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Short Duration Physical Activity Program On Balance Performance And Lower Limb Strength In Older Adults: An Interventional Study

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ABSTRACT

In older adults, progressive aging leads to a gradual decrease in physical ability and balance, increasing the risk of fall associated injuries. This increase in fall accidents is due to the impaired balance in older adults. The study investigated the potential of engaging older adults in short term balance exercise to increase physical activity and balance. 44 older adults ranged between 65 to 75 years were randomly chosen and divided into experimental and control groups. Experimental group practiced balance training for 3 days in week for 4 weeks. The balance training measure using of Berg balance scale (BBS) and Time up and go test (TUG-T) and lower limb Strength measure using of 30 seconds sit to stand test (STS). BBS, TUG-T and STS test were compare within group using paired T test and between group used independent t test. The level of statistical significance difference for all analysis was set at p value less than 0.05. this study indicates statistically significance for all outcomes in experimental group compare to control group so the study indicated that 3 alternate days/week for 4 weeks' short duration physical activity program effective on balance performance and strength in older adults.

Keywords: Physical activity, Balance, Lower limb strength, older adults

INTRODUCTION

Physically inactive is among the strongest predictors of physical disability in older adults. [1,2] Due to aging, changes in the sensorimotor and neuromuscular system due to that core affection in static and dynamic postural control even in healthy older adults. [3] and also worsen in sensory function, inefficient integration of sensory systems, and reduced overall muscle strength contribute to decreased balance performance in older adults. Degradation of balance performance, increases fall risk and fear of falling, and inhibits mobility, thereby increase dependency and compromise in quality of life. [4]

A clear description has been proposed for a "fall", namely "unintentionally coming to rest on the ground, floor or other lower level. so as in normal terms to drop or descend under the force of gravity, as to

a lower place through loss or lack of support. Almost 33% older adult people experience a fall every year. [5]

while a person who experiences at least two falls within 6 months is defined as a "recurrent faller". [5,6] Falls in older people are concerning events that could result in bone fractures, residual disability, subacute to chronic pain, and increase dependency, leading to important social and public health consequences requiring expensive long-term treatments. [7]

Physical activity is essential for healthy ageing, and it has been established that a physically active life contributes to health-related quality of life and helps to retain a necessary balance function. The Physical Activity Guidelines for Americans provides advised for adults to be active daily and to accumulate moderate to vigorous intensity physical activity perform at least 150 minutes per week, [8] or for substantial health benefits, adults should do at least 2 hours and 30 minutes to 5 hours a week of moderate-intensity aerobic activity or 1 hour and 15 minutes to 2 hours and 30 minutes a week of moderate and vigorous-intensity aerobic physical activity. [1,2]

There are several therapeutic approaches have been shown to be effective on fall prevention among older adults, by physical activity training programs. Evidence suggests that balance training for a 6 weeks' longer duration is effective in improving balance and reducing the fear of falls in an elderly population [9], and Perturbation-based balance training also appears to be a feasible approach to reducing falls and improve balance in an elderly population. [10] long duration Ten weeks of balance training improved balance, gait speed, leg strength, and fear of falling in older adults. [11] However, many older adults face barriers to engaging in regular exercise due to time constrains, mobility issues, or health concerns. Some Studies have shown that long term physical activity can significant health benefits to improve stability, balance & muscle power so that's why this study needed to show the effects of short duration physical activity program on balance and endurance in elderly populations and objective were 1. To evaluate the effect of short duration physical activity program on time up and go test (TUG-T) in older adults. 2. To evaluate the effect of short duration physical activity program on Berg balance Scale (BBS) in older adults and 3. To evaluate the effect of short duration physical activity program on 30 seconds sit to stand (STS) test in older adults.

MATERIALS AND METHOD

- Study design: Experimental
- Study population: Older adults
- Sampling Method: Simple random Method
- Study Source: Outdoor parks, Ahmedabad
- Sample Size: 44 (22 experimental + 22 control)
- Study Duration: 3 alternate days a week for 4 weeks

selection criteria

-Inclusion criteria

• Age 65 to 75 years
• Both males and females
• BBS score value between 20 to 41.
• TUG-T more than 20 sec

-Exclusion criteria

History of cardiovascular, neurological problems, recent trauma of musculoskeletal disorders.
• Vertigo
• Elders who used Walking aids
• Participants who did not attend maximum 2 sessions consecutively or not.
• Those participants who participated in other study.
• Uncooperative participants.

Procedure

A total of 44 older adults were selected for this study by giving consideration to inclusion and exclusion criteria and consent was taken. Group 1 (experimental group) followed a structured exercise program, while Group 2 (control group) was instructed to continue with their usual activities of daily living (ADL).

In order to meet the selection criteria of this study, all subjects of group 1 were asked to perform warm up, exercise program and cool down (table 1 and figure 1) and both the group evaluated by BBS and TUG-T, STS before and after 4 weeks.

(Table 1: Physical activity program for experimental group (group 1))

Starting of every session warm up exercises performed for 10 minutes including neck to ankle all movements for 10 repetitions (rep), 3 rep and 10 seconds hold for self-stretching of bilateral calf, hamstring and quadriceps in lower limb.	
Exercise program (duration 30 minutes)	Repetitions (rep)
Marching	15 rep of 2 sets
Side walking	5 meters both side and 2 rep
Backward walking	5 meters – 2 rep
Mini squat	10 rep of 1 sets
Tandem walking	5 meters forward tandem walking – 2 rep
Single leg standing	10 rep for each limb.
Standing with eyes closed	15 secs hold – 5 rep.
Forward lunges	10 rep for each limb
end of every session cool down exercises perform for 10 minutes including neck movements, shoulder girdle movements, trunk movements and self-stretching of bilateral calf, hamstring and quadriceps muscles 3 rep and 10 seconds hold of lower limb.	
The exercise protocol was specifically designed according to the requirements of the study objectives.	

Figure 1: Physical activity program.

Three outcome measurements were measured pre and post 4 weeks. For lower limb strength evaluation used STS. participant was instructed to rise to a full standing position and then sit down again, with arms folded across chest, as many times as possible in 30s. This test has been shown to be valid and reliable for assessing leg muscles strength in older adults. [11] TUG-T is an easy tool to assess the overall motor function and easy to use in clinical setting. [12]

TUG-T measures the time in seconds taken by participants to stand up from a chair, walk as quickly as possible and covered a distance of 3 meters away, turn around cone, return walk to the chair, and sit down. [12,13] BBS used to evaluate performance during various balance activities. The scale consists of 14

items, 5-point ordinal scale and scored from 0 to 4 for each item, which are added to make a highest score is 56; a higher score indicates better balance. [14]

RESULT

Statistical analysis

• Statistical software:

All statistical analysis was done by SPSS version 20.0 for windows software. Microsoft word were used to generate tables & graphs.

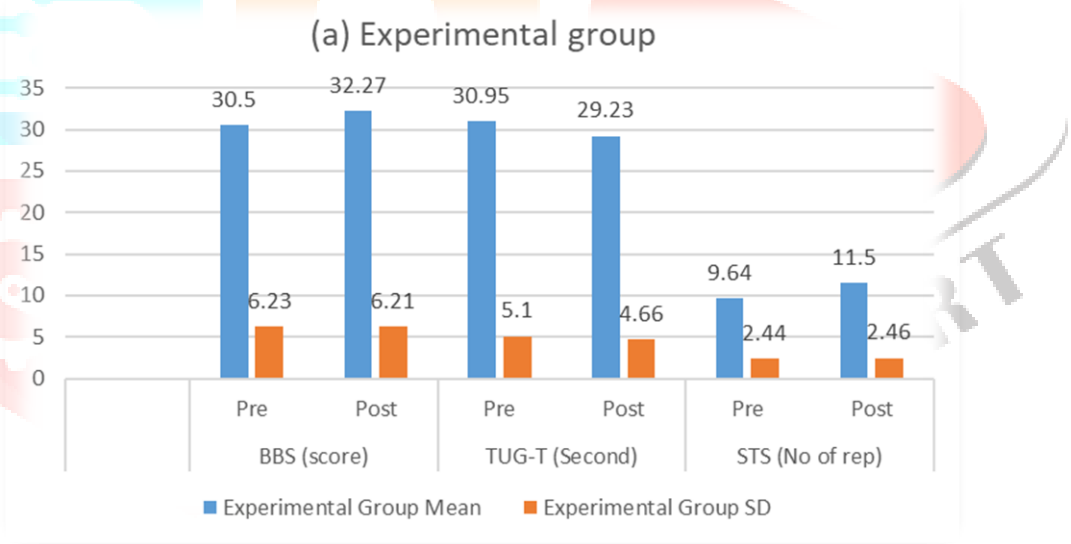
• Statistical test:

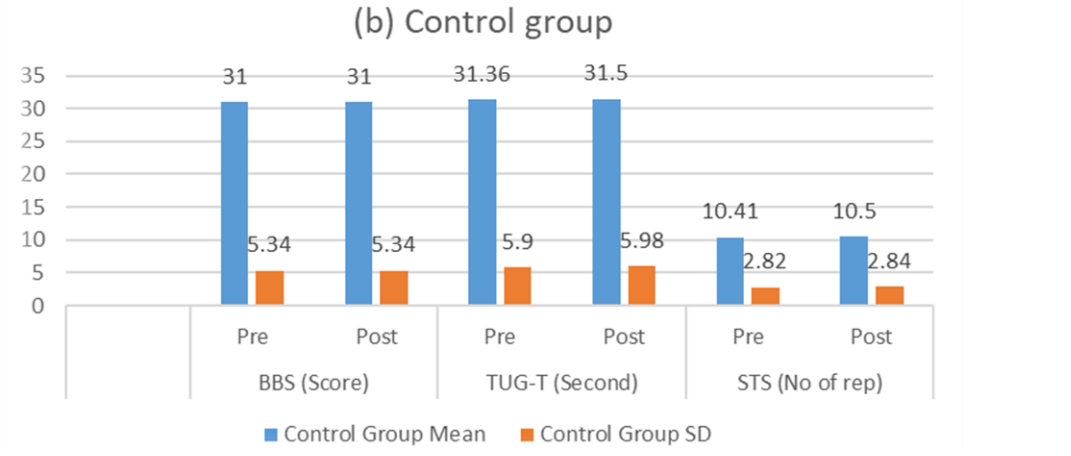
Mean was calculated as a measure of central tendency for all three outcome measurements and Standard Deviation (SD) was calculated as a measure of dispersion. Shapiro-wilk test using for checked normality of data.

Difference of pre and post training value of TUG-T follow normal distribution so for that used paired t test, and Difference of pre and post training value of BBS and STS not follow normal distribution so for that used Wilcoxon sign ranked test. between group independent t test was used, Level of significance (p value) was set to 0.05.

Total 44 older adults between the age group of 65 to 75 years (mean 70 ± 3.32(SD)) were included in the study, 22 subjects were taken in experimental group and 22 taken for control group. Outcome measurements BBS, TUG-T and STS were taken before and after completion of 3 alternate days/week for 4 weeks of physical activity exercise program of experimental and control group.

Graph (a) & (b) Mean and SD of pre and post physical activity exercise for both the group.





Interpretation: The above graphs shows mean and standard deviation value of outcome

measurements of pre and post physical activity exercise program of both the groups and its shows that there were changed in value of outcome measurements in experimental group compared to control group.

Table 2: statistical test value of outcome measurements for experimental group.

Outcome measurements	Test value	P value < 0.05
BBS	Z value -3.795	
TUG	T value 0.000366	
30 sec SIT to stand	Z value -3.548	

Interpretation: The above table shows the statistical p value of all three test are < 0.05 so it is statistically significance of experimental group.

Table 3: statistical test value of outcome measurements for between groups.

Independent t test for between group						
		N	Mean	Std. Deviation	t VALUE	REMARK
BBS	CONTROL	22	0.00	0.000	-6.192	<0.05
	EXPERIMENTAL	22	1.77	1.343		
TUG-T	CONTROL	22	-.09	.294	-4.397	<0.05
	EXPERIMENTAL	22	1.82	2.015		
STS	CONTROL	22	.05	.213	-5.791	<0.05
	EXPERIMENTAL	22	1.86	1.457		

Interpretation: The above table shows t value of all three test are < 0.05, all three outcome measurements (BBS, TUG-T & STS) of experimental group statistically significantly compared to control group. alternate hypothesis accepted and null hypothesis rejected.

DISCUSSION

The intent of the study was to effects of short duration physical activity program on balance performance and strength in older adults and result of the present study favors the alternate hypothesis which indicates there is statistically significant in all three outcome measurements within experimental group 1(P<0.05) (table 2) and also statistically significance between experimental and control group (P<0.05) (table 3). This training program was effective at improving participant's lower limb strength, mobility and reduce risk of fall that leads to greater improve in their confidence.

Many researchers have used various exercises to improve balance in the geriatric population. Chi-Min Yang et al suggested that Kinect exercise was more effective to functional reach enhancement and in terms of overall balancing presentation and Kinect exercise as a feasible, safe, and effective training method for improving community older adults' confidence. [15] Zouita et al. suggested that long duration balance training on unstable surfaces helps older adults to efficiently utilize their sensory inputs and improve attention demands which help to reduce the postural sway by using this biofeedback. [16]

According to the various literatures postural control is the result of the co-operation and the integrity of the motor, sensory and cognitive systems, all of which would undergo unavoidable degenerative changes following aging.[17] due to aging especially lower limb muscles strength and flexibility will diminish as a result decreased proprioception and old adults can not apply hip and ankle strategies immediately upon confronting perturbations and this disability can eventually increase the risk of falling.[18] Therefore, in this study exercises program focused on lower limb muscles, walking, weight bearing exercises, endurance and stretching exercises (part of warm and cool down), by this sensory – motor exercises program improving in

lower limb muscles strength and also facilitate in independence mobility and ADLs, confidence, reduce fall risk. according to some theories exercise leads to new formation of myofibril causes hypertrophic muscle and because of this increase in breakdown of phosphagen, including ATP and phosphocreatine that can boost muscle strength in old adults. [19]

In this study physical activity program was given for alternate day a week for four weeks and for lower limb strength assessment STS selected and increased number of repetitions in 30 seconds suggested good strength of the lower limb and this test after 4th week program statistical significant. and for balance assessment FIM and TUG-T were selected. lower value suggested good balance, after 4th week program both the tools were statistical significant. Eeva Aartolahti et al suggested that long term strength and balance training program once weekly for 2.3 years improve strength of lower limb muscles and independent mobility in elderly. [20] Ulfiana et al also suggested that balance exercise can improve postural balance in the elderly through lower limb movements exercises, which can stimulate the ability of the elderly to maintain postural balance. [21]

In this study, physical activity program more focused on lower limb muscles and according to various studies and theories this is obvious that lower limb muscle exercises including weight bearing and endurance could increase muscle strength, maintain body balance in various ADLs.

CONCLUSION

This study concluded that, four weeks' physical activity program increase lower limb muscle strength and improve in balance performance hence reduce risk of fall in older adults, therefore it is recommended for alternate day a week exercises performance to older elder.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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