

Effects of Static Somatosensory Balance Training Versus Bosu Ball Training on Balance For Institutional Elderly Population

Priyadharshini S¹, Kamalakannan M², Andrew Anbarason J P³, Anitha A⁴, Ramana K⁵

¹Undergraduate, ²Associate professor, ³Tutor, ⁴Associate Professor, ⁵Assistant professor, Saveetha college of physiotherapy, Saveetha Institute of Medical & Technical Sciences, chennai, Tamil Nadu, India.

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Abstract

Background: As individuals age, balance becomes a critical aspect of daily tasks, involving the integration of sensory feedback for movement planning and execution. The aging process leads to gradual degeneration, increasing the risk of falls and associated mortality rates among seniors. Falls can result in debilitating injuries, signalling the onset of various health issues and potentially leading to a cycle of decline in physical function.

Purpose: To compare the effectiveness of static somatosensory physical activity for the state of equilibrium and bosu ball sessions on elderly individuals. These activities can help improve balance. They cannot really address fear or dread as those are psychological in nature.

Materials and Methods: The 30 subjects were obtained from Neo Education Social Awareness And Management Society (NESAM) Old Age Home between the ages of 60 and 70 were selected based on selection criteria and assigned to two groups. The inclusion criteria encompassed participants with scores between 35 and 45 on the Berg Balance Scale (BBS) and a score of four on the fall risk assessment questionnaire. Group A underwent 30-minute BOSU ball exercises. Group B received static somatosensory balance exercises. *Study period* : November 2022 to July 2023.

Result: The study's results revealed that both groups exhibited significant improvements in equilibrium, with a p-value < 0.001. However, the BOSU ball group showed more notable enhancements than the static somatosensory balance exercises group.

Conclusion: In conclusion, both BOSU ball sessions and static somatosensory sessions were effective in enhancing balance in elderly individuals. Nonetheless, BOSU ball exercises were found to be superior in improving equilibrium.

Keywords: Equilibrium, posture, control, geriatrics, old age home, collapse

Introduction

A body is in an upright position when its centre of the force of gravity has been confined by its base of

support. Balance is of two kinds- Dynamic Balance: When engaging in actions like walking or reaching, this balance is required to keep the point at which of the body's cog. Static Balance: When seated and

Corresponding Author: Kamalakannan M, Associate Professor, Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India.

E-Mail: kamalakannan.scpt@saveetha.com

standing quietly, the body must maintain this balance to keep the cog over the base.¹ Vestibular, Visual, and other somatosensory stimuli can be used to determine where the body is in space and where its centre of gravity is. The term “geriatric population” describes seniors 65 yrs. and over. Uneven balance is known to be more likely to occur in this age group.²

According to Carr and Shepherd (1998), Balance and action are inextricably linked to the environment in which it is carried out. The “foundation for all voluntary motor skills” is therefore balanced (Woolcott and mission 1996). In order to better adjust to the shifting Centre of gravity (COG), it is essential to be functionally aware of the Base of support (BOS).³ Falls are one of the major problems for the elderly and one of the “geriatric diseases” (falls, confusion, incontinence, homeostasis and iatrogenic diseases) that contribute significantly to morbidity.⁴ The most prevalent geriatric syndrome is thought to be falls.⁵ Every year, about 35% of adults over 65 experience a fall. A person’s confidence and independence are greatly affected by falling, which can also result in hospitalization, institutionalization, or even death).⁶ Age-related structural changes indicate a significant decline in physical fitness.⁷

Falls are highly likely to occur when there are balance issues.^{8,9} Falls represent one of a number of major challenges that the senior individuals face. Loss of independence, impairments, and an overall reduction in quality of life can follow a fall injury.¹⁰ BOSU ball is a device created for balance training among athletes and other active people for leisure. A strong plastic base and an air-filled rubber sphere that is comparable to a Swiss ball split in half make up the BOSU’s structure. The BOSU ball is intended to be used on either the dome or the platform. Any population can benefit from the equipment’s use when it comes to rehabilitation following an injury or surgery.¹¹

Only the body centre of mass (COM) moves during static balance, leaving the base of stability (BOS) immobile. Maintaining the Centre of Mass within the Base of Support, also referred to as the stability limit, is the goal of the balance task. The Berg balance scale (BBS), which assesses balance in elderly individuals. The scale, which is used to assess functional balance, consists of 14 accessible tasks

representative of commonplace circumstances. Each category has a standard five-alternative scale with values between 0 to 4, and the maximum score that can be achieved is 56. The score is null if the patient requests aid in order to stand, and if the patient can stand unassisted, the score is 4. A score of less than 45 is regarded as indicative of impaired balance and a fall risk.¹²

Aim

The study is intended to compare the effect of static somatosensory balance training and bosu ball training improving balance in elderly population.

Methods

A sample size of 30 aged between 60- 80 years, were taken into consideration to assess balance and fear of fall. *Study period* : November 2022 to July 2023.

Inclusion criteria:

- Institutionalized elderly
- Male/Female between 60-80 years of age.
- Cognitively intact (MMSE>24)
- Berg Balance Scale 35-40.
- Able to walk independently at least 10 meters.
- At least 1 fall in the previous 6 months (not resulting from a violent blow; loss of consciousness, paralysis, or seizure).
- Independent in ambulation.

Exclusion criteria:

- Uncooperative patients.
- Patients with any history of neurological deficit or cerebellar dysfunction.
- Patients with a history of severe cardiac or pulmonary disease, terminal illness, dementia, medical unresponsive depression.
- The Subjects with visual problems or severe auditory problems.
- Elderly who used assisted walking devices or who were unable to walk independently at least 10 meters .

Outcome measures:

Assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Berg balance scale (BBS) to assess balance.
- Fall risk assessment questionnaire to assess individuals risk of experiencing a fall.

Procedure

Based on inclusion and exclusion criteria, the subjects were identified. They were provided with an explanation of the study. The included participants were randomly allocated to 2 groups; Group A underwent 30 minutes of bosu ball exercises (knee bend, one leg stand, unilateral heel raise, marching and split stance with torso rotation), with each set of exercises consisting of 5-8 repetitions and a 2-minute rest period. Static somatosensory balance exercises were given to Group B. For 30 minutes, Group B underwent static somatosensory balance exercises with 5-8 repetitions of each set and a 2-minute rest period between sets. For four weeks, the study was carried out five days per week.

Group A: Bosu Ball Exercise

At first, all of these sorts of activities were carried out with assistance.

Warm up: Exercises for arm, hip, and leg joint mobility are recommended as part of the warm-up.

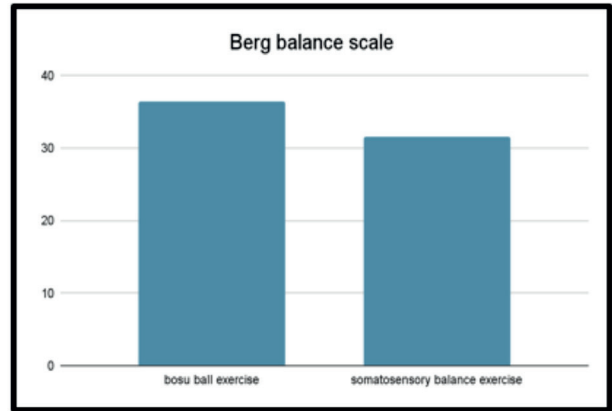
1. A single heel lift
 - Put one foot on the bosu ball.
 - Repeat this motion 5-8 times by raising and lowering the heel that is on the floor.
2. March
 - Stance atop the disc.
 - March for 20 counts, then repeat 5-8 times.
3. Knee flexion
 - Stance atop the disc.
 - Kneel on both knees.
 - Remain in place for 10 counts.
 - It needs to be repeated 5-8 times.
4. Torso rotation while in a split stance
 - Position one leg atop the ball.
 - Repeat this motion 5-8 times while raising your arms around your trunk.
5. Stand on one leg
 - Stance atop the disc.
 - Lift a leg.

- For 10 counts, hold it.
- You should do it 5-8 times.

Group B: Static Somatosensory Balance Exercise

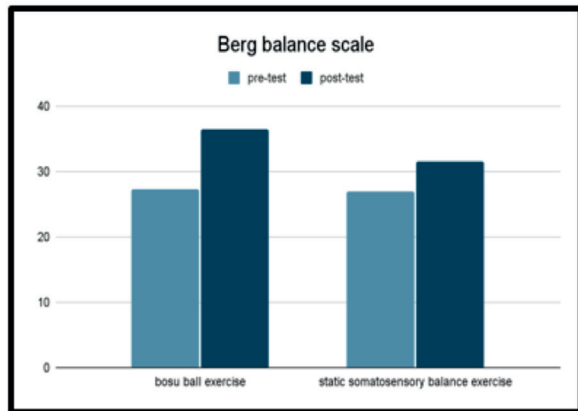
1. Under the Foot Roll
 - Drop a little ball to the ground.
 - Roll the ball under the foot in a circular motion while barefoot.
 - Change feet and reverse the circling motion.
 - Make sure your posture is upright while performing this exercise or any other exercise.
2. Exercise your toes out
 - Roll a tiny ball from the big to the small toe while taking off your shoes to spread and stretch your toes.
 - At all times, your heel should be in contact with the ground.
 - This exercise will help you balance by making your toes more flexible and enhancing your foot somatosensory awareness.
3. Tandem position
 - Putting themselves in an upright position next to a chair.
 - Put both feet together in a straight line, with the toes of one foot nearly touching the heel of the other.
 - Make sure your toes are pointing forward and that your feet are not spread out.
 - Change your feet once the allotted time has passed.
 - You can close your eyes and practice holding for the designated amount of time to make this exercise more difficult.
4. Standing on one leg with assistance
 - Performed with hands on hips, eyes open.
 - Time starts when the patient stands on one leg (with assistance if necessary), and it ends instantly when the patient's other foot touches the ground or when their hands leave their hips.
 - Similar modifications are made, such as standing on one leg with the leg raised sideways and lifting the back off the ground.
5. Narrow base of support (with eyes closed)
 - Request that the subject close his or her eyes and stand straight up.

- As a safety measure, stand close by to prevent the person from falling over and hurting themselves.
 - Swaying, occasionally and even toppling over are observed as positive signs.
 - The patient’s increased unsteadiness when their eyes are closed is the key characteristic.
6. Changing to the sway’s maximum range
- The performance-based on the length of stay of the subjects was found through demanding them to shift their weight around for as long as their bodies could in three distinct directions (forward, right, and left) while retaining a foundation of support.
 - For practical and safety motives, we did not evaluate the performance-oriented length of stay in the reverse direction.

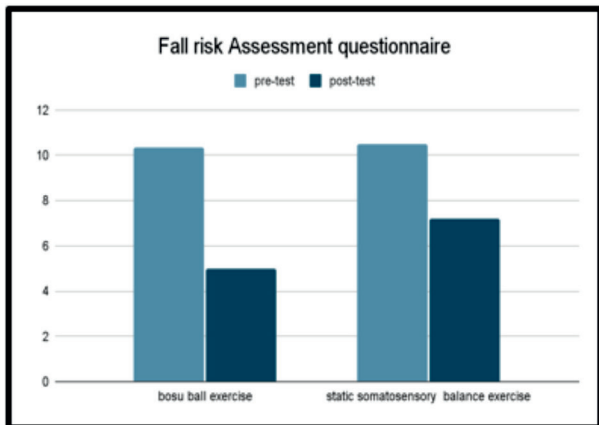


Graph No.3 Comparison of post-test values of Group-A and Group-B using BBS.

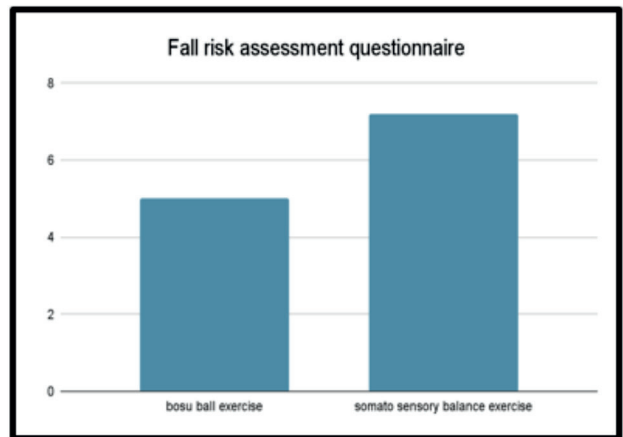
Data Analysis



Graph No.1 Comparison of pre-test and post- test values of Group A and Group B using BBS.



Graph No. 2 Comparison of pre-test and post-test values of Group-A and Group-B using FRAQ.



Graph No. 4 Comparison of post-test values of Group A and Group B using FRAQ.

Result

A statistical comparison of quantitative data between the BOSU ball physical activity group and the static somatosensory balance physical activity group showed a statistically significant variance in values.

The results of bosu ball exercises using the Berg Balance Scale (BBS) and Fall Risk Assessment Questionnaire are compared using the Berg balance scale, the pre-test mean value was 38.0, and the post-test mean value was 45.73. Using the Fall risk assessment questionnaire, the pre-test and post-test mean values were 10.33 and 5.00, respectively. As a result, when the p-value is less than 0.0001, the results are regarded as statistically substantial.

The static somatosensory exercise’s pre-test and post-test results using the Berg balance scale and

the Fall risk assessment questionnaire are compared using the Berg balance scale, the pre-test mean value was 37.86, and the post-test mean value was 41.13. Using the Fall risk assessment questionnaire, the pre-test and post-test means were 10.47 and 7.20, respectively. As a result, when the p-value is less than 0.0001, the results can be considered as statistically valid.

The post-test results of the BOSU ball exercise group and static somatosensory exercise groups are compared which shows that the mean values for the BOSU ball exercise group were 45.73 using the Berg balance scale and 5.00 using the Fall risk assessment questionnaire, while the mean values for the static somatosensory balance exercise group were 41.13 using the Berg balance scale and 7.20 using the Fall risk assessment questionnaire. As a result, when the p-value is less than 0.0001, the results are deemed statistically significant.

Discussion

Evidence from numerous studies suggested that exercise can help older people with their balance.

According to Paterson et al., despite the fact it can restrict their capacities to perform ordinary everyday tasks, older adults remain capable of improving their joint elasticity through exercise.¹³

According to Rozzi et al., Balance exercises can improve balance and reduce sway conditions by restoring ankle equilibrium, which may also help the proprioceptive mechanisms that were ruined.¹⁴

Soderman et al., Investigated to determine whether stability board guidance could help prevent painful lower-extremity region injuries.¹⁵

According to Behm et al., Instead of focusing on building strength, a physio ball (BOSU) training program should aim to increase stability, balance, and proprioceptive abilities.¹⁶

Stanek et al., identified the center of pressure (COP) and the average sway acceleration. They discovered that, in terms of both COP and sway velocities, the BOSU ball appeared to be the most difficult.¹⁷

Pijnappels et al., conducted a study in which one leg becomes unbalanced while walking, the other

leg is instantly lifted off the ground in an effort to avoid falling. This mechanism explains why there is a decline in the frequency of fear of falling.¹⁸

According to Hausdorff et al. (1997), Fallers in their senior years walk noticeably more slowly than non-fallers.¹⁹ Wolfson et al. (1995) comparing the walking speed and duration of strides of fallers and non-fallers produced similar findings.²⁰

Kronhed et al. (2001) found that participants who were performing activities involving balance transformed their one-legged stance scores and walked at a greater speed.²¹ The fear of tumbling is a common worry among the elderly, particularly those who live in institutions. It is important to acknowledge that fear of falling is a complex issue influenced by various psychological and physical factors. Psychological factors such as anxiety, depression, and previous fall experiences can contribute to the development and persistence of fear of falling. Therefore, identifying effective interventions to address fear of falling is crucial for promoting overall well-being and independence among the institutional elderly population.

Limitations:

- No follow up was done.
- The duration of the study is short.

Recommendations:

- Future studies can be done with longer duration and periods.
- Follow up should be done.
- Future research is needed on subjects of other age group

Conclusion

The study's findings demonstrate that BOSU ball exercise is more effective than static somatosensory balance training in reducing fear of fall in institutionalized elderly. The results show that after the training, posture, base of support, coordination, and balance significantly improved.

Ethical Clearance: Taken from institutional ethical committee 03/ 063/ 2022/ ISRB/ SR/ SCPT.

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Conflict of Interest: Nil

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