This pre-test post-test study included 78 participants who were residents of old age home, situated at Shirdi, Ahmednagar. Total 68 subjects were diagnosed with sarcopenia by criteria given by, European Working Group in Sarcopenia with Older People (EWGSOP). The intervention with exercise programme based upon recommendations. The exercise programme consists of resisted knee extension with free weights by sand bags of 2-5kg's and heel raises with chair support. The exercises were given in form of 4 sessions per week, with 20-30 minutes of each session for 6 weeks. The outcome measures used were, timed get up and go test (TUG) and calf circumference measurement (CCM). The outcome was measured at the end of 6 weeks.

**Results:** Results of the study showed that significant difference in TUG ( $t=6.314$ ,  $p<0.0001$ ) and there was slight improvement in CCM, ( $t=3.299$ ,  $p=0.0008$ ) in left and ( $t=2.895$ ,  $p=0.0026$ ) in right lower extremity after 6 weeks.

**Conclusion:** 6 weeks of resistance training is effective in improving gait speed and muscle mass in sarcopenic individuals at old age home.

**Keywords:** Sarcopenia, old age home, TUG, calf circumference measurement

### Introduction

Edward Stanley (1826-1893) stated that "Those who think they have no time for bodily exercise will sooner or later have to find time for illness." Today his statement has become almost a universal truth especially in the field of

geriatrics. The aging process involves numerous changes in body composition that affect health amongst which sarcopenia is of clinical and functional significance. The term 'sarcopenia' first coined by Irwin Rosenberg in 1989 is now widely accepted to describe the steady and involuntary loss of skeletal muscle mass during aging. Sarcopenia literally means 'loss of flesh' [Greek, sarco-flesh; penia-loss]. Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death.[1] Sarcopenia is a generic term for the

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loss of skeletal muscle mass, strength and quality. It is a natural phenomenon, where the ability to remain independent is highly challenged. Sarcopenia occurs in all individuals to some degree as a consequence of aging, but it can be accelerated by a variety of factors including inactivity, poor nutrition and chronic illness. When an individual passes age 30, muscle mass decreases approximately 0.3-0.5% every year, and after age 60, the rate of decrease is very substantial. At age 80; muscle mass is thought to decrease to 50% or lower than during the prime years. In bed, muscles also decrease by 0.6% per day.[2] Its occurrence is irrespective of race, habitat or sex in human beings; though its effect varies according to these factors.

Loss of muscle mass during aging could be due to decline in protein synthesis, increase in protein degradation or a

combination of both. Also, due to associated symptoms of Sarcopenia, like loss of energy and increase in fat content of limbs, it can be associated with the cardiac and other vascular disorders. The causes of sarcopenia are multi-factorial, and can include disuse, altered endocrine function, chronic diseases, inflammation, insulin resistance, and nutritional deficiencies.[3]

In mobile settings like remote rural areas it is difficult to provide conventional investigative modalities for estimating accurate muscle mass, fat mass or body fat percentage such as, Dual Emission X-ray Absorptiometry (DEXA) or Bio-Impedance Analysis (BIA) hence Anthropometric measurements will be easier to assess the muscle mass changes in such settings; like, Calf Circumference measurements (CCM) with Hand-grip strength.[4] (Fig.1)

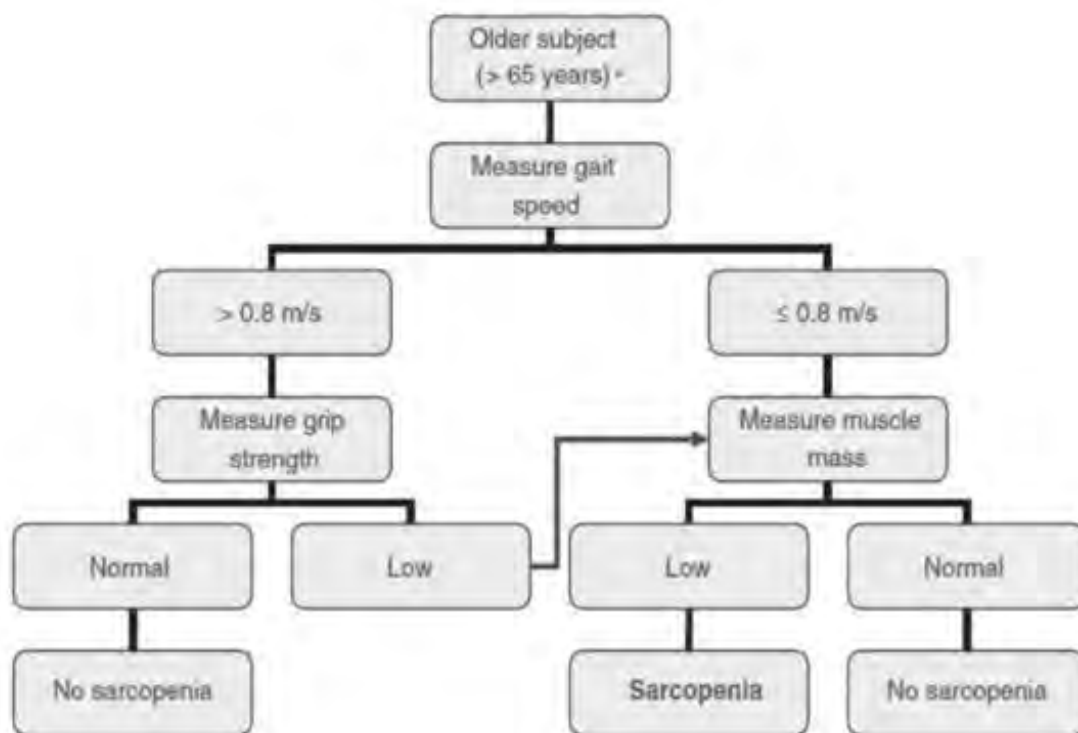


Figure 1: EWGSOP-suggested algorithm for sarcopenia case finding in older individuals.

Physiotherapists play important role in treatment of sarcopenia, because changes in muscle properties and performance can profoundly affect an older person's ability to walk and function independently.[5]

Numerous studies conducted since the late 1980s have demonstrated that resistance or weight training is an

effective countermeasure to sarcopenia. Frontera et al, reported increased muscle cross sectional area (CSA) of the mid-thigh (11.4%) and muscle strength (>100%) following 12 weeks of high intensity training in older men.[6] American College of Sports Medicine (ACSM) guidelines report that elderly individuals show sarcopenia

and diminished muscle strength in nearly all cases, and state that resistance training is needed to enhance muscle strength and maintain muscle mass.[7,8] Considering low exercise adherence in older adults, simple exercise program may be required to provide resistance training; hence exercises such as, heel raises and quadriceps exercises in form of weight resisted knee extension were included in program.

There are few studies on this condition in Indian community.[9] Sadly no prevalence studies are also found in Indian population for sarcopenia. Specially, in rural region like of Loni and surroundings geriatric population is present in large number. In local area the primary occupation is farming; which requires heavy physical work in youth and sudden pause in work after age of 60 or above causing loss of muscle mass gradually as an effect of inactivity. Hence, it's very important to study the changes in muscle mass and find a solution for it is necessary to assess the effectiveness of resistance training, in elderly Sarcopenic individuals in rural part of like Loni. Further assessing effect of resistance training will help in establishing the exercise as a treatment method for sarcopenia.

### Materials and Methods

An interventional study was conducted among 78 subjects during the period of June 2012 to August 2012 at Shri Dwarakamai Trust's Vrudhashram, Shirdi for this one group pretest-posttest designed study. After demographic data collection and obtaining written consent from each subject, Timed Get up and Go test, Calf Circumference Measurement, Hand grip strength measurement were carried out with standardized protocols.[10,11] For screening of sarcopenia according to the protocol.[2]

The final score sheet of participants was matched with cut-off points suggested. The positively diagnosed participants were selected as subjects. The subjects were alerted about the sarcopenia and its adverse effects. They informed briefly about available treatment options and requested to join the present study for highlighting the importance of resistance exercises as a treatment option for sarcopenia. The willing participants signed the informed consent and joined study as a subjects. The selected subjects were prescribed with resistance exercise program including heel raise exercise (Picture 1) and free weight resisted knee extension exercises as

per guidelines provided for formulating the exercise program for sarcopenia. Three sessions per week at alternate day for six weeks were given. The free weights in form of sand bags were used to provide the resistance for knee extension in range of two to five kilograms. (Picture 2)



**Picture 1: Heel raise with chair support**



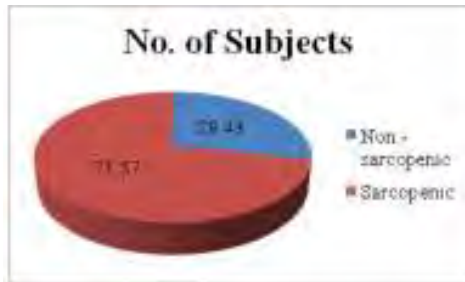
**Picture 2: Knee extension with free weights**

The 1RM of each subjects was calculated and the weight for each subject was decided accordingly 80% of 1RM. The weight was progressively increased up to 1RM gradually by 5% of 1RM on successfully completing maximum 10 repetitions of knee extensions per session. The local care takers were informed about risk factors and possible adverse effects of exercises and instructed to supervise the subjects while performing exercises. We grouped the subjects in three and requested one of the three participants to become the group leader to promote exercise adherence and to supervise the subjects during exercises and report during follow-up visit. The follow-up was performed every weekend for four weeks. At the end of last week final outcome measures were assessed in form of TUG and CCM. Same procedure was followed and average was considered as a final score.

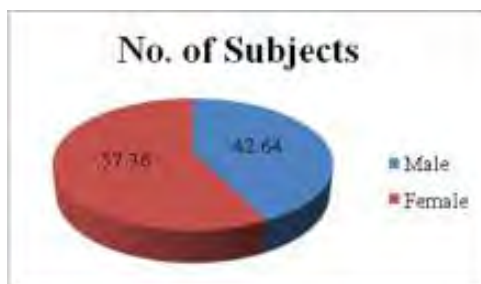
### Results

In total, sixty-eight subjects were screened for sarcopenia and selected for intervention with mean age value of  $71.94 \pm 6.95$  with 29 males (42.64%) and 39 females (57.35%). (Graph 1 & 2)

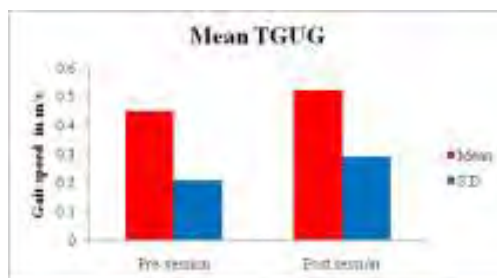
The data was analyzed calculating mean value and standard deviation of each parameter, and performing Students paired 't' test with the help of InStat software trial version (Ver.4.0) The mean Calf Circumference measurement was 28.13 ±3.20 for left lower extremity and 28.12±3.24 for right lower extremity during post-intervention assessment. The TUG score was 0.45 ±0.21 (Graph 3)



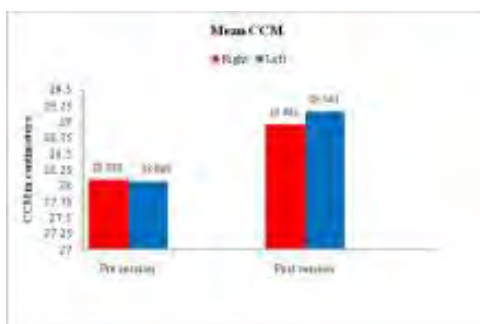
Graph 1: Distribution of sarcopenia in residents



Graph 2: Distribution of gender in subjects



Graph 3: Pre and post intervention TUG score



Graph 4: Pre and post intervention calf circumference measurements

The post-intervention assessment concluded that, there was significant increase in TUG score. The post-intervention mean value of TUG score was 0.52m/s±0.29. After performing paired 't' test, the result shown extremely significant changes (p<0.0001) with 't' value=6.314. Post-intervention mean value of calf circumference measurement was 29.161±3.49 and 29.161±3.49 for right lower extremity. The paired 't' test revealed extremely significant difference t=2.895 (p=0.0026) for right lower extremity calf circumference measurement than before. (Graph 4)

### Discussion

Sarcopenia caused by multifactorial involvement, such as physical, genetic, psychosocial, and nutritional factors. Previous studies have suggested the nutritional management options for sarcopenia, especially; dietary protein is considered good for management in longer periods. But, alone diet protein can cause considerable side effects for elderly persons.[12] Present study, involved total of seventy eight residents of old age home out of which, sixty-seven subjects were screened and diagnosed for sarcopenia. The resistance exercise programme in form of progressive resistance exercise and heel raises were given to them for six weeks of duration. Similar studies were done before, but for longer duration like twelve weeks.[13] The results of previous studies shown significant improvements in muscle mass, strength and function; but the exercise adherence in elderly population was markedly less, causing longer duration interventions to re-schedule their management period. Hence, this study was conducted for finding a short term but equally effective management option for sarcopenia.

Distribution of age and gender: The present study shows that, there is high prevalence (71.6%) of sarcopenia in old age home residents. Previous studies in nursing homes have found a high prevalence of sarcopenia in this population.[14] Also, there are studies demonstrating the reducing nutritional status and muscle mass in elderly population especially in nursing or old age homes.4 this study also shows the inequality in gender distribution of sarcopenia which is more in women. There were thirty nine females comparatively twenty nine males diagnosed as sarcopenia from residents showing women develop greater musculoskeletal impairment than males in later

life.[15] In this study the age group most affected was >65yrs which was having 41 subjects (60%); while 26 subjects (38.23%) were belonging to >75yrs age group. This shows that, though sarcopenia affects more in above 80 years of age its prevalence is increasing in elderly with age of 65 or more years also.

A study by Podsiadlo and Richardson suggest that the timed get up and go test is a reliable and valid test for quantifying functional mobility that may also be useful in following clinical change over time.[10] This study shows significant improvement in timed get up and go test after intervention period, which supports the outcomes of previous studies performed.[16,17,18] Previous studies have shown that, improvement in muscle mass and strength which occurred without measurable hypertrophy may have been due to neural adaptation to this form of explosive resistance training.[19] Keysor and Jetty mentioned in their review that they found consistent scientific evidence that older adults who engaged in strengthening and aerobic exercise were able to increase their strength, flexibility, and aerobic capacity and improve their balance, walking, and transfer activities.[20] An overall change in gait speed between 0.01 to 0.02 m/s according to some studies.[21] A small to moderate positive effect of progressive resistance training was also found for gait speed and the time to rise from a chair.[5]

**Muscle mass:** Present study shown reasonable improvement in calf circumference measurements in both the legs. The resistance exercises were given in form of the heel raises and free weight resisted knee extension were performed bilaterally by the subjects and the improvement in both the lower extremities in form of CCM was similar (Rt. =  $28.6 \pm 3.4$  and Lt. =  $29.16 \pm 3.4$ ). This improvement caused by resistance exercises influenced muscle mass and resulted in increase of gait speed. In one of the previous study it is found that, the home-based exercise program offered a practical means for ambulatory adults with multiple sclerosis to improve leg power by more than 30% in a short time.[22] In the aged, unloading-induced myofibril atrophy can also be reversed by resistive exercise.[23] Roth et al demonstrated that 6 months of whole body resistance training in older people (65–75 years) produced gains in muscle cross sectional area (CSA) similar to those achieved in younger individuals aged 20–30 years.[24]

**Resistance exercise in sarcopenia:** Resistance exercise increases contractile protein synthesis resulting in an increase in myofibril CSA and muscle strength in aged muscle.[6,23,25] In present study resistance exercises used in form of progressive resistance exercises with free weight resisted knee extension and heel raises are turned out to be effective in short term of six weeks. The possible mechanism of resistance exercises on muscle mass and strength is considered by significant increases in protein synthesis, increases type II muscle fiber size and improves satellite muscle recruitment in older persons.[26] Lifting moderate to heavy weight develops muscle strength. Aerobic exercise recruits slow oxidative (type I) fibers, whereas resistance exercise recruits fast glycolytic (type II) fibers.[27] Recent work shows that resistance type exercise training can augment type II muscle fibre size and reverse the age-related decline in satellite cell content. The latter is supported by an increase in satellite cell activation and proliferation factors that generally appear following exercise training.[28] Resistance exercise reduces the chronic status of inflammation in elderly people by decreasing the level of pro-inflammatory mediators produced by monocytes/macrophages, increasing the production of anti-inflammatory cytokines or reducing the inflammatory response to acute exercise.[29]

Though there are many studies recommending other treatment approaches like nutritional supplements, hormonal therapy and whole body vibration therapy, resistance exercise remains good option for management of sarcopenia. Results of this study suggest resistance training can improve muscle mass and gait performance, thus it can be added in home exercise programme with appropriate supervision by care-takers at home or old age homes. Also, due to its cost- effectiveness it is affordable and easily available at any setting. It can be used as adjunct to other treatment options for enhanced effectiveness also.

### Limitations

The samples for this study were limited to only one old age home. Also, the sample distribution was limited geographically. Only lower extremities were treated with intervention. Use of highly reliable assessment tools like DEXA, BIA could have done more accurate estimation of muscle mass also; changes would be more specific

and flawless but use of anthropometry added limitation to this study. Lack of full time supervision and dependency on care-takers for the same was also a limitation of this study. Due to short duration of intervention the effect observed was minor and could be more noticeable if used longer duration interventions. The follow up visit assessments were not in consideration for this study.

The increase in muscle mass and function should be correlated with the daily activities. More strength variables can be taken for better evaluation of resistance exercise programme. A better evaluation of the changes during training should be carried out with more reliable and valid assessment tools. Future studies for assessing overall body response for resistance exercises. Including more geographically varied population and larger sample size may improve the generalization and validity of resistance exercise as a treatment option for sarcopenia.

## Conclusion

The results of present study shows significant improvement in gait speed in form of TUG score and muscle mass in form of Calf Circumference Measurement comparatively baseline values of sarcopenia assessment after six weeks of progressive resistance exercise programme.

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