ORIGINAL RESEARCH

IJPHY

EFFECT OF SPECIFIC BALANCE STRATEGY TRAINING PROGRAMME ON BALANCE IN INSTITUTIONALIZED ELDERLY POPULATION

[1]Muzaffar Mairaj
[2]Hamdani Nusrat
[3]Walia Shefali

ABSTRACT

Background: Balance emerges from the interaction of multiple systems that are organized to meet functional task goals and that are constrained by environmental context, but is often compromised with advancing age. At least 30% of older people experience decline in physical activity after entry into residential care. Participation in activity is more difficult for older people because of fear, lack of motivation, depression and poor understanding of the long term benefits of physical activity. Thus our purpose was to investigate effect of specific balance strategy training programme as compared to general balance training in improving balance in institutionalized elderly population.

Methods: 26 institutionalized elderly subjects participated in the study. Participants in group A were given specific balance strategy training programme and those in group B were given general balance training. Intervention was for 40 min per day, thrice a week for 4 weeks. Balance was assessed using Berg balance scale and Timed up and go test.

Result: Both the interventions showed marked improvement in balance when assessed on Berg balance and Timed up and go test. The group having specific balance strategy training programme proved to be significantly better than general balance training programme.

Conclusion: Specific balance strategy training programme being more effective than general regimens should be incorporated in addressing balance related problems of institutionalized elderly population.

Keywords: Specific Balance Strategy, General Balance stratergy, Institutionalized, Elderly, Falls, Physical activity

Received 05th August 2015, revised 21st August 2015, accepted 02nd October 2015

www.ijphy.org

DOI: 10.15621/ijphy/2015/v2i5/78223

[2]Asst Professor, Dept of Rehabilitation Sciences, Faculty of HIMSR, Jamia Hamdard, New Delhi, India.
[3]Asst Professor, ISIC, Vasant Kunj, New Delhi, India.

CORRESPONDING AUTHOR

[1]Muzaffar Mairaj

Physiotherapist, Help Age India, Jammu and Kashmir, India.

INTRODUCTION

Balance is a complex function involving numerous neuromuscular processes.[1,2,3,4] Control of balance is dependent upon sensory input from the vestibular, visual and somatosensory systems. Central processing of this information results in coordinated neuromuscular responses that ensure the centre of mass remains within the base of support in situations when balance is disturbed. Effective control of balance thus relies not only on accurate sensory input but also on a timely response of strong muscles. Balance impairments are associated with an increased risk of falls and poorer mobility measures in the elderly population. [5, 6, 7]

For many elderly subjects, the aging process is inevitably accompanied with restriction of the ability of independent movement and loss of balance (Woollacott 1993). The postural system consists of several sensory systems (somatosensory, visual and vestibular), the motor system and a central integrating control system, which involves complex interactions among multiple neural systems (Horak and MacPherson 1996).

These systems are known to be affected by aging and result in an impairment of the ability to maintain stance (DuPasquieretal.2003)[8]

In old age, muscle weakness due to sarcopenia is responsible for the development of frailty and important disability.[9,10] Especially in institutionalized elderly persons, muscle strength can deteriorate to a point where it becomes critical for independence of transfers and walking.[10]

At least 30% of older people experience decline in physical activity after entry into residential care. Participation in activity programmes is more difficult for older people because of fear, lack of motivation, depression and poor understanding of the long term benefits of physical activity.[11]

Due to their frailty, persons living in long term care facilities are at increased risk of further decline. Physical functioning, or the ability to perform activities of daily living, essentially contributes to the quality of life of older persons.[12, 13]

Several balance assessment tools are available to check for any balance disorder or fall. Get up and go test, timed up and go test[14], Berg balance scale[15], Tinnetti fall efficacy scale[16,17], functional reach test, sensory organization testing, electromyography are to mention few.

Balance exercise programs can be effective in improving gait and balance, as well as reducing falls and fall related injuries.[18] Efforts to reduce the risk and incidence of falls in older adults are plentiful, as evidenced by intervention studies which have appeared in the literature within the last 2 decades detailing various exercise interventions intended to reduce falls.[19] These interventions have emphasized a variety of exercise models including resistance training[19], Tai Chi[20], Yoga [21,22], Computerized Biofeedback of sway, and Flexibility exercises. More commonly some combinations of these and other similar activities are used.[22, 23]

The high rate of falls and fall related injuries in the nursing homes should not be viewed as inevitable, but as outcomes that can be substantially improved through structured safety programs.[24]

A study was done to establish the effects of a short individualized exercise programme on balance dysfunction in elderly, and the researchers concluded that a short individualized exercise programme can improve functional balance in people aged 75 years and older. This improvement was maintained at least for one month but had worn off by one year.[25]

Jensen et al. described a cluster randomized trial in nine Swedish residential homes (n = 439) using staff education, environmental / equipment review, progressive exercise, multidisciplinary post-fall assessment and hip protectors. There was a significant reduction in incidence ratios for falls. Fractures were also significantly reduced, although to what extent this was due to the use of hip protectors is unclear. Falls reduction was less pronounced in the subgroup of individuals with cognitive impairment. Becker et al. reported a cluster randomized trial (n = 981) in six German nursing homes, using staff education, progressive balance training, environmental adaptations and hip protectors. There was a strong and significant reduction in falls rate and in the number of clients who fell, though no effect on fractures.[26]

Perturbed walking exercise using a bilateral separated treadmill for 6 months was found to be effective in improving balance and reaction time in 32 long term care facility residents and out patients.[27]

Functional and static balance, mobility and falling frequency in elderly osteoporotic women was seen to be reduced following a 12 month intervention using balance training.[28]

MATERIALS AND METHODS

SUBJECTS

A total of 30 subjects were recruited for the study out of which only 26 (11 Males & 15 Females) subjects completed the study. Subjects were

recruited from different old age homes , having age 60 years and above, MMSE (Mini Mental State Examination) score =24 and above, independent ambulatory. Subjects were excluded if they had pre-existing major lower limb pathology, neurological disorders that would prevent standing for the duration of the procedure. Health conditions like uncontrolled hypertension that would preclude participation in the balance programme, uncorrected visual and hearing impairment and those participating in other formal exercise programmes.

Berg balance scale and the timed up and go test were used to assess the balance of the elderly. Berg balance scale included 14 different activities were participants made sit to stand, transfer, standing with eyes open and eyes closed and so on. During timed up and go test, patients were made to stand from a standard chair with arm rest, walk up 3 m mark, turn back, again sit in the same chair. The activity is timed and recorded

INSTRUMENTATION

Standard arm chair (seat height approximately 46cm) ,stepper, stools of varying heights for progression in difficulty in the tasks, tables for transfer of objects, balls of various sizes, weighing machine, stop watch, measuring tape, mat, cards and mirror.

PROCEDURE

All the selected subjects were informed in detail about type and nature of the study and were asked to sign an informed consent. All the subjects were screened by a general assessment and then were divided in two groups randomly. Demographic data was obtained prior to the intervention. Baseline measures on Berg Balance Scale and Timed Up and Go test were found to be insignificantly different between the two groups. The specific balance strategy training group performed sit-to-stand-to-sit, stepping in all directions, reaching to the limits of stability, step up and down, ankle, hip and upper limb balance strategy practice, sideways reach task, ball games and card treasure hunt. The general balance training group performed initial warm up, marching forward, backward, sideways, standing still flexing and extending elbow, hip extension and abduction, stepping sideways with arm swings and so on .Warm down, gentle stretching and walking on the spot. After 4 weeks of intervention given thrice a week for 40 minutes per day balance was reassessed using same tools.

DATA ANALYSIS

Data analysis was done using SPSS version 17 software. T-test was used to compare the difference between the group A and group B on Berg balance scores and timed up and go test. Intra group analysis between pre and post-intervention values on both the scales was also done using paired t-test. The level of significance was fixed at ≤ 0.05.

RESULTS

Pre-intervention Berg balance scale of group A and group B and Pre-intervention timed up and go scores of both the groups were calculated to be insignificantly different from each other. Pre-intervention Berg balance scale score of group "A" was found to be 41.31 ± 3.01 S.D and that of group "B" was 42.85. ± 5.46 S.D Pre-intervention timed up and go score of group "A" was calculated to be 13.15 ± 2.00 S.D and PRTUG of group "B" was found as 12.97 ± 2.30 of this suggested the homogeneity of the two groups

Table 1

Scales.	Group A	Group B	t– Value.	P– Value.
POBBS	50.08 ± 2.22	47.23 ± 4.48	2.06 S	0.05
POTUG	9.98 ± 0.81	11.95 ± 1.97	3.33 S	0.003

S = Significant.

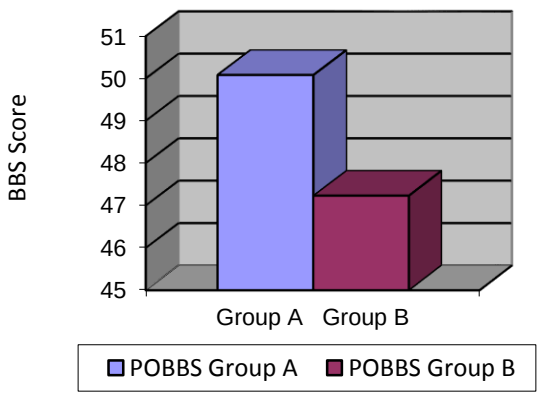
Berg Balance Scale

Between group analysis

After the analysis of the post intervention Berg balance Score between group A (mean 50.08 ± 2.22 S.D) and group B (mean 47.23 ± 4.48 S.D) using t-test, it was observed that there was a significant difference (t- value = 2.06), (Table :1) between the two groups. Indicating that the specific balance strategy training programme was more effective than General balance training (Graph.1)

Comparison of post- intervention BBS of group A and post- intervention BBS of group B

Graph. 1



Keys:- BBS = Berg balance scale, POBBS = Post-intervention BBS,

Within group analysis

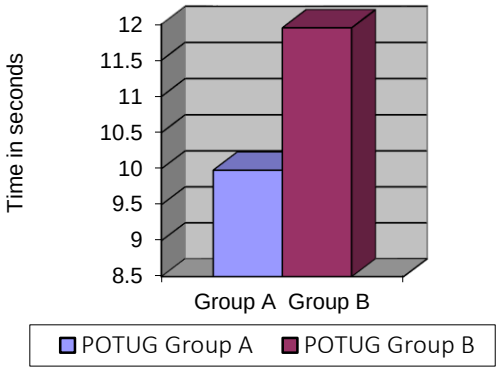
There was a significant difference in BBS of group A with a t- value of 8.11.when the PRBBS (mean 41.31 ± 3.01 S.D) and POBBS (mean 50.08 ± 2.22 S.D) were analyzed using paired t-test.

The difference after within group analysis of pre-intervention Berg balance scale (mean 42.85 ± 5.46 S.D) and post-intervention Berg balance scale (mean 47.23 ± 4.48 S.D) in group B was calculated to be significant, t-value being 5.68.

Timed up and go test (TUG).

Comparison of post-intervention TUG of group A and post-intervention TUG of group B

Graph. 2



Key: TUG = Timed up and go, POTUG = Post intervention TUG

Between group analysis

Post intervention timed up and go of group A (mean 9.98 ± 0.81 S.D) and post intervention timed up and go of group B (mean 11.95 ± 1.97 S.D) when compared with each other, revealed a significant difference (Table:1) in the scores at a t-value of (3.33). Indicating that the specific balance strategy training programme was more effective than general balance training in improving balance on timed up and go test. (Graph 2)

Within group analysis

There was a significant difference between the pre-intervention timed up and go (mean 13.15 ± 2.00 S.D) and post-intervention timed up and go (mean 9.98 ± 0.81 S.D) of group A with a t- value of 6.26.

The difference after within group analysis of pre-intervention timed up and go (mean 12.97 ± 2.30 S.D) and post-intervention timed up and go (mean 11.95 ± 1.97 S.D) in group B on Berg balance scale was calculated to be significant, paired t-value was calculated to be 5.34.

Both the specific balance strategy training programme and general balance training were effective in increasing the balance of institutionalized elderly population but the specific balance strategy training programme was found to be more effective programme.

DISCUSSION

Our study aimed to compare specific balance strategy training programme and general balance training programme in institutionalized elderly population. The results showed significant improvement in balance, both within and between groups on both Berg balance scale and timed up and go test. Balance strategy training programme group significantly outperformed general balance training group.

One factor that might have contributed to the improvement in the functional ability in the balance group was the composition of the workstation tasks they practiced. These tasks contained elements that encouraged participants to bend, turn and reach to limits of stability on various surfaces thereby providing added vestibular stimulation. Such interventions encouraged increased speed and size of movements which may have increased strength and endurance in addition to improving flexibility and reaction time for the balance group. This could have resulted in more efficient movement reflected in the improved functional ability to balance, ambulate in the environment and at a faster velocity. Support for this view comes from the improved outcomes from a similar multidimensional balance-training programme delivered as an individual intervention[29] rather than small groups.

There has been 25 % reduction in the risk of falls in those trials that more specifically focus on balance training as part of the training intervention. Systemic reviews of the intervention trials suggesting that exercise is effective in reducing fall-risk only when part of a multi-factorial approach that specifically includes balance training.[22, 30, 31]

The other differences between the two exercise interventions were multiple task (cognitive and motor) training, as reported by Silsupadol et al. that dual task balance training is more effective in improving balance measures.[32]

Visual feedback (by the mirror) was provided to the patients during various tasks on different surfaces, that might have lead to the enhancement in balance. This idea is supported by the findings of Sanna E. et al whose findings suggested that balance training based on visual feedback improves the balance control in frail elderly women living in residential care.[33]

Sit-to-stand-to-sit being a component of specific balance strategy training programme and focused to improve the lower limb strength might had lead

to improvement in post intervention test scores.[31, 32, 33]

The specific balance strategy group reached limits of stability during the activities that might have lead to the enhancement of postural reactions which may have contributed to the improvement of balance function against perturbations.[27]

The general balance training group also showed improvement in balance. This can be attributed to the generation of the new motor skills by the practice of physical activity.[34] General balance training programme might have lead to improved muscle strength or muscle volume that might have improved balance.[35,36] There is further support for improved physiologic capacity and physical function in individuals who do not have functional limitation or severe illness.[37]

Although both the interventions proved to be beneficial for balance training in institutionalized elderly populaton, the specific balance strategy training programme was found to be significantly more effective than general balance training. This can be said to be due to the diversity and progression of the specific balance strategy training programme like multiple task, reaching limit of stability, visual cueing, turning and bending movements, stepping on the blocks and sit to stand activities which were lacking there in the general balance training programme. The possible cause that might have lead to the difference in the outcomes in the two interventions seems to be the difference in the design or content of interventions.

CONCLUSION

Institutionalized elderly present higher likelihood to suffer falls than non-institutionalized ones, because the previous have lower levels of strength, balance, flexibility and physical endurance & they need effective interventions to cope with the postural instability. The present study highlighted the superiority of specific balance strategy training programme over general balance training programme in institutionalized elderly population.

ACKNOWLEDGEMENTS

The Authors would like to thank Gharaunda Vridhashram, Fatehpur Beri New Delhi .Home for the aged, Christian friend in need society, Asola fatehpur, New Delhi. Vishraam Vridhashram, Gautampuri , New Delhi.Jhon's day care and boarding for senior citizens. Aaya Nagar, New Delhi.

REFERENCES

1. Horak FB, Shupert CL,Mirka A. Components Of Postural Dyscontrol In The Elderly: A review. Neurobiol Aging. 1989;10(6):727–38.
2. Stelmach GE, Teasdale N, Di Fabio RP, Phillips J. Age Related Decline In Postural Control Mechanisms. Int J Aging Human Dev. 1989;29(3):205–23.
3. Jones G. Posture. In: Kandel E, Schwartz J, Jessell T, eds. Principles Of Neural Science. New York: McGraw-Hill,2000:816–31.
4. R S Hinman, K L Bennel, B R Metcalf and K M Crossley. Balance Impairment In Individuals With Symptomatic Knee Osteoarthritis: A Comparison With Matched Controls Using Clinical Tests. Rheumatology. 2002;41(12):1388-1394.
5. Imms FJ, Edholm OG. Studies Of Gait And Mobility In The Elderly. Age Ageing 1981;10(3): 147–56.
6. Lichenstein MJ, Shields SL, Shiairi RG, Burger MC. Clinical Determinants Of Biomechanics Platform Measures Of Balance In Aged Women. J Am Geriatr Soc. 1988;36(11): 996–1002.
7. Shumway-Cook A, Brauer S, Woollacott M. Predicting The Probability For Falls In Community-Dwelling Older Adults Using The Timed Up & Go Test. Phys Ther 2000;80(9):896–903.
8. D. Abrahamova A, F. Hlavacka. Age-related changes of human balance during quiet stance. Physiol Res.2008;57(6):957-964.
9. Fried LP et al. Frailty in older adults: Evidence For A Phenotype. J gerontol A Biol Sci Med Sci 2001;56(3):m146-157.
10. Ivan Bautmans, Ellen Van Hees, Jean-Claude Lemper and Tony Mets. The Feasibility Of Whole Body Vibration In Institutionalized Elderly Persons And Its Influence On Muscle Performance, Balance And Mobility: A Randomized Controlled Trial. BMC Geriatrics 2005;5:17
11. Kathryn Peri, Ngaire Kerse, Elizabeth Robinson, Mathew Parsons, Jhon Parsons, N Latham. Does Functionally Based Activity Make A Difference To Health Status And Mobility? A Randomized Controlled Trial In Residential Care Facilities (The Promoting Independent Living study; PILS). Age and ageing. 2008;37(1):57-63
12. Jagger C, Spiers NA, Clarke M. Factors Associated With Decline In Function, Institutionalization And Mortality Of Elderly People. Age and ageing. 1993;22(3):190-197.
13. Amika S Singh, Marijke JM Chin A Paw, Ruud J Bosscher and Willem Van Mechelen. Cross-

sectional Relationship Between Physical Fitness Components And Functional Performance In Older Persons Living In Long-Term Care Facilities. BMC geriatrics. 2006;6:4
14. Berg K, Maki B, Williams JI, Holliday P, Wood-Dauphinee S: A Comparison Of Clinical And Laboratory Measures Of Postural Balance In An Elderly Population. Arch Phys Med Rehabil.1992; 73(11): 1073-1083.
15. Diane Podsiadlo, Sandra Richardson. The Timed Up And Go: A Test Of Basic Functional Mobility For Frail Elderly Persons. J Am Geriatr Soc. 1991; 39(2):142-148.
16. Katherine Berg. Balance And Its Measure In The Elderly: A Review. Physiotherapy. 1989;41(5):240-246.
17. Lichtenstein MJ, Burger MC, Shields SL, Shiavi RG. Comparison Of Biomechanics Platform Measures Of Balance And Videotaped Measures Of Gait With A Clinical Mobility Scale In Elderly Women. J Geront. 1990;45(2):M49-M54.
18. Tatjana Bulat. Effect Of A Group-Based Exercise Program On Balance In Elderly. Clinical Interventions In Ageing. 2007;2(4):655-660.
19. Judge JO, Lindsey c, Underwood M, Winsemius D. Balance Improvements In Older Women. Effect Of Exercise Training. Phys Ther.1993;73(4):254-265.
20. Komagata S, Newton R. The Effectiveness Of Tai Chi On Improving Balance In Older Adults: An Evidence Based Review. J.Geriatric Phys. Ther.2003;26(2):9-16.
21. Bastille JV, Gill-Body KM. The Effect Of A Yoga –Based Exercise Program On Individuals With Chronic Post-Stroke Hemiparesis. Neurology Report. 2002;26:203.
22. James W. Bellew, Paula Click Fenter, Bryan Chelette, Rebecca Moore, Daniel Loreno. Effects of A Short-Term Dynamic Balance Training Program In Healthy Older Women. J Geriatr Phys Ther. 2005;28(1):4-8, 27.
23. Skelton DA, Dinan SM. Exercise For Falls Management. Rationale For An Exercise Programme To Reduce Postural Instability. Physiother Theory Prac. 1999;15(2):105-120.
24. Wayne A. Ray et al. A Randomized Trial Of A Consultation Service To Reduce Falls In Nursing Homes. JAMA. 1997;278:557-563.
25. Bernard Wolf. Effect Of A Physical Therapeutic Intervention For Balance Problems In The Elderly: A Single Blind, Randomized, Controlled Trial. Clinical Rehabilitation. 2001;15(6):624-636.
26. Tahir Masud et al. Preventing Falls and Injuries In Nursing Care Homes. Age And Ageing 2004;33:532-535.
27. Shimada H, Obuchi S, Furuna T, Suzuki T. New Intervention Program For Preventing Falls Among Frail Elderly People: The Effects Of Perturbed Walking Exercise Using A Bilateral Separated Treadmill. Am J Phys Med Rehabil. 2004;83(7):493-499.
28. M.M. Madureira, L Takayama, A. L. Gallinaro, V. F. Caparbo, R.A. Costa, R .M. R. Pereira. Balance Training Programme Is Highly Effective In Improving Functional Status And Reducing The Risk Of Falls In Elderly Women With Osteoporosis: A Randomized Controlled Trial. Osteoporos Int. 2007; 18(4):419-425.
29. Shumway-Cook A, Grubner W, Baldwin M, Liao S. The Effect Of Multidimensional Exercises On Balance, Mobility, And Fall Risk In Community-Dwelling Older Adults. Phys Ther 1997; 77(1):46–58.
30. Sowden A, Sheldon T, Pehl L. Preventing Fall And Subsequent Injury In Older People. Effective health care.1996; 2(4):1-16.
31. Bernard Wolf. Effect Of A Physical Therapeutic Intervention For Balance Problems In The Elderly: A Single Blind, Randomized, Controlled Trial. Clinical Rehabilitation. 2001;15(6):624-636.
32. Tome I, Yasuyoshi A, Akimitsu T. The relationship between quadriceps strength and balance to fall of elderly admitted to a nursing home. J Phys Ther Sci. 2003;15:75-79.
33. Marion E, t. Mc Murdo, Lucy M, Rennie. Improvements In Quadriceps Strength With Regular Seated Exercise In The Institutionalized Elderly. Arch Phys Med Rehabil. 1994;75(5):600-603.
34. Gerome C. Gauchard, Pierre Gangloff, Claude Jeandel, and Philippe P. Perrin. Influence Of Regular Proprioceptive And Bioenergetic Physical Activities On Balance Control In Elderly Women. Journal of Gerontology: Medical sciences. 2003;58A(9):846-850.
35. Skelton, D.A., Effects Of Physical Activity On Postural Stability. Age Ageing, 2001. 30 Suppl 4: p. 33-9.
36. Magnus K. Karisson, Anders Nordqvist and Caroline Karisson. Physical Activity, Muscle Function, Falls And Fractures. Food and Nutrition Research. 2008;52.
37. M. Eaine Cress. et al. Exercise: Effects On Physical Functional Performance In Independent Older Adults. Journal of Gerontology. Medical sciences. 1999;54(5):M242-248.

Citation
Muzaffar Mairaj, Hamdani Nusrat, & Walia Shefali. (2015). EFFECT OF SPECIFIC BALANCE STRATEGY TRAINING PROGRAMME ON BALANCE IN INSTITUTIONALIZED ELDERLY POPULATION. *International Journal of Physiotherapy*, 2(5), 705-711.