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# Dual-Task net-step exercise versus balance training exercise program on foam rubber pad in community-based older adults: A randomized clinical trial

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**Abstract**
**Background:** Balance and Cognitive dysfunction are common symptoms in individuals as they age. This makes older individual more prevalent to fall, fear of falling and reduction in Quality of life. Hence there is a need to develop effective balance training programs at community level.
**Purpose:** To investigate the effects of Dual-Task Net-Step exercises and balance training program using a Foam rubber pad in Indian community-Based older adults.
**Design:** Randomized clinical trial.
**Setting:** The study was conducted at old age homes in Belagavi city, Karnataka state India.
**Patients:** 30 individuals in the 65 to 80 years group were recruited for balance dysfunction.
**Intervention:** Intervention included in Group A: Dual-task Net-step Exercise and Group B: Exercise on Foam Rubber Pad.
**Measurements:** Patients were assessed at baseline and at fourth week post intervention using one lag stance test (OLS), Time up and go test (TUG), chair standing test (CST) and Modified fall efficacy scale (MFES).
**Results:** Mean, standard deviation, paired and unpaired *t* test were used do inter and intra comparison in the two intervention groups. Both the groups showed positive results in terms of balance measurement.
**Conclusion:** Both the groups showed positive results in balance function. Group B was significantly better than Group A in improving balance when compared with OLS, TUG, CST and MFES.

**Keywords:** Balance, community-based older adults, Dual-Task Net-Step, foam rubber pad, modified fall efficacy scale.

## Introduction
Balance or equilibrioception is a physiological sense that refers to an individual's ability to maintain the body's center of mass over its base of support [1]. "Balance is controlled by a complex set of body systems: (proprioception) that gives cues of our body's image in relation to space or surrounding, (vestibular system) ears and the eyes (visual system)". These three systems give feedback about the body orientation to the central nervous system. This inturn integrates with other systems (musculoskeletal systems) and subsequently generates a corrective, stabilizing torque by selectively activating muscles which result in maintaining body's line of gravity within its Base of support (BOS) [2]. This allows humans to see clearly while moving, to determine speed and direction of movement, making an image of body in relation with its surroundings in brain and make postural adjustments automatically to maintain posture and stability in various activities and conditions. If any of these systems are disrupted intense consciousness efforts has to be applied to overcome the abnormal sensations and maintain or control proper balance. The risk of developing one or more problems related to these systems also increases as the age increases, as the body organs and structures are exposed to degenerative or the effects of injuries and infectious diseases accumulated over a lifetime [3].
Falls are the leading causes of increasing negative impacts on individual's quality of life. It causes a long hospital stay, dependency on others, different present of injuries and fractures that are painful injure related loss of work, relative or permanent disability and may also lead to death. Over 30% of community-dwelling healthy older adults fall each year, and 15% fall

more than once [4]. This may develop fear of fall that may further cause serious negative impact in individual's physical, functional, psychological and social life.

Evidence shows exercise and planned physical activities improves stability and other specific aspects of physical fitness that helps in controlling balance. Many rehabilitation programs also use multiple compensatory strategies as therapeutic approaches to improve the balance in elderly people. This exercise has shown some positive changes in improving equilibrium and to gain strength in muscles that controls the change in center of mass of the body.

A dual-task paradigm is a procedure in experimental neuropsychology that requires an individual to perform two tasks simultaneously, in order to compare performance with single-task conditions [5]. Balance training program on any foam rubber pad has shown positive results in many of the studies regarding strength in lower extremities and balance. Dual-Task Net-Step Exercise is a new exercise intervention in balance training and not many have been conducted. Effect of Balance training program using a foam rubber pad in community-based older adult has limited research. Both the therapies are new to Indian population and hence there is paucity of literature for the same. Hence the need of the study is to evaluate the effect of Dual-Task Net-Step exercises and balance training program using a Foam rubber pad in Indian community-Based healthy older adults.

**Materials and Methodology**

The Study approval was obtained from the Institutional Ethical committee. The primary data was collected from Old age homes in, Belagavi, Karnataka, for the randomized clinical trial and informed consent was signed by the participants to participate in the study. The study sample included 30 healthy older adult participants both male and female from community of age group 65 to 85 years with inclusion Criteria as participants able to participate in physical activity for more than 30 min and Participants welling to participate in study. Exclusion Criteria included participants with known orthopedic, neurological or circulatory disorders that would prevent older adults from participating in the study, blind or experience severe visual field deficit affecting balance and gait and those with Presence of uncontrolled hypertension.

Outcome measures taken for the present study were 1) The One-Legged Stance Test (OLST) that is a simple, easy and effective method to screen for balance impairments in the older adult population [6, 7]. 2) The chair stand test is similar to a squat test to measure leg strength and is designed to test the functional fitness of seniors [8, 9]. 3) The Timed Up and Go test (TUG) is a simple test used to assess a person's mobility and requires both static and dynamic balance. It is used frequently in the elderly population, as it is easy to administer and can generally be completed by older adults [10, 11]. And 4) The Modified Falls Efficacy Scale (MFES) can be self-administered [12]. The MFES scale is a visual analog scale in which items are scored from 0 to 10, with 0 meaning "not confident/not sure at all" and 10 being "completely confident/completely sure". Scores of < 8 indicate fear of falling, 8 or greater indicate lack of fear [13].

After finding their suitability as per the inclusion criteria, participants were assessed for the baseline data and grouped equally in two groups. All the participants in this group had intervention of more than 20 minutes per session for 15 session's alternate days over a period of four weeks. First phase (warm up phase) of this intervention was of 5 minutes in which participants were asked to do general physical exercises (like breathing exercise, general upper and lower body movements, stretching etc.), and the third phase (cool down phase) was of 5 minutes in which participants were asked to do breathing exercises and other general body movement exercises were same for both the groups.

**Group A:** The second phase was trial phase on the first day of intervention where the Fumanet was placed on a normal surface and participants were then be asked to walk in the squares of Fumanet in a specific design or in order on count of 1, 2, 3 etc, along with these they have to sing a song to perform duel-task activity as recreational phase. This order was changed for every session. The song that they have to sing was of their choice. The participants were only encouraged and no negative points were given during the intervention session.

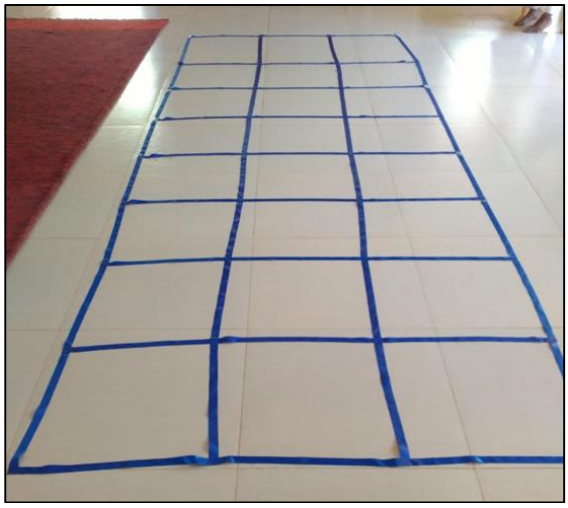


**Fig 1:** Dual Task Net Step Exercise net

**Fig 2:** subjects performing Exercise in Group A

**Group B:** The second phase of 10 minutes, balance training on foam rubber pad was advised. The balance training program included 5 exercises performed in standing position as follows; double stance standing, one-leg standing, free-

leg standing, and heel to toe raise and Neck and Trunk Rotations with reach outs, followed by 5 repetitions of each exercise.

**Fig 3:** Subject performing exercise on foam rubber pad in group B

**Results:** Statistical analysis for the present study was done manually as well as using statistical package of social sciences (SPSS) version 21 so as to verify the results obtained. For this purpose data was entered into the Microsoft Excel Sheet, tabulated and subjected to statistical analysis. Mean, standard deviation, and test of significance that is paired and unpaired *t* Test, were used. Nominal data from patient's demographic data i.e. age and gander was analyzed using *t*-test. Percentage of distribution of males and female was done by Chi-square test with Yates's correction= 0.0001, *P* = 1.0000 which showed equal distribution of males and females in both the groups. (Table No.1). There was no statistical significance in mean age of males and females in both the groups (Group A 76.73± 5.40 years and Group B 76.20± 7.13 years) (*p*= 0.81) (Table No.2).

**Table 1:** Gender distribution two intervention Groups (A and B).

| Gender | Group A | % | Group B | % | Total | % |
|---|---|---|---|---|---|---|
| Male | 4 | 26.67 | 5 | 33.33 | 9 | 30.00 |
| Female | 11 | 73.33 | 10 | 66.67 | 21 | 70.00 |
| Total | 15 | 100.00 | 15 | 100.00 | 30 | 100.00 |

**Table 2:** Mean age Comparison in the two intervention Groups (A and B).

| Groups | Mean | SD | SE | t-value | P-value |
|---|---|---|---|---|---|
| Group A | 76.73 | 5.40 | 1.40 | | |
| Group B | 76.20 | 7.13 | 1.84 | 0.2308 | 0.8191 |

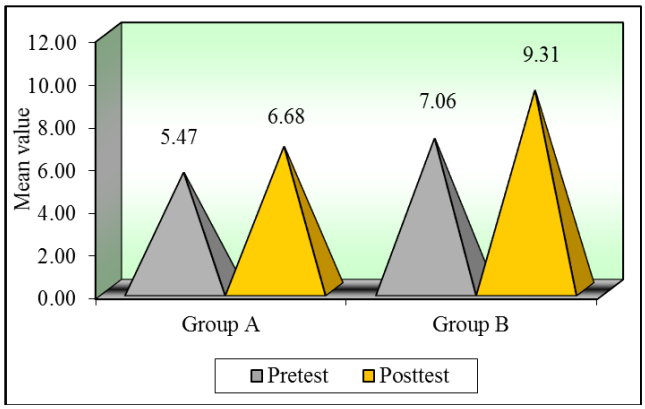
In the present study Normality of pretest and posttest scores of all variables wear seen by Kolmogorov Smirnov test, which showed no significant changes in all values hence we can say that all variables followed a normal distribution ($p$>0.05) and therefore, the parametric tests were applied. Comparison of two study groups (A and B) with mean age was performed by t test. Comparison of the pre intervention and post intervention for both intra (Table No.3) as well as inter groups (Table No.4) outcome measures such as The One-Legged Stance Test (OLST) (Graph No.1 & 2), the chair stand test (Graph No.1 & 2), the timed Up and Go test (TUG) (Graph No.3 & 4) and The Modified Falls Efficacy Scale (MFES) (Graph No.5 & 6) were done by independent and dependent *t* test respectively. Probability values less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant.

**Table 3:** Inter Group Comparison in the two intervention Groups (A and B).

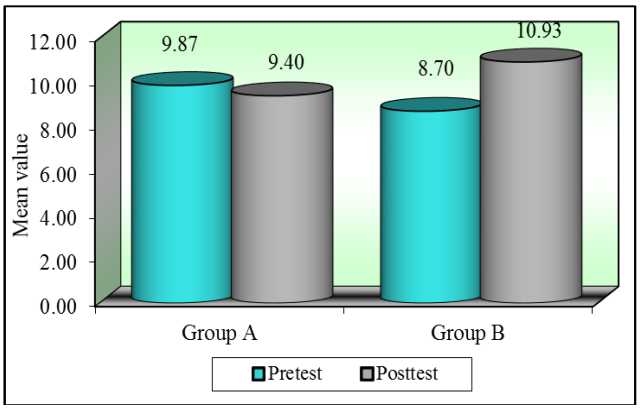
| Groups | Time | Mean | Std. Dv. | Mean±SD | % of change | Paired t | p-value |
|---|---|---|---|---|---|---|---|
| Intra group comparison of One leg test (sec) scores | | | | | | | |
| Group A | Pretest | 5.47 | 5.41 | -1.22±1.11 | -22.23 | -4.25 | 0.0008* |
| | Posttest | 6.68 | 5.91 | | | | |
| Group B | Pretest | 7.06 | 4.76 | -2.25±1.43 | -31.85 | -6.10 | o.ooo1* |
| | Posttest | 9.31 | 3.86 | | | | |
| Intra group comparison of Chair standing scores | | | | | | | |
| Group A | Pretest | 9.87 | 2.85 | 0.47±3.83 | 4.73 | 0.47 | 0.6446 |
| | Posttest | 9.40 | 4.60 | | | | |
| Group B | Pretest | 8.73 | 2.84 | -2.20±1.15 | -25.1.15 | -7.43 | 0.0001* |
| | Posttest | 10.93 | 2.46 | | | | |
| Intra group comparison of Time up and go (sec) scores | | | | | | | |
| Group A | Pretest | 15.10 | 5.01 | 0.70±0.56 | 4.62 | 4.83 | 0.0003* |
| | Posttest | 14.41 | 4.88 | | | | |
| Group B | Pretest | 18.56 | 13.27 | 0.58±3.28 | 3.12 | 0.69 | 0.5058 |
| | Posttest | 17.98 | 11.96 | | | | |
| Intra group comparison modifide fall efficacy scores | | | | | | | |
| Group A | Pretest | 0.74 | 0.16 | 0.01±0.19 | 1.99 | 0.30 | 0.7664 |
| | Posttest | 0.72 | 0.24 | | | | |
| Group B | Pretest | 0.66 | 0.09 | -0.04±0.02 | -6.26 | -7.750 | 0.0001* |
| | Posttest | 0.70 | 0.09 | | | | |

**Table 2:** Inter Group Comparison in the two intervention Groups (A and B).

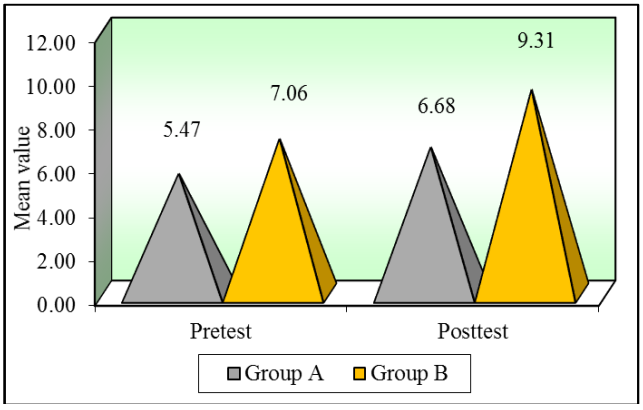
| Variable | Groups | n | Mean ±SD | SE | t-value | P-value |
|---|---|---|---|---|---|---|
| Inter Group comparison of One leg test (sec) scores | | | | | | |
| Pretest | Group A | 15 | 5.47 ±5.41 | 1.40 | -0.8594 | 0.3974 |
| | Group B | 15 | 7.06 ±4.76 | 1.23 | | |
| Posttest | Group A | 15 | 6.68 ±5.91 | 1.53 | -1.4444 | 0.1597 |
| | Group B | 15 | 9.31 ±3.86 | 1.00 | | |
| Difference | Group A | 15 | 1.22 ±1.11 | 0.29 | -2.2156 | 0.0350* |
| | Group B | 15 | 2.25 ±1.43 | 0.37 | | |
| Inter Group comparison of Chair standing scores | | | | | | |
| Pretest | Group A | 15 | 9.87 ±2.85 | 0.74 | 1.0909 | 0.2846 |
| | Group B | 15 | 8.73 ±2.84 | 0.73 | | |
| Posttest | Group A | 15 | 9.40 ±4.60 | 1.19 | -1.1391 | 0.2643 |
| | Group B | 15 | 10.93 ±2.46 | 0.64 | | |
| Difference | Group A | 15 | -0.47 ±3.83 | 0.99 | -2.5812 | 0.0154* |
| | Group A | 15 | -0.47 ±3.83 | 0.99 | | |
| Inter Group comparison of Time up and go (sec) scores | | | | | | |
| Pretest | Group A | 15 | 15.10±5.01 | 1.29 | 0-0.9435 | 0.3535 |
| | Group B | 15 | 18.56±13.27 | 3.43 | | |
| Posttest | Group A | 15 | 14.41±4.88 | 1.26 | -1.0720 | 0.2929 |
| | Group B | 15 | 17.98±11.96 | 3.09 | | |
| Difference | Group A | 15 | 0.70±0.56 | 0.14 | 0.1388 | 0.8906 |
| | Group B | 15 | 0.58±3.28 | 0.85 | | |
| Inter Group comparison of Modifide fall efficacy scores | | | | | | |
| Pretest | Group A | 15 | 0.74±0.16 | 0.04 | 1.5986 | 0.1211 |
| | Group B | 15 | 0.66±0.09 | 0.02 | | |
| Posttest | Group A | 15 | 0.72±0.24 | 0.06 | 0.2973 | 0.7685 |
| | Group B | 15 | 0.70±0.09 | 0.02 | | |
| Difference | Group A | 15 | -0.01±0.19 | 0.05 | -1.196 | 0.2600 |
| | Group B | 15 | 0.04±0.02 | 0.01 | | |



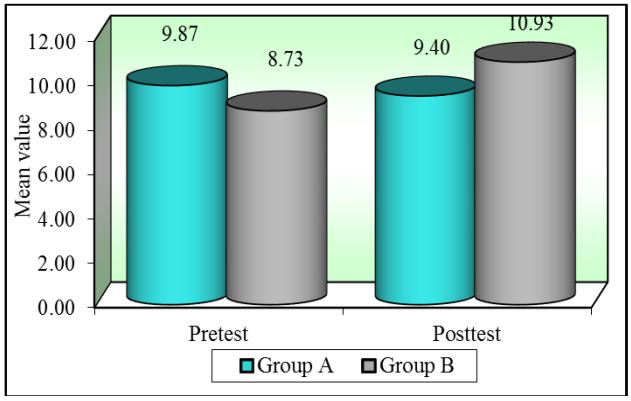

**Graph 1:** Intra group comparison of One leg test (sec) scores



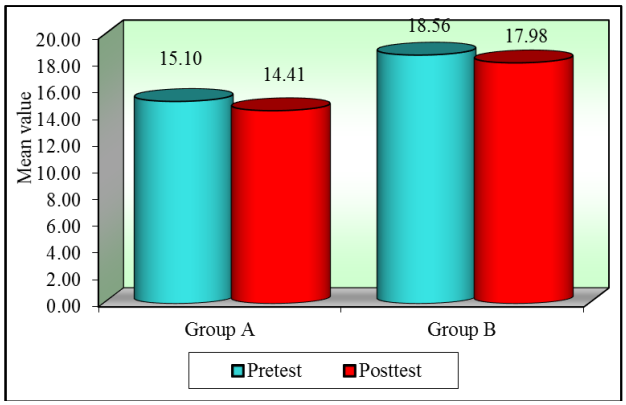

**Graph 3:** Intra group comparison of Chair standing scores



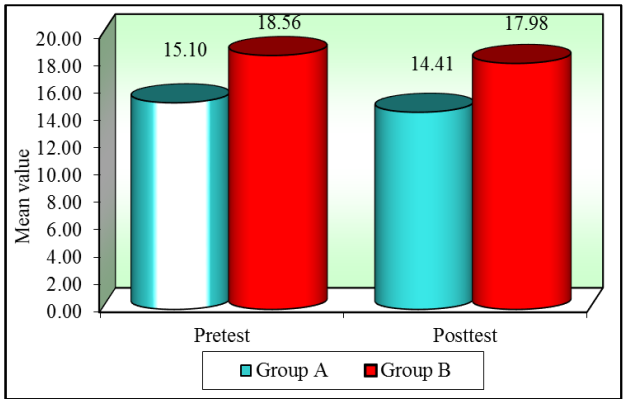

**Graph 2:** Inter Group comparison of one leg test (sec) scores



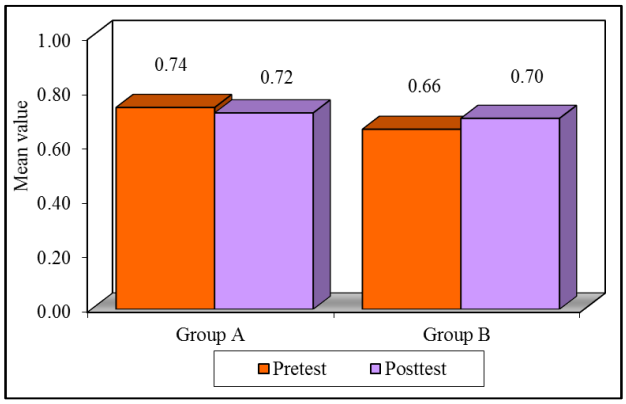

**Graph 4:** Inter Group comparison of Chair standing scores



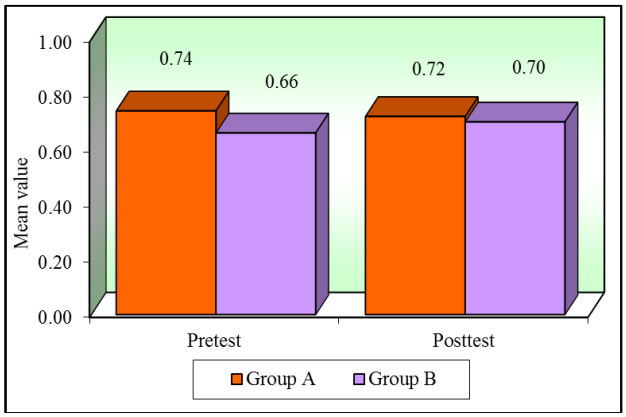

**Graph 5:** Intra group comparison of Time up and go (sec) scores




**Graph 6:** Inter Group comparison of Time up and go (sec) scores




**Graph 7:** Intra group comparison Modified fall efficacy scores




**Graph 8:** Inter Group comparison of Modified fall efficacy scores

## Discussion

The present study was conducted on older adults with balance dysfunction in Dual-task Net-step exercise and Balance training program on foam rubber pad and evaluated on four different outcome measures. This study included total 9 males and 21 females. Another study with 76 years mean age suggested similar age and gender distribution as our study with mean age of 76 years [14]. This study gives an idea that more number of females had balance dysfunction compared to males of this group. The study further supports that the age has direct relation for occurrence of balance dysfunction. The present study included significant number of participants that had fear of fall (FOF) in the age group of 65 to 80 which may be due to previous fall related emotional status, lack of confidence and poor functional performance. Previous studies support this study as many epidemiological studies have found that 21 -61% older population experience some degree of FOF. This study further detected statistical correlation between risk of falling and the increasing age that may have resulted from the accumulated effect of multiple conditions [15].

The present study showed positive results in dual task training with Fumanet. This study demonstrated that the positive results of balance training on dual task may be due improved obstacle crossing conditions.Similar results were also obtained in a study where the effects of dual task balance training in elderly people who were 65 years and above was studied. The experimental group which was given strength and balance training, while performing cognitive task simultaneously showed significantly higher improvement as compared to control group where only strength and balance training with no cognitive task training was performed [16]. Similar study predicted that Changes related to dual task walking performance on elderly person with balance impairment demonstrated two models in their subject. The task-automatization model states that dual task performance improvement is the result of increased automatization of the individual tasks. The task-integration model suggested that an efficient integration of the two tasks acquired during dual-task training is crucial for the improvement of dual-task performance. That concluded dual task performance can be improved only by dual task training programs [17].

Balance training program on foam rubber pad also showed highly significant results in the present study due to improved anticipatory activity. Related studies done to evaluate balance control on various support surfaces suggested that balance training exercises on different surfaces generate multidirectional destabilization, causing the central nervous system to use proprioceptive signals from ankle mechanoreceptors for maintaining balance [18]. Another basis that supports the present study suggested that recent application of noninvasive electrophysiological and brain imaging techniques revealed insights into the brain matter and the adaptations induced by balance training i.e. the soleus H-reflex amplitude was down-modulated in parallel with improvement in balance control after balance training performed on a foam rubber pad. Studies have suggested that balance training is not only applied for rehabilitation and prevention but also for improving motor performance, muscle power as improvement in functional status resulting from more effective regulation of motor outputs [19].

In the present study both the groups had positive results in comparison to the baseline data of outcome measurement. Dual-task Net-step exercise with Fumanai shown good improvement time up and go test whereas the participants

treated with balance training on foam rubber pad showed greater significance in one leg test, chair standing test and modified fall efficacy scale that the intervention might have resulted in lower extremity improvement, muscle power, joint integrity and proprioception improvement.

**In conclusion:** The study showed statistically significant difference in the balance outcomes i.e. OLS, TUG, CST and MFES. Hence the statistical finding suggests that balance training with foam rubber pad can be given to patients with balance dysfunction to improve measures of balance and to reduce fear of fall and improve Quality of life. Study suggest that improvement in the balance functioning are due to better anticipatory performance and overcoming the fear of fall at the end of intervention. This study also suggests that balance training programs on foam rubber pad is an easier way to maintain their balance functioning in old age.

**Limitations of the study:** Most of the subjects included in the study were from old age home which is good for the positive psychological support. However in the study the population from regular urban or rural area were limited. Contribution of the improvement achieved by the old age individual were not tracked for longer duration, hence limited to mention about period of lasting effect.

**Future scope:** A longer duration study can be taken up to evaluate the carryover effects of Dual-Task Net-Step Exercise and Balance Training Exercise Program On Foam Rubber Pad In Community-Based Older Adults separately. A study can be done to identify possible intervention for batter balance functioning or to see among the foam rubber pad exercises which exercise is best suited for individuals with balance issue.

**Conflict of interest**
None declared

**References**


1. Shumway-Cook A, Woollacott MH. Motor Control: Theory and Practical Applications. Philadelphia: Lippincott, Williams & Wilkins, 2001.
2. Susan sullivan BO, Leslie Portnry G. Physical Rehabilitation: Sixth Edition. Philadelphia: FA Davis. 2014.
3. The balance system, assessed on 13/02/2017 at 5:00 pm http://balanceandmobility.com/for-clinicians/the-balance-control-system.
4. Dutch Guideline Prevention of Falls in the Elderly, 2004. www.cbo.nl
5. A dual-task paradigm, assessed on 12/02/2017 at 6:00 pm https://en.wikipedia.org/wiki/Dual-task_paradigm. page modified on 17 December 2016, at 07:31
6. Jonsson E, Seiger Å, Hirschfeld H. One-leg stance in healthy young and elderly adults: a measure of postural steadiness?. Clinical biomechanics. 2004; 31, 19(7):688-94.
7. Silsupadol P, Siu KC, Shumway-Cook A, Woollacott MH. Training of balance under single-and dual-task conditions in older adults with balance impairment. Phys Ther. 2006; 86(2):269-81.
8. The 30-Second Chair Stand Test, assessed on 17/02/2017 at 5:00 pm https://www.cdc.gov/steadi/pdf/30_second_chair_stand_test-a.pdf
9. Johansen KL, Stistrup RD, Schjøtt CS, Madsen J, Vinther A. Absolute and Relative Reliability of the Timed 'Up & Go'Test and '30second Chair-Stand'Test in Hospitalised Patients with Stroke. PloS one. 2016; 31, 11(10):0165663.
10. Time up and go test (TUG) assessed on 18/02/2017 at 5:00 pm https://www.unmc.edu/media/intmed/geriatrics/nebgec/pdf/frailelderlyjuly09/toolkits/timedupandgo_w_norms.pdf.
11. Sebastião E, Sandroff BM, Learmonth YC, Motl RW. Validity of the timed up and go test as a measure of functional mobility in persons with multiple sclerosis. Archives of physical medicine and rehabilitation. 2016; 31, 97(7):1072-7.
12. Modified Falls Efficacy Scale (MFES)- Geriatric assessment tool kit, assessed on 18/02/2017 at 5:30 pm http://geriatrictoolkit.missouri.edu/vest/Modified-Falls-Efficacy-Scale.pdf
13. Modified Falls Efficacy Scale (MFES), assessed on 18/02/2017 at 6:00 pm http://geriatricphysio.yolasite.com/resources/falls%20efficacy%20scale.pdf.
14. Wolfson L, Whipple R, Derby CA, Amerman P, Nashner L. Gender differences in the balance of healthy elderly as demonstrated by dynamic posturography. Journal of Gerontology. 1994; 1, 49(4):M160-7.
15. Andresen EM, Wolinsky FD, Miller JP, Wilson MM, Malmstrom TK, Miller DK *et al.* Cross-sectional and longitudinal risk factors for falls, fear of falling, and falls efficacy in a cohort of middle-aged African Americans. Gerontologist. 2006; 46:249-57.
16. Hiyamizu M, Morioka S, Shomoto K, Shimada T. Effects of dual task balance training on dual task performance in elderly people: a randomized controlled trial. Clinical rehabilitation. 2012; 26(1):58-67.
17. Silsupadol P, Lugade V, Shumway-Cook A, van Donkelaar P, Chou LS, Mayr U *et al*. Training-related changes in dual-task walking performance of elderly persons with balance impairment: a double-blind, randomized controlled trial. Gait & posture. 2009; 30, 29(4):634-9.
18. Forestier N, Terrier R, Teasdale N. Ankle muscular proprioceptive signals' relevance for balance control on various support surfaces: an exploratory study. American journal of physical medicine & rehabilitation. 2015; 1, 94(1):20-7.
19. Taube W, Gruber M, Gollhofer A. Spinal and supraspinal adaptations associated with balance training and their functional relevance. Acta Physiologica. 2008; 1, 193(2):101-16.