Effect of Physical Activity Programme on Balance and Quality of Life in the Elderly

Dr Usha S. Nair[1], Miss Arya S.[2]

ABSTRACT

Falls are common in older adults and linked to decreased balance and increased morbidity. Regular exercise can improve balance and decrease fall risk. However, the effects of exercise may vary depending on the health and wellbeing of the individuals, the structure and the intensity of the exercise programme and the role played to motivate them for exercise. This study describes the effects of participation in a 12 - week of physical activity programme on measures of balance and quality of life in the elderly.

The subjects in this study were 40 elderly between the age group of 60-75 years, from Trivandrum district, in Kerala State. These subjects were randomly assigned to an experimental group (N=20) and a control group (N=20). The experimental group participated in the physical activity training programme, three times in a week, for a period of twelve weeks. Individualized based exercises targeted strength, flexibility, balance, gait, and cardiovascular fitness. The control group did not participate in any sort of structured physical activity programme, during the same period. Balance and quality of life was measured at baseline and after completion of the 12-week exercise programme, using the Timed up and go, Berg balance scale and WHOQOL-BFEF Questionnaire. Mean, SD and t test was computed to know the characteristics and pair wise mean difference in the selected variables.

Experimental group experienced significant improvement in balance, and in all the domains of quality of life. It may be concluded that 12-week physical activity programme was safe and associated with improvements in balance and quality of life in older adults.

KEY WORDS:

Physical activity programme, balance, quality of life, elderly

1. Associate Professor, SAI, LNCPE, Thiruvananthapuram
2. Assistant Professor, S D College, Allepey

INTRODUCTION

Aging does not begin suddenly at age 65 or 70. An inherent linear decline in functional capacity begins at approximately 30 years of age (Jette & Branch, 1981). Fortunately, this decline can be modified substantially by exercise, weight control and diet (Bortz, 1982; Shephard, 1986). As noted by (Smith, 1981), "Some of the current research suggests that 50% of the decline frequently attributed to physiological aging is, in reality, disuse atrophy resulting from inactivity in an industrialized world". Exercise and healthful dietary and living habits (a) decrease the physical burdens of aging, (b) enhance psychological and emotional well-being and (c) increase the likelihood of living to one's full life expectancy (85+5 Years) (Spirduso, 1986).

Aging subjects have a more difficult time adapting and maintaining balance. Thus, when vision is lost or when somatosensory information is dulled through aging, the greater reliance on a vestibular system, that is also aging, results in a more fragile balance. A life time of physical disuse can have catastrophic effects, eroding strength, the mobility and eventually transforming an individual into an exceedingly frail, immobile and totally dependent human being (Fries and Crapo, 1981). Albertsson, 2006 conducted a study on Hip fracture prevention by screening and intervention of elderly women in Primary Health Care. One in four Swedish women suffered a hip fracture (HF). Ten studies, involving 553 subjects, investigated the effect of exercise on balance. Improvement was found in weight bearing exercise; resistance exercise; osteoporosis specific exercise; and balance exercise.

Researchers investigating the older populations' quality of life have broadly measured constructs such as health, happiness, self-esteem and life satisfaction (George & Bearon, 1980). Aging and Quality of life are strongly linked. Quality of life is only of value, however, if the quality of life is endurable, and the goal of extending the life span is only viable if a reasonable quality of life can be maintained throughout the terminal years. The quality of life in the elderly, particularly the frail elderly, is affected by 11 major factors: health status, physical function, energy and vitality, cognitive and emotional function, life satisfaction and a feeling of well-being, sexual function, social function, recreation and economic status. Most of these factors highly interact with each other.

Balance is defined as the ability to maintain the projection of the body's centre of mass within manageable limits of the base of support, as in standing or sitting, or in transit to a new base of support, as in walking (Winter, 1995). Therefore, balance involves anticipatory and ongoing postural adjustments and is thus a co-ordination task. Studies show that people over the age of 65, more than any other age group, require adequate fitness levels to help them maintain independence, recover from illness and reduce high risks of disease. (Blair et al, 1995). The human body responds positively to exercise, no matter what its age.

Given the current prevalence of frailty among the elderly and understanding the effect of an exercise programme on the functional fitness and quality of life in the elderly is critical. The purpose of this study was to investigate the effects of participation in a 12-week exercise programme on physical function in the elderly, on measures of balance and quality of life.

METHODOLOGY

Participants included were 40 older adults between the age group of 60-75 years, from Kripalayam old age home, Ulloor, Thiruvananthapuram district in Kerala state. Subjects were randomly assigned to an experimental group (N=20) and a control group (N=20), having 2 or more chronic conditions, including but not limited to diabetes, the ability to ambulate independently with or without an assistive device (cane), functional vision (limited vision accepted), willingness to participate in a 12-week physical activity programme. Participants were excluded if they have severe health problems. Eligible participants who agreed to participate were sent a consent form. Upon receipt of the completed consent form, medical clearance was obtained from each participant's physician. Primary outcomes were balance and quality of life.

Balance ability of all subjects was measured by static and dynamic functional balance tests. Timed Up and Go Test (TUG) and Berg Balance Scale (BBS) The Berg Balance Scale has been shown to be both reliable and valid, with values of 0.96 and 0.85 (Berg 1992) were used to assess dynamic and functional balance, quality of life was measured using WHOQOL-BREF Questionnaire.

Data was collected on participants at two different time periods, throughout the duration of the study, in order to assess changes over time in balance and quality of life. Data was collected by a single researcher, when answering the QOL-BREF questionnaire; participants had the option of reading the test themselves or having the questions read aloud by the researcher for time purposes.

All the subjects of the study were tested in the selected variables, before and after 12 weeks of training period. Training programme was conducted at the Kripalayam old age home, Ulloor, Thiruvananthapuram. The training programme was carried out by the subjects under the supervision of the supervisor .The experimental group performed the exercise thrice a week for a period of 12 weeks. The training session included warming up, muscle strength exercise, balance and cardiovascular or aerobic activities and cool down. Each session lasted for 60 minutes. The adaptation periods of two weeks was followed, the training load was increased gradually, step by step, after a definite time interval. Exercise programmes which included exercises that challenge balance are more effective in preventing falls than programmes which do not challenge balance. These programmes included: exercises conducted while standing

in which participants aim was to (a) stand with their feet closer together or on one leg, (b) minimize use of their hands to assist balance and (c) practice controlled movements of the body's centre of mass. The initial level of balance exercise difficulty had to be tailored to the capabilities of the individual and with consideration of safety.

Once these older person had mastered a balance task in a stable manner without the need for upper limb support, the task was progressed to increase the challenge to balance. Methods to increase the intensity and effectiveness of balance challenging exercises over time included (a) using progressively difficult postures with a gradual reduction in the base of support (e.g. two-legged stand, semi tandem stand, tandem stand, one-legged stand), (b) using dynamic movements that perturb the centre of gravity (e.g. tandem walk, circle turns, leaning and reaching activities, stepping over obstacles), (c) specific resistance training for postural muscle groups (e.g. heel stands, toe stands, hip abduction with added weights to increase intensity, unsupported sit to stand practice), and (d) reducing sensory input (e.g. standing with eyes closed, standing and walking on an unstable surface).

The Borg scale was used to determine perceived level of exertion during the exercise sessions. Weekly exercise sessions consisted of approximately 15 minutes of progressive strength training, 15 minutes of balance training, and 20 minutes of cardiovascular exercise. Each session also included a review of the previous week's exercise, discussion of identified barriers to exercise and goal-setting.

RESULTS & DISCUSSION

The results were analyzed using the Statistical Package for Social Sciences (SPSS) Version 19 software for Windows. Descriptive Statistics such as Mean and SD was computed, to determine the mean difference from pre to post - t test was used. Levels of $p < 0.05$ were considered statistically significant difference were seen, at 0.01% level, in balance and Quality of life, in the experimental group, following twelve weeks of physical activity training programme of elderly.

While in the case of control group there was no significant change in any of the variables. Mean age of 40 elderly was 66 ± 5 years. Mean and SD Scores of Experimental group (BBS Pre 39.00 ± 10.44 ; post 46.60 ± 10.84), (TUG Pre - 8.8 ± 0.6 ; Post - 7.72± 0.68), (QOL Pre - 44.8 ± 8.4 ; post - 59.86± 8. 81) while that of the control group were (BBS Pre 39.16 ± 11.27 ; post 39.11 ± 11.20), (TUG Pre - 8.81 ± 0.92 ; Post - 8.83 ± 0.94), (QOL Pre 44.80 ± 8.40 ; post 59.86 ± 8. 81) . The 't' value needed for significance at 0.05 level with 19 degrees of freedom was 2.093 and 0.01 level was 2.861 .

The difference in mean scores of balance and quality of life is presented in Table 1 and 2. Mean scores of experimental and control group and percentage gain in balance is presented in Fig: 1 and 2; and quality of life in Fig: 3 and 4.

Table - 1 : Difference in Mean Scores of Experimental and Control group on Balance

	Group		Mean	SD	MD	t
Berg balance scale	Exp.	Pre	39.00	10.44	7.6	8.027**
		Post	46.6	10.84		
	Cntl.	Pre	39.16	11.27	0.05	1.000
		Post	39.11	11.20		
Timed up and go	Exp.	Pre	8.80	.60	1.09	5.952**
		Post	7.72	.68		
	Cntl.	Pre	8.81	.92	0.02	1.455
		Post	8.83	.94		

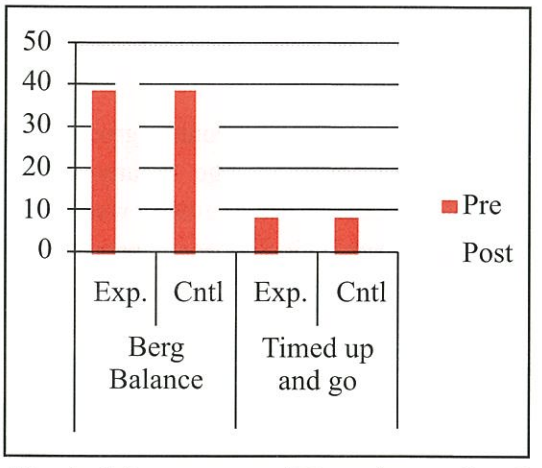

Fig -1 : Mean scores of Experimental and Control group on Balance

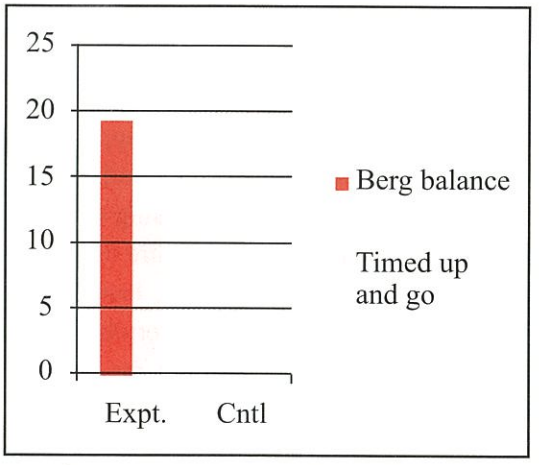

Fig -2 : Percentage gain on Balance

Improvement was seen in balance in the experimental group following twelve weeks of physical activity programme. Balance is the ability to maintain position over its base of support, either static or dynamic. It depends primarily on kinesthetic tactile and to some extend vestibular sense organs. The exercises involved to develop strength such as hip flexion, hip extension, knee flexion, knee extension, knee bends, ankle plantar, ankle dorsi flexor might have provided daily challenges and practice opportunities for balance mechanism. The physical activity programme would have brought about better neuromuscular control, strengthening of the lower limbs and decrease in body weights would have contributed to an improvement in balance. The increase in balance did bring about an increase in self confidence of the elderly, thus improving their functional

Table - 2 : Difference in Mean Scores of Experimental and Control Group on Quality of Life

	Group		Mean	SD	MD	t
Physical Domain	Exp.	Pre	44.85	12.32	11.90	4.384**
		Post	56.75	17.40		
	Cntl.	Pre	45.47	12.11	0.00	.000
		Post	45.47	12.11		
Mental Domain	Exp.	Pre	44.80	9.55	16.25	7.461**
		Post	61.05	8.86		
	Cntl.	Pre	45.16	11.85	0.74	1.319
		Post	45.89	11.52		
Social Domain	Exp.	Pre	43.45	9.83	16.55	8.607**
		Post	60.00	10.27		
	Cntl.	Pre	44.42	9.06	0.32	1.000
		Post	44.74	8.43		
Environmental Domain	Exp.	Pre	46.10	10.46	15.55	6.521**
		Post	61.65	10.97		
	Cntl.	Pre	49.47	12.49	1.68	1.573
		Post	47.79	12.72		
Overall Quality of life	Exp.	Pre	44.80	8.40	15.06	6.467**
		Post	59.86	8.81		
	Cntl.	Pre	46.13	9.37	0.17	0.536
		Post	45.96	9.19		

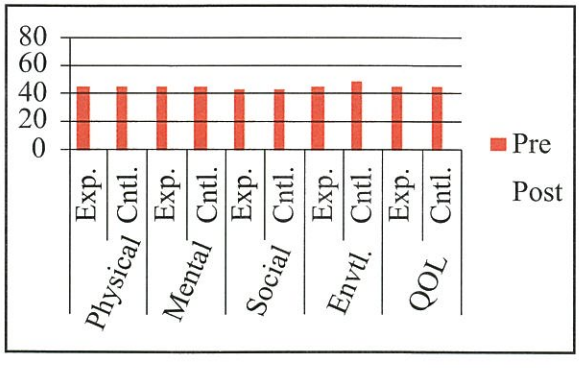

Fig -1 : Mean scores of Experimental and Control group on Balance

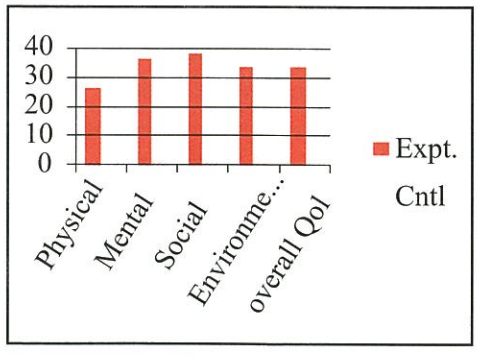

Fig -2 : Percentage gain on Balance

ability and enhancing mobility. Research findings of (Elisabeth Rydwik,v2007) also agree with these findings of the study.

Quality of life improved in the experimental group following training, showing that practice of physical activity promoted modifications on perceptions with life. This corroborate with (Huang's 2006) study. When analyzing the domains separately, it can be observed that, in the case of the experimental group Dom1 (Physical Domain)The physical activity programme resulted in an improvement in work capacity, improved sleep, increase mobility, improved energy levels and the activities of daily living could be perform in much better way. There was also decrease in symptoms of fatigue, pain and discomfort, thus leading to improved physical health. The sessions of the physical activity training programme was not just physical but involved a variety of activities which did bring about an overall development of the (Psychological Domain) Dom2. There was an improvement in the bodily image and appearance, improved positive well being, personal beliefs, enhance self esteem, improved memory and concentration and reduce negative feelings. As the subjects were elderly they were eagerly looking forward to social support Dom 3 (Social Domain). Thus the group activities did provide the means for providing an opportunity to socially interact, providing social support, motivating the less able ones, respecting each other's and forming a social bond. Recreational games provided an opportunity for the subjects to interact, share and adjust among themselves might have resulted in the improvement in social domain.

Opportunities for leisure activities, health and social care, freedom, physical safety and security Dom4(Environmental Domain))increased following physical activity training programme and overall quality of life increased as a result of twelve weeks of training programme. Quality of life is a personal satisfaction with the cultural or intellectual conditions under which ones lives. . Exercise, diet, safety, hygiene, pain relief, engaging in activities, social contact could have contributed to an improvement in overall quality of life. During the training programme, there was a positive rapport between the subjects and the scholar. Physical activity helped them to utilize their energy properly and experienced a sense of personal worth. No changes were seen in the control group, in any of the domains, in the quality of life of the elderly.

This study demonstrated that 12 - week physical activity programme consisting of progressive strength training, balance and cardiovascular or aerobic activities was safe and associated with an improvement in physical function, including upper and lower extremity strength and mobility, as indicated by improvements in both berg balance and the TUG. These results are consistent with findings from a systematic review of 20 randomized control exercise trials with frail older adults, which found that most exercise programmes were effective in improving at least 1 outcome measure in frail elders. (Wolfson et al, 1992) reported that the decline

in balance ability in the elderly was most probably related to loss of strength in lower extremity and decline in sensorimotor functions. This study also confirmed that advanced age is an important factor for impairment of balance. Women are more prone to falls than men. Although, there is no gender difference for falls in advanced age, the incidence of falls is higher in middle–late aged women when compared to men of the same age (Crilly, 1987). Estrogen withdrawal after menopause leads to slowing of speed of information processing in brain. This change is especially important for postural stability which depends on identifying sensory input and initiating appropriate physical response (Shepherd, 2001). Aging and sedentary life cause diminution of muscle mass (sarcopenia) and strength. Sports, and being physically active, might prevent or delay these changes. Increased physical activity is related to better muscle strength, reaction time, balance and coordination, and all these help to prevent falls and fall-related fractures (Carter, 2002). (Myers, 1996) found that physically active elderly persons had better postural control than inactive peers. Since it was shown that balance ability was not divergent in individuals who started sportive activities later in life and in individuals who never gave up sports, it is essential to prescribe physical activity to elderly persons who were previously sedentary (Myers AH, 1996). Physically active individuals regulate somatosensory inputs more efficiently and this leads to better balance control. Proprioception and sensory inputs originating from plantar surface of the foot are important systems for maintenance of balance. Physical activity provides more effective postural adaptation via increasing susceptibility to these stimuli (Myers, 1996).

The limitation of the study was that the number of participants was less; the programme should have been at least of six month duration .It was very difficult to motivate these older adults for an exercise programme since they were too inactive. Most of them felt they cannot perform, but finally most of them succeeded.

In the study, moderate-intensity exercise programme was carried out and was personally supervised. The programme intensity was individualized to the baseline function of each participant and was progressed weekly on the basis of changes in performance. This approach of matching the intensity of the programme to the changing needs of the individual and personally motivating them might have been a critical factor in improving function.

FUTURE DIRECTIONS

Future studies should examine the effect and benefits of a exercise programme to improve functional fitness. This may yield more information on the types, method, and dose of exercise that are most beneficial to each of these groups. Future studies should also follow the participants for a longer period of time to determine factors that influence adherence to this type of exercise programme and how adherence impacts physical and psychological parameters.

CONCLUSION

The physical activity programme had many positive outcomes in the elderly. Many older women are reluctant to participate in an exercise programme because of medical obstacles such as poor health, fear of injury and transportation problem. To get these elderly involve in the exercise throughout the training was itself an achievement. They could stand and walk well. Static and dynamic balance improved, quality of life improved. The quality of life improved which is a very important factor where the number of older people above the age of 65 years are on the increase, they could be productive in the society. It must be recognized that not every aspect of human life is reduced to the practice of physical activity; however, it is an important instrument that generates functional autonomy and well-being in this age group. It is hoped that human beings can be independent in their daily activities and autonomous in their decisions, thus living longer and happier lives.

REFERENCES

Albertsson, D., Gause-Nilsson, I., Mellstrom, D., Eggertsen R.(2006). Risk group for hip fracture in elderly women identified by primary care questionnaire-clinical implications. Ups J Med Sci. ;111:179-87.

Berg, K.O., Maki, B.E., Williams, J.I., Holliday, P.J., Wood-Dauphinee, S.L. (1992). Clinical and laboratory measures of postural balance in an elderly population. Arch Phys Med Rehabilitation 73:1073–1080

Blair, S.N., Kohl, H.W., Barlow, C.E., (1995). Changes in physical fitness and all-cause mortality. A prospective study of healthy and unhealthy men. *JAMA* ;273:1093-8.

Bortz, W.M. (1982). Disuse and aging, journal of American Medical Association, 248:1203 1208.

Brooke-Wawel, K., Prelevic, G.M., Bakridan, C., Ginsburg, J. (2001). Effects of physical activity and menopausal hormone replacement therapy on postural stability in postmenopausal women: a cross sectional study. Maturitas 37(3):167 172

Carter,N.D.,Khan,K.M.,Mckay,H.A.,Petit,M.A.,Waterman,C.Heinonen,A.,Jansen,P.A, Donaldson,M.G.,A.Riddel,L.,Kruse,K ., Prior, J.C and Flicker,L. (2002). Community based exercise programs reduces risk factors for falls in 65-to 75 years old women with osteoporosis: randomized controlled trial. CMAJ; 167 :997 - 1004.

Crilly, R.G., Richardson, L.D., Roth, J.H., (1987). Postural stability and colles fracture. Age Ageing .16:133–138.

Elisabeth Rydwik, (2007). Effects of a physical and nutritional intervention program for frail elderly, Journal of aging clinical and experimental research, volume 20, issues 1-3

Fries, J. F. & Crapo, L.M. (1981). Vitality and aging: Implications of A rectangular curve. San Francisco, CA : W.H. Freeman.

George, L.K. & Bearon, L.B. (1980). Quality of Life in Older Persons: Meaning and Measurement. New York: Human Sciences Press.

Gregg, Edward, Kriska, Andrea, Narayan, Venkat, & Knowler, William (1996). Relationship of Locus off Control to Physical Activity among People With and Without Diabetes. Arch Intern Med. 2003;163:1440-1447

Huang, I-C., Wu, A.W. & Frangakis, C. (2006). Do the SF-36 and WHOQOL-BREF measure the same constructs? Evidence from the Taiwan population. Quality of Life Research,15, 15-24

Jette, A.M. & Branch, L.G. (1981). The Framingham disability study: II Physical diability among the aging. American journal of public health.71 (11): 1211-1216

Myers, A.H., Yong, Y., Langlois, J.A. (1996). Prevention of falls in the elderly. Bone 18:87–102

Shepherd, J.E. (2001). Effects of estrogen on cognition, mood, and degenerative brain diseases. J Am Pharm Assoc 41:221–228

Shepherd, R.J. (1986). Economic benefits of enhanced fitness. Chaimpaign , IL: Human Kinetics.

Smith, E.L. & Gilligan, C. (1981). Age: The interaction of nature and nurture. Exercise and aging: The scientific basis (p- 11-17)

Spirduso, W.W. (1986). Physical activity and prevention of premature aging. In. V.Seefeldt

(Ed.)Physical activity and wellbeing (pp.146-160). Reston,VA: AAHPERD.

Winter D.A., (1995). A.B.C. (Anatomy, Biomechanics and Control) of balance during standing and walking. Ontario: Waterloo Press.

Wolfson, L., Whipple, R., Derby, C.A., (1992). A dynamic posturography study of balance in healthy elderly, Neurology, 42 : 2069-2075