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PHYSICAL FITNESS IN COMMUNITY DWELLING ELDERLY AND INSTITUTIONALIZED ELDERLY USING SENIOR FITNESS TEST (SFT)

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ABSTRACT

Background: Aging is a physiologic process that affects all of our body systems. It is characterized by a physiological decline in bodily functions. Physical fitness helps to maintain a good quality of life. Thus we need to study the effect of physical activity on one's physical fitness. The main aim of our study was to compare physical fitness in community-dwelling elderly and institutionalized elderly using Senior Fitness Test (SFT). This test assessed strength, flexibility, balance and endurance. These components are frequently used in one's daily activities and thus helpful to evaluate physical fitness. Since there is an increase in the number of elders becoming institutionalized, it is imperative to understand if there is a difference in demands on their bodily systems which will affect their fitness parameters, hence this study was undertaken.

Methods: Two groups were selected (n=40) which included 20 individuals from the community and 20 from an institution. Their fitness level was evaluated using Senior Fitness Test (SFT) which had six components to assess upper body strength and upper body flexibility, lower body strength and lower body flexibility, 8 feet test, 6-minute walk test.

Result: Comparison of SFT components was made by using unpaired t-test and Mann-Whitney test. Analysis of this study revealed significant difference in lower body strength (p value=0.0028), 8 feet test (p value=0.0205) and 6-minute walk test (p value=<0.0001) which was better in community-dwelling elderly than institutionalized elderly. Also, upper body flexibility (p-value = 0.4477) and lower body flexibility (p-value =0.0766) were better in community-dwelling elderly though was not statistically significant.

Conclusion: The current study suggests that community-dwelling elderly have better lower body strength, dynamic balance and aerobic endurance in comparison to institutionalized elderly of the same age group. Thus, it can be said that staying in institutions, in a restricted environment with less amount of physical activity has a negative impact on one's functional and physical independence.

Keywords: Physical fitness, Community-dwelling elderly, Institutionalized Elderly, Senior Fitness Test (SFT).

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INTRODUCTION

Globally, the population is aging, and the World Health Organization (WHO) predicts that the elderly population aged 60 years and above will increase to 2 billion between years of 2015 to 2050 (i.e., an increase of 12% to 20% of the entire world's population). Aging of the population is occurring at an increased rate than in the past [1]. Indian population is consistently on the rise in the demographic cycle and is presently in the late expanding phase [2]. Some physiologic changes which take place with aging are as follows [3]:

- 1) Skeletal tissue deterioration which begins in the third decade of life and continues there after.
- 2) Decrease in bone mineral density because of decreased osteoblastic activity and increased osteoclastic activity.
- 3) Collagenous tissue undergoes changes like loss of water from matrix, increase in crosslinks (leading to stiffness) and loss of elastic fibers.
- 4) Decrease in lean body mass and increase in fat mass.
- 5) Nervous system changes include myelin loss, axonal loss, sensory neuron loss.
- 6) Pulmonary changes include a reduction in the functional capacity of the lung due to increased compliance and decreased elastic recoil.

Thus it is important to further understand the problems of this age group and develop an appropriate fitness plan to meet their physical demands and thereby help them to maintain a good fitness level thus preventing and delaying the onset of various age-related health problems. National Policy on Older Persons was adopted by Government of India in January 1999 which defined a senior citizen as 60 years and above [4]. Also, as per Maintenance and Welfare of Parents and Senior Citizens Act, 2007, a senior citizen is an individual of 60 years, and above [4,5] Community-dwelling elderly includes elderly (≥ 60 years of age) who live independently in the community. Institutionalized elderly includes elderly (≥ 60 years of age) who live in some committed specialized institutions. For the convenience of this study, elderly population was divided into age groups as follows: 60-65, 66-70, 71-75, 76-80, 81-85, 86-90.

Physical fitness forms an essential part of defining one's quality of life, but it often declines with increasing age [6]. Hence it is important to find an easy and a reliable, validated technique for evaluation of fitness in this age group [7]. The Senior Fitness Test (SFT) formulated by Roberta Rikli and Jessie Jones at California State University helps the examiner to evaluate the key components of strength, flexibility, speed, dexterity, endurance, balance [8,9,10]. The importance of assessing physical fitness in the elderly cannot be neglected because physical fitness forms the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure pursuits and to meet unforeseen emergencies. It is a set of measurable health and skilled related attributes that include cardiorespiratory fitness, muscular strength and endurance, body composition and flexibility, balance,

agility, reaction time and power[11]. SFT includes upper body strength, upper body flexibility, lower body strength, lower body flexibility, 8 feet trial test and 6MWT. These simple components can also be correlated in one's day to day activities. The six components of this test have good reliability and validity [9,10]. These tests are easy to understand and can be conveniently performed without use of any huge or expensive equipment. This assessment, in turn, will help the examiner to target specific areas of weakness and develop an appropriate protocol for exercise.

Change in lifestyle and bodily adaptations can be expected in these two groups because of the difference in demands placed on them by their lifestyle. Few examples include:

- (1) Handrails in the rooms, raised toilet seats for institutionalized elderly which may or may not be present for community-dwelling elderly in their houses.
- (2) Bed height and non-slippery surface adjustments made in the institutions for elderly which may or may not be seen in the local community set up for the elderly population.
- (3) More social support given to the elderly living in community because of the close and intimate relationship between their relatives and family members which may be absent in an institutionalized elderly's life because of distant relations and being away from relatives.

The factors mentioned above may directly or indirectly affect the level of physical fitness of an older adult, and thus it becomes important to assess their fitness levels. Previous studies have emphasized the need for good and adequate physical activity for good physical health in elderly [12,13,14]. This study will help us identify if there is any dissimilarity regarding physical fitness of these two groups and whether or not it is significant.

METHODOLOGY

This cross-sectional study included elderly population above sixty years of age. Two groups were selected, one from the community and the other from an institution. For calculation of sample size from the pilot study, Open Epi software with 95% confidence interval and 80% power of the study was used. The estimated sample size was 13 in each group, i.e., total 26 participants in both the groups. In this study, 20 subjects were enrolled in each group with a total sample size of 40 subjects. Subjects were included in this study using simple random sampling technique. Subjects from the community included males and females of age 60 years or more, inclined for participating in this study, asymptomatic (may have age-related co-morbid factors), ambulatory individuals (walking independently). Subjects selected from the institution met the criteria mentioned above in addition to being institutionalized for more than six months. Subjects with chest pain (discomfort), recent myocardial infarction, uncontrolled arterial blood pressure exceeding 180/100 mmHg, severe musculoskeletal conditions (e.g., grade 4 osteoarthritis knee, unhealed fracture, etc.) or neurologic conditions (stroke, Parkinson's disease, cerebral palsy, etc.) and who were ambulatory with support were excluded. Materials needed

for this test included two chairs with a seat height of 44cm (without armrest), weight cuffs measuring 2 kg and 3.5 kg for females and males respectively, measuring tape, 30cm ruler, Stethoscope, Sphygmomanometer, stopwatch and cone to mark turning points.

PROCEDURE

Subjects were explained about the procedure of this test in their vernacular language. They were also explained that all the data collected in this study would be used for research purpose and will be kept confidential. Written consent was taken from all the participants. Following this, assessment of fitness using Senior Fitness Test (SFT) was done. The test was conducted as follows [6,15,16,17,18,19]:

1) UPPER BODY STRENGTH

The arm curl: This component indirectly assessed upper body strength. The subject was sitting on a chair of standard height 44cm, without arm rest, with feet resting on the floor. Weight cuffs measuring 2 kg and 3.5 kg for females and males respectively were tied on their dominant arm. Weight cuff tied at the wrist with elbow straightened and palm facing forwards was taken as the starting position, and then the subject was asked to bend the elbow such that palm faces the body completely. Verbal commands were given to ensure that movement was performed correctly and shoulder movements avoided. A total number of times the subject bends and straightens the elbow within 30 seconds form the result of this test.

Picture 1: Arm curl exercises



2) UPPER BODY FLEXIBILITY

Upper body flexibility trial – “back scratch” test was done with the subject in relaxed standing position. The dominant arm was placed over the same shoulder with the palm facing towards the body and fingers outstretched. The other hand was placed behind the back, palm facing outwards and fingers outstretched. After correct positioning, the subject was asked to approximate third digits of both the hands. The movement had to be smooth without any pulling of fingers. A 30cm ruler was used to measure distance (in inches). The distance between the third digits constituted the result of this trial. If fingers overlapped, then it was taken as a “+” value else “-” value.

Picture 2: Upper body flexibility test “back scratch.”



3) LOWER BODY STRENGTH

The lower body strength trial-This test included standing up from a chair and bending down to sit on a chair of standard height. The subject was seated in a chair with feet touching the floor and elbows bent such that fingers cross the midline and touch the opposite shoulder. On being asked by the examining person, the subject stands and then sits again on the chair. The number of such cycles performed within a span of 30 seconds was the result of this test. In case the subject had assumed the standing position and the time was up, this standup was also taken into account and included in the total score.

Picture 3: The lower body strength trial



4) LOWER BODY FLEXIBILITY

Lower body flexibility trial – “chair sit.” Here subject was seated at the edge of the chair. The non-dominant leg was kept flexed with the foot resting on the floor (hip-knee 90-90) while the dominant leg was outstretched with its heel resting on the floor. The vertebral spine was maintained as straight as possible. The test involved forward flexion from the hip maintaining the vertebral spine erect. Arms were outstretched and placed on each other with the subject trying to touch toes with fingers. The subject was asked to hold the position of forward reach for a duration of two seconds. The distance between subjects 3rd digit and great toe was measured (in inches) and was the result of this test. A positive value “+” indicated fingers are crossing the line

of all toes; a negative value indicated no crossing of fingers.

Picture 4: Lower body flexibility trial



5) AGILITY OR DYNAMIC BALANCE

8 feet trial test- for dynamic balance. The test was started with the subject seated. At examiner's command, the subject stood quickly from the chair, walked for the said distance measured from the chair to the pole/cone and quickly returned to again sit on the chair. The distance walked by the subject was free from all obstacles and thus ensured smooth completion of the task. Time was measured from giving the command till the time subject returned to sitting position.

Picture 5: 8 feet trail test



6) CARDIOPULMONARY ENDURANCE: 6MWT

The 6-minute walk trial

This test helped the examiner to determine aerobic endurance of the subject. Subject's pre-test vitals were assessed, and Rate of perceived exertion (RPE) was recorded before starting 6MWT. The subject was explained to walk as far as possible and if tired could rest for some time and resume walking once comfortable. Once the subject was ready for walking, the test was started, time and laps were recorded. Distance completed was calculated in meters. In case of difficulty in continuing this test, the test was terminated and distance walked by the subject was recorded. After six minutes, post-test vitals were recorded, followed by re-check of vitals which was done at the end of 3 minutes and 5 minutes to ensure vitals had values similar to pre-test values, thus ensuring complete cardiovascular recovery.

Picture 6: 6 minutes walk test



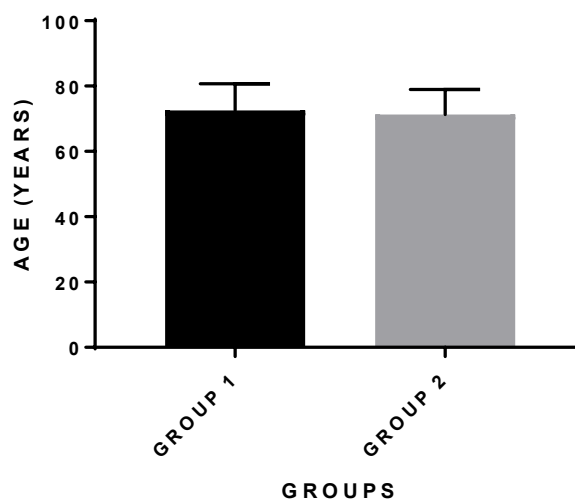
RESULTS AND ANALYSIS

Statistical analysis of the collected data was done for the total sample size (n=40) using Graph Pad Prism 7. Two groups were selected. One included Institutionalized elderly (Group 1) and the other Community-dwelling elderly (Group 2). Demographic characteristics like age, gender, BMI were matched. Age, BMI and all components of SFT were checked for normality and the ones that passed the normality test (D'Agostino and Pearson normality test) were further analyzed using unpaired t-test and the rest using Mann-Whitney test. The level of significance for this study was set to a p value<0.05. The inference from tables and graphs of this study are as follows:

Table 1: COMPARISON OF AGE IN BOTH THE GROUPS

GROUPS	n	MEAN (YEARS)	STANDARD DEVIATION	p-VALUE	SIGNIFICANCE
GROUP 1	20	72.5	8.211	0.6355	NOT SIGNIFICANT
GROUP 2	20	71.3	7.665		

GRAPH 1: COMPARISON OF AGE IN BOTH THE GROUPS

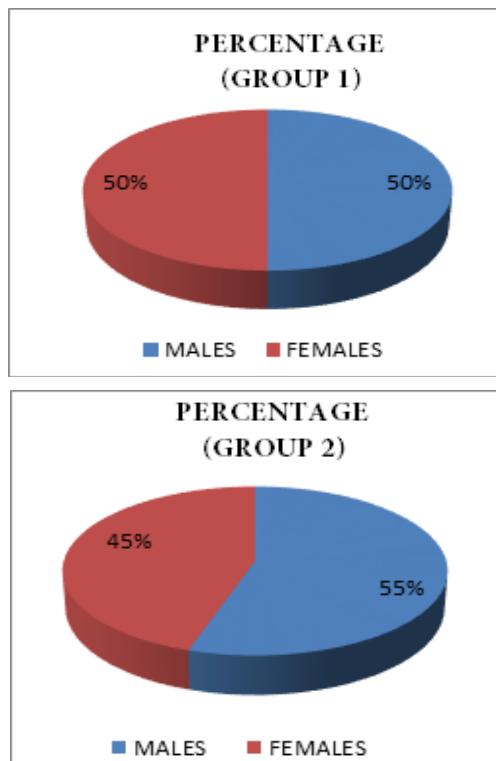


The above graph shows no significant difference of age in both the groups, p-value = 0.6355, i.e., >0.005.

Table 2: DISTRIBUTION OF GENDER IN BOTH THE GROUPS

GENDER	GROUP 1		GROUP 2	
	FRE-QUENCY	PERCENT-AGE	FRE-QUENCY	PERCENT-AGE
MALES	10	50	11	55
FEMALES	10	50	9	45
TOTAL	20	100	20	100

Figure 1: DISTRIBUTION OF GENDER IN BOTH THE GROUPS



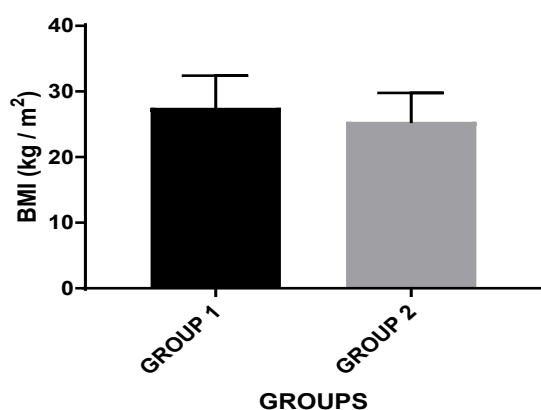
The above pie-chart shows equal distribution of gender in both the age groups.

3) BODY MASS INDEX (BMI)

Table 3: COMPARISON OF BMI IN BOTH THE GROUPS

	n	MEAN (KG/M ²)	STANDARD DEVIATION	p-VALUE	SIGNIFI-CANCE
GROUP 1	20	27.52	4.909	0.1553	NOT SIG-NIFICANT
GROUP 2	20	25.39	4.384		

Graph 2: COMPARISON OF BMI IN BOTH THE GROUPS



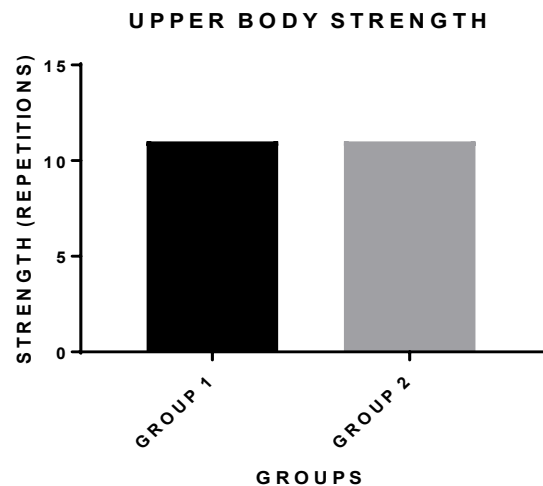
Values of BMI in both the groups had no significant statistical difference since p-value >0.05 (i.e., >0.1553)

COMPONENTS OF SFT

TABLE 3.1: COMPARISON OF UPPER BODY STRENGTH (REPETITIONS) IN BOTH THE GROUPS

GROUPS	n	MEDIAN (REPETITIONS)	P-VALUE	SIGNIFICANCE
GROUP 1	20	11	>0.9999	NOT SIGNIFICANT
GROUP 2	20	11		

Graph 3.1: COMPARISON OF UPPER BODY STRENGTH (REPETITIONS) IN BOTH THE GROUPS

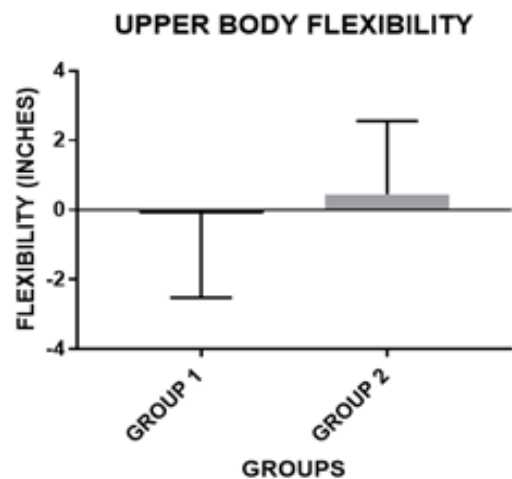


Upper body strength has no statistical difference between the two groups.

Table 3.2: COMPARISON OF UPPER BODY FLEXIBILITY (INCHES) IN BOTH THE GROUPS

	N	MEAN (INCHES)	STANDARD DEVIATION	p-VALUE	SIGNIFI-CANCE
GROUP 1	20	-0.1	2.415	0.4477	NOT SIG-NIFICANT
GROUP 2	20	0.45	2.108		

GRAPH 3.2: COMPARISON OF UPPER BODY FLEXIBILITY (INCHES) IN BOTH THE GROUPS

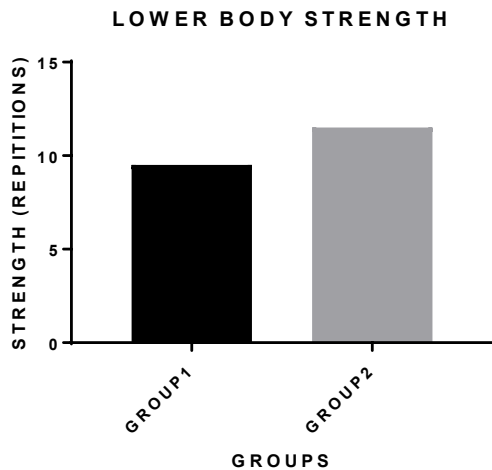


Group 2 has better upper body flexibility than group 1 though not statistically significant.

Table 3.3: COMPARISON OF LOWER BODY STRENGTH (REPETITIONS) IN BOTH THE GROUPS

GROUPS	n	MEDIAN (REPETITIONS)	p-VALUE	SIGNIFICANCE
GROUP 1	20	9.5	0.0028	SIGNIFICANT
GROUP 2	20	11.5		

GRAPH 3.3: COMPARISON OF LOWER BODY STRENGTH (REPETITIONS) IN BOTH THE GROUPS

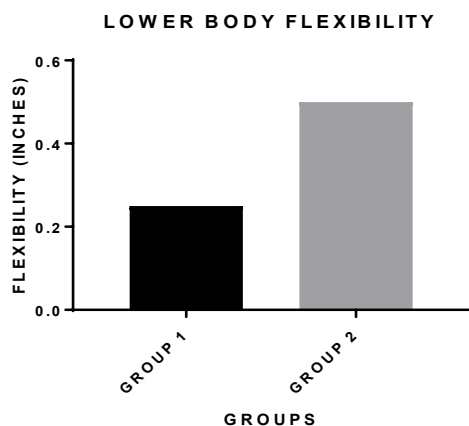


Group 2 has better lower body strength than Group 1

Table 3.4: COMPARISON OF LOWER BODY FLEXIBILITY (INCHES) IN BOTH THE GROUPS

GROUPS	n	MEDIAN (INCHES)	p-VALUE	SIGNIFICANCE
GROUP 1	20	0.25	0.0766	NOT SIGNIFICANT
GROUP 2	20	0.5		

Graph 3.4: COMPARISON OF LOWER BODY FLEXIBILITY (INCHES) IN BOTH THE GROUPS

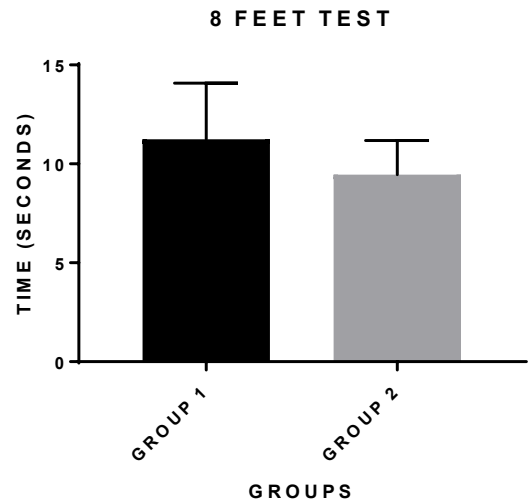


Group 2 has better lower body flexibility than group 1 though not statistically significant.

Table 3.5: COMPARISON OF 8FEET TEST IN BOTH THE GROUPS

	N	MEAN (SECONDS)	STANDARD DEVIATION	p VALUE	SIGNIFI-CANCE
GROUP 1	20	11.25	2.837	0.0205	SIGNIFI-CANT
GROUP 2	20	9.453	1.725		

Graph 3.5: COMPARISON OF 8FEET TEST IN BOTH THE GROUPS

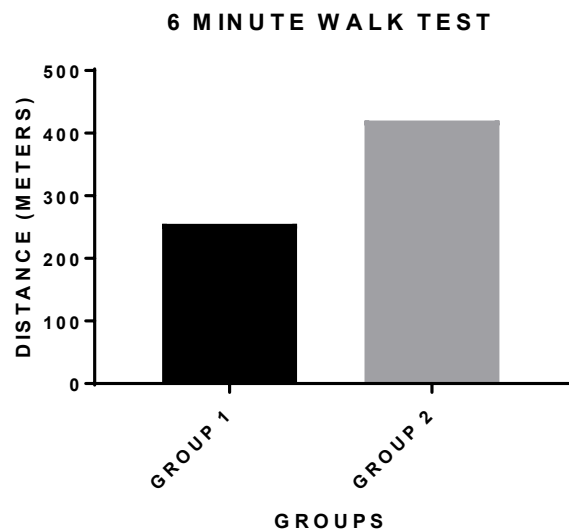


Group 2 has better agility and dynamic balance than Group 1

Table 3.6: COMPARISON OF 6 MINUTE WALK TEST IN BOTH THE GROUPS

GROUPS	n	MEDIAN (METERS)	p-VALUE	SIGNIFICANCE
GROUP 1	20	255	<0.0001	SIGNIFICANT
GROUP 2	20	420		

Graph 3.6: COMPARISON OF 6 MINUTE WALK TEST IN BOTH THE GROUPS



Group 2 has better cardiopulmonary endurance than Group 1

DISCUSSION

This study compared physical fitness using Senior Fitness Test (SFT) in two groups viz. Institutionalized elderly (Group 1) and Community-dwelling elderly (Group 2) which had subjects in between 60-90 years. Age, Gender, BMI were matched to decrease the possibility of any form of bias in this study [20]. Also, there were an equal number of exercising and non-exercising subjects in both the groups, thus eliminating exercise becoming a confounding

factor for analysis of this study. Out of the six components of SFT, there was a significant difference in three components, i.e., lower body strength, 8 feet test, 6-minute walk test.

The arm curl test for upper body strength showed no statistically significant difference in the two groups (p value >0.999). Also, both the groups had the same median value of 11. However, this is in contrast to the findings of Robert Csapo (2009) where upper body strength was found to be better in the group of community-dwelling elderly [21]. The probable reason for the difference in result could be the difference in their day to day activities. In the current study, Group 1 had subjects who were involved in mild to moderate exercise (group exercise like aerobics, upper body strengthening two times a week). Group 2 had activities in their daily routine like lifting grandchildren, carrying grocery bags, lifting jars from shelves in the kitchen, cooking, participating in strengthening exercise (three times per week). All these factors could probably be the reason for similar results in both the groups.

The back-stretch test was used to check upper body flexibility, and the results depicted no statistically significant difference in both the groups (p value $=0.4477$). However, it was observed that group 2 had better values for flexibility than group 1. Individuals in both the groups were functionally independent in their activities of daily living which included activities like wearing overhead garments, combing one's hair, lifting a box from the overhead shelf, reaching across the body and overhead. These activities were performed by both the group subjects which could be the reason why upper body flexibility was better in community-dwelling elderly, though it was not statistically significant.

There was a significant difference in lower body strength in both the groups (p value $=0.056$). This could be attributed to the fact that group 2 elderly were engaged in activities which required good strength in the lower body, e.g., climbing stairs of uneven height, walking uphill, standing for a long time in a queue or standing while using public transport. However, such activities were seen to a lesser extent among institutionalized elderly which may have resulted in a difference in result, i.e., elderly in group 2 were using lower body muscles in everyday activities and exercise which could be the cause for better results of lower body strength in them. The result of this test is thus similar to what was suggested by Jacqueline M. Mioitto et. al. (1999) which showed better values in lower body strength in community-dwelling elderly [9].

Chair sit and reach test for lower body flexibility showed no statistically significant difference in both the groups (p value $=0.0766$), but it was observed that lower body flexibility was better in group 2. Lower body flexibility is necessary for activities like bending down to pick up an object, getting in and out of a vehicle, pulling on socks and shoes, crossing obstacles, etc. The requirement for such activities is much less in institutionalized elderly due to which the lower body and limb muscles may not be used to its full

range very often. This could be the reason for better flexibility in group 2 elderly, but since the institutionalized elderly were participating in a group exercise program, the difference in result was not statistically significant.

8 feet test for agility and dynamic balance showed a significant difference in group 1 and 2 (p value $=0.025$). Activities requiring agility or dynamic balance include crossing roads, walking on uneven terrain, attending a phone call, getting into a vehicle, boarding a train, etc. These activities are more common in the life of community dwelling elderly and less in an institutionalized elderly. All such activities demand more precision and balance and thus may be the reason for better performance in group 2.

Distance measured in 6-minute walk test also showed the extremely significant difference between the two groups (p value $=0.001$). Better performance was seen in group 2. Individuals in group 2 have activities in their daily routine like walking a long distance, leisure activities like sightseeing, shopping, etc. which could contribute to better performance regarding aerobic endurance in group 2. Group 1 had less of such activities thus resulting in poorer performance in comparison.

Thus, this study gives a result similar to that obtained by Jacqueline M. Mioitto et. al. (1999) which showed better values in endurance and balance components of SFT for physically active elderly [9]. Similar results were found in a study conducted by Robert Gandee (1993) who concluded that Elderhostel participants (physically more active) had better agility and upper body strength, with no significant difference in flexibility when compared to the Senior Center participants [22].

One of the contributing factors of poorer fitness parameters found in institutionalized elderly could be lack of family support and no motivation by the relatives to engage in fitness and social activities like exploring the outside environment. These factors can directly or indirectly affect the physical functioning of an older adult.

CONCLUSION

This study suggests that community-dwelling elderly have better lower body strength, dynamic balance and aerobic endurance in comparison to institutionalized elderly of the same age group. Thus, it can be said that staying in institutions in a restricted environment has a negative impact on one's functional and physical independence.

Limitations:

- 1) Subjects were selected only from one institution.
- 2) Limited geographical area for selecting community-dwelling elderly.
- 3) City population was selected for this study.

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