Published online: 16 July 2018

The Effects of Simple Home-Based Balance Training Program on Balance Performance And Quality of Life in Community Elderly

Ladawan Thammasat

Email: ladapn992@gmail.com

Master of Science (Anti-aging and Regenerative Science)

School Of Anti-Aging And Regenerative Medicine

Karnt Wongsuphasawat, B. Pharm., Ph. D

Email: karnt.won@mfu.ac.th

School Of Anti-Aging And Regenerative Medicine

Mae Fah Luang University

ABSTRACT

The objective of this study was to compare the effects of simple home-based balance training program on balance performance and quality of life in elderly. A total of 28 participants have 60 to75 years of age were randomly assigned to balance training (BT) group (n=14), and control (CT) group (n=14). Balance training program was designed to challenges balance consist 3 practice including marching in place, lean backward and sit to stand. Balance training program included performing moderate intensity, 3 days per week, with 30 to 45 minutes taken to complete 3 sets of 10 repetitions for 4 weeks. The balance measurement was Functional Reach test (FRT) and quality of life (QOL) measurement was The WHOQOL-BREF-THAI version. Balance performance and quality of life variables between at baseline and after 4th week were analyzed by paired t-test. Independent t-test was used to compare the variables among the group. Differences were considered to be significant at $p<0.05$ levels. The results found that at baseline and after 4th weeks, the improvement of balance performance was demonstrated by the increment of FRT in both BT and CT group ($p<0.001$). Moreover, BT group achieved significantly higher of distances change in FRT than CT group ($p<0.001$). For QOL, after 4th weeks the improvement of QOL scores in all 4 domains was demonstrated by the increment of each domain scores and total scores in both BT and CT group ($p<0.001$). However, the QOL scores change after training in BT group was significantly found only in a physical domain ($p<0.05$) from four domains while the other three domains, psychological, social relationships and environment were not found any statistically significant compared between BT group and CT group. Therefore, this study

indicated that the simple home-based exercise program used in the study has shown the successfully beneficial effect by improving balance performance and quality of life in the physical health of elderly. However, balance training in this study was recommended for the elderly to perform anywhere by themselves household.

Keywords: Simple Home-Based Exercise/Balance Performance/Quality of Life

INTRODUCTION

Falls are one of the major health problems among elder. The frequency of falls increases with aging that the risk factors for fall. Falls are costly and have potentially devastating physical, psychological, and social consequences. Falls and fall-related injuries can cause restricted mobility and functional decline leading to disability and may have a negative effect on the socioeconomic status and quality of life (QOL) in elderly individuals. (Alexander, 2010) The Survey of the older persons in Thailand according to that 10.2 percent of Thai men elders and 12.8 percent of Thai women elders had one or more fallen down during the past six months, the most common cause of last fall was slipped to a loss of balance control insides of the house.

Many studies that the relationship between balance control and age-related changes may be associated to the normal aging process degenerative in central nervous system (CNS) integration consisted of the sensory, neurological, and musculoskeletal systems (Horak, 2006) and these contribute to deterioration in balance performance seen in among older adults. Several studies suggested that difficulty in controlling balance is a major contributing lead to the risks of falls and sustaining fall-related injuries in the older adult. (Anne et al., 2009) The most critical component in physical activities among older adult is balance control that good balance living independently such as cooking, shopping, and traveling (Judge, Schechtman, & Cress, 1996; Lausawatchaikul, 1999; Assantachai, Praditsuwan, Chatthanawaree, Pisalsarakij, & Thamlikitkul, 2003)

However, balance training in some studies was not recommended for the elderly to perform by themselves at home. For these reasons, this study developed a clinical practice guideline for a simple home-based balancing training that is effective, safe, and acceptable to elderly people, and to perform anywhere, anytime in every household. Therefore, the aim of this

Mae Fah Luang University

study was to evaluate the effects of 4 weeks simple home-based balance training program on balance performance and quality of life in elderly by using simple daily activity living exercise.

Objective

To compare effects of the simple home-based balance training program on balance performance and quality of life in elderly.

Variables

1. Independent variable: Simple balance training.
2. Dependent variable: Balance performance, Quality of life.
3. Confounding factor: Medication, Physical activity, Exercise.

LITERATURE REVIEW

In Thailand, the Survey of the older persons in 2014 found the incidence of falls in the community elders varies from 10.2 percent in male and 12.8 percent in females who had one or more fallen down during the past six months. The main cause of falls included extrinsic factors, of which slipping was the most frequently reported and intrinsic factors, of which acute leg muscle weakness was found (Lausawatchaikul, 1999). There is also evidence that falls risk factor in the community elderly can be concluded intrinsic factors: (1) impairment of gait and balance (2) limitation in general physical function due to a combined effect of normal age-related changes and concurrent disease. Cognitive processing: With aging, the performances of tasks requiring central nervous system processing are slowed, with the particular slowing in information integration and in response preparation processes. This slowing of motor skills may be critical in maintaining balance, particularly in challenging situations (Horak et al., 1997)

The abundant researchers have shown that the positive effects of individualized short-term balance training among older adults aim to improve balance performance have been reported focusing on improving the organization of sensory information related postural control. (Han, Ricard & Fellingham, 2009; Lourembam, Khuman, Trivedi, Devanshi & Mital, 2014) Exercise programs have included training including such as endurance, muscle strength, mobility, flexibility and sensory training separately or combination or have concentrated or the only

Mae Fah Luang University

component of the balance control. Specifically targeted balance training programs have reported improvements in body sway and muscle response have been noted after 10-15 day training. (Anne, Baldwin, Polissar & Gruber, 1997)

The previous study reported exercise programs, aim to decrease the risk of falling by considering all contributing factors such as muscle strength, flexibility, and balance, have the potential to both decreases the risk of falling and improve the quality of life. Due to this interaction, the relationship between risk factors for falls and the quality of life becomes significant was used by WHOQOL-BREF (Lin et al., 2007). The research studied the superiority of home-based exercise training group over the other two interventions, educational group and home safety assessment and modification group among elderly who have recently fallen. Home-based exercise consists of stretching, muscle strengthening and balance training at progressive challenge difficulty, was individualized for each participant, supervised by the Physical therapist. It was presented significant improvement to physiological, psychological and environmental domains of quality of life questionnaire WHOQOL-BREF after two months. (Lin et al., 2007)

METHODOLOGY

Research Design

This study is the randomized controlled trial between 2 groups : balance training group and control group.

Measurement

1. Questionnaires data:

Age, body height, weight, prescribed medications, marital status, education, and ethnicity, history of falls, physical activity level, and a number of exercises.

2. Thai –MMSE 2002

Use test of cognitive function at baseline among the elderly; it includes Orientation for time (5 point), Orientation for place (5 point), Registration (3 point), Attention/Calculation (5 point), Recall (3 point), Naming (2 point), Repetition (1 point), Verbal command (3 point), Written command (1 point), Writing (1 point), Visuoconstruction (1 point).

Mae Fah Luang University

3. WHOQOL-BREF-THAI

The WHOQOL-BREF-THAI is the Thai version of a brief form (WHOQOL-BREF) of a generic and transcultural QOL assessment instrument developed by WHO (WHOQOL-100). It is a 26-item scale with 5- point responses, having 4 domains measuring physical health, psychological well-being, social relationships and satisfaction with the environment.

4. Functional Reach Test (FRT)

The Functional Reach Test was first developed by Pamela Duncan and colleagues in 1990. It is an easy quick and simple, single-task dynamic test that defines functional reach as "the maximal distance one can reach forward beyond arm's length while maintaining a fixed base of support in the standing position".

Intervention

The simple home-based balance training program of this study incorporated the physiological principle of overload and specificity and was constructed according to the American College of Sports Medicine (Garber, et al. 2011) and other researchers. The intervention that should be progressed to increase the challenge to balance. Methods to increase the intensity and effectiveness of balance challenging exercises overtime consist of 3 practicing exercise including a) using progressively postures with a gradual reduction of base of support (Marching in place) b) using movements that perturb the center of gravity (Lean backward) c) specific resistance training for postural muscle groups (unsupported sit to stand practice). The participant could perform moderate intensity, 3 sets of 10 repetitions at 60 to 70% 1RM for each individual exercise with good quality (e.g. full range of motion) before fatigue, rest between sets 1-2 min, at a target exertion rate of 12-14 on the 6-20 point Borg scale, 3 times per week for 4 weeks at home visit as described in Table1. Each session starting with 10-minute warming-up and ended with 10-minute cooling-down stretching.

The training program will be demonstrated and supervised by the physical therapist to certify correct technique is used and the risk of falling is minimized. For safety, the participants were asked to wear a safety belt during training exercise all the time. In order to monitor the level of activity and to prevent participants, the exhaustion of participant during exercise was detected by the rating of perceived exertion (RPE) by the Borg scale was noticed approximately interval

Mae Fah Luang University

sets during training at a target exertion rate of 12-14 on the 6-20 point Borg scale. The participants will perform the exercise next to a chair or to the wall, for immediate support in the event of loss of balance or if the participant feels unsafe, however, the use of upper limb support will be minimized when it is safe to do so to maximize the challenge to balance.

Data Collection

Subjects from the community who live in Pathumthani were recruited to the study. Subjects who volunteers were interviewed for inclusion and exclusion criteria. All procedures were explained to participant then they were asked to sign a consent form. Then, subjects were randomly divided into two groups as balance training and control group. Before enrolling the program, demographics, cognition, balance performance and mobility were assessed by the physical therapist. All Subjects were responded orally to a questionnaire regarding their health characteristics, includes age, body height, weight, heart rate in resting, blood pressure prescribed medications, marital status, education, ethnicity, history of falls, physical activity level, and the number of exercises. Moreover, the participants were asked about the history of falls that occurred during the six months and answered the question of Physical Activity Readiness Questionnaire PAR-Q (Appendix H) before enrollment. After baseline assessment, the participants in both groups were received health education. The participants in a balance training group received the designed group exercise program for balance training of this study whereas the control group received the upper limb exercise with the ball under the supervision of a physical therapist described as Table 3.1 and 3.2.

In this study, the balance measurement was Functional Reach test (FRT). The Quality of life (QOL) was The WHOQOL-BREF-THAI version. For the FRT, subjects were asked to stand in comfort to make a grasping hand, and raise their arm until it was planned in parallel to the yardstick. Subjects were instructed “Reach as far forward as you can without taking a step” The position of the end of the third Metacarpal was recorded. Each subject was given 3 trials; one for practice and others were results as the mean value for statistical analysis. For The WHOQOL-BREF-THAI version was evaluated using the questionnaire displayed in scale from 26 to 130, where 26 point means the worst quality of life and 130 point corresponds to the best quality of life.

Mae Fah Luang University

Data Analysis

After 4 weeks, participants were reassessed on baseline measures. All data were analyzed by a statistic computer and analysis program. Descriptive statistics and baseline measures were generated for participants who completed the intervention.

All data outcomes of this study were analyzed in the following sequences:

The normal distribution of variables was determined by Kolmogorov-Smirnov test.

The differences in the scores of balance and quality of life variables were compared, before and after the intervention in each group.

For variables with normal distribution, a paired t-test and for variables other than those, a Wilcoxon test was used.

To compare quantitative variables between the two groups, Independent t-test, and Mann-Whitney U test was used for normal and non-normal distribution variables.

Differences p-value ≤ 0.05 were considered to be statistically significant.

RESULT

Characteristics of this Study

Table 1 Comparison of the characteristic of elderly in balance training (BT) and control groups (CT) at baseline

Characteristics	Balance training group (n=14)	Control group (n=14)
Gender		
Male	2	3
Female	12	11
Age (years)		
Mean ± SD.	68.14±4.90	67.50±5.27
Min-Max	60-74	60-75
Height (Meters)		
Mean ± SD.	1.58±0.97	1.56±0.09
Min-Max	1.45-1.8	1.45-1.78

Mae Fah Luang University

Table 1 (Continued)

Characteristics	Balance training group (n=14)	Control group (n=14)
Weight (Kilograms)		
Mean ± SD.	56.79±6.14	61.71±8.89
Min-Max	50-70	48-73
BMI (kg/m^2)		
Mean ± SD.	22.67±3.03	25.29±2.76
Min-Max	19.49-30.92	20.20-29.78
MMSE (scores)		
Mean ± SD.	23.36±1.44	22.36±1.73
Min-Max	21-26	20-26

The independent t-test was to compare the percentage of gender and mean of age, height, weight, BMI, and MMSE in BT group and CT group at baseline. There was no a significant difference in each of these characteristics.

Balance Performance

Table 2 Comparison of distances changes to reach of balance performance within the group between at baseline and after the end of 4^{th} week

Functional Reach Test (cm)	At baseline		After 4^{th} week		df	t	p-value
	Mean	S.D	Mean	S.D			
Balance training group (n=14)	14.06	4.31	19.42	4.42	13	18.744	<0.001
Control group (n=14)	15.14	5.80	18.43	6.11	13	11.880	<0.001

Note. p-value from Paired t-test, * significant at the 0.05 level

The results of baseline and after 4 weeks in both BT group and CT group were demonstrated in table 2. That showed the mean of balance performance, participant in BT group had increased from 14.06 to 19.42 cm. The mean difference was statistically significant at 0.001

Mae Fah Luang University

levels. While the mean of balance performance in CT group had increased from 15.14 to18.43 cm. The mean difference was statistically significant at 0.001 levels.

Table3 Comparison difference distances changes to reach of balance performance between Balance training group (n=14) and Control group (n=14)

Functional Reach Test (cm)	Mean	S.D.	df	t	p-value
Balance training group	5.36	1.07	26	0.477	<0.001
Control group	3.29	1.04			

Note. Difference scores = post – pre**,** p-value from Independent t-test, * Significant at the 0.05 level

At baseline and after the 4-week training program, the results were demonstrated in table 3. That showed the mean of difference distances changes to reach, the participant in BT group had 5.36 cm. and in CT group had 3.29 cm. The mean difference was statistically significant at 0.001 levels when compared between groups

Quality of life

Table 4 Comparison of quality of life scores between at baseline and after the end of 4th weeks within and between among BT group (n=14) and CT group (n=14)

Quality of life (WHOQOL-26) (scores)	At baseline		After 4th week		d	Sd	df	t	p-value
	Mean	S.D	Mean	S.D					
Physical									
Balance training group	20.29	2.64	24.86	1.56	4.57	2.21	13	7.744	0.001
Control group	22.00	1.96	24.64	1.55	2.64	1.08	13	9.141	0.001
p-value	**0.062**		**0.718**		**0.007**				
Psychological									
Balance training group	17.93	1.73	20.21	1.67	2.29	1.94	13	4.412	0.001
Control group	16.79	2.12	19.86	1.88	3.07	2.46	13	4.664	0.001
p-value	**0.130**		**0.599**		**0.357**				

Mae Fah Luang University

Table 4 (continued)

Quality of life (WHOQOL-26) (scores)	At baseline		After 4th week		d	Sd	df	t	p-value
	Mean	S.D	Mean	S.D					
Social relationships									
Balance training group	8.21	1.58	10.64	1.28	2.43	1.60	13	5.667	0.001
Control group	8.57	1.83	11.14	1.29	2.57	1.45	13	6.624	0.001
p-value	**0.585**		**0.313**		**0.807**				
Environment									
Balance training group	22.14	3.01	25.29	2.95	3.14	1.79	13	6.565	0.001
Control group	19.93	3.25	24.36	4.24	4.43	2.53	13	6.541	0.001
p-value	**0.072**		**0.507**		**0.133**				
Total									
Balance training group	**74.93**	**6.97**	**87.00**	**6.10**	**12.07**	**3.83**	**13**	**11.786**	**0.001**
Control group	**72.79**	**6.87**	**85.36**	**6.58**	**12.57**	**2.82**	**13**	**16.676**	**0.001**
p-value	**0.420**		**0.499**		**0.697**				

Note. p-value from Paired t-test, * significant at the 0.05 level

The results of quality of life at baseline and after 4 weeks in both BT group and CT group were demonstrated in table 3. That showed in BT group, the mean of physical domain scores had increased from 20.29 to 24.86 scores. The mean of psychological domain scores had increased from 17.93 to 20.21 scores. The mean of social relationships domain scores had increased from 8.21 to 10.64 scores. The mean of environment domain scores had increased from 22.14 to 25.29 scores. The mean of total scores had increased from 74.93 to 87.00 scores. The BT group showed a significant increase in all domain of QOL scores and total QOL scores after 4-week training compared to baseline ($p<0.001$).

While in CT group, the mean of physical domain scores had increased from 22.00 to 24.64 scores. The mean of psychological domain scores had increased from 16.79 to 19.86 scores. The mean of social relationships domain scores had increased from 8.57 to 11.14 scores. The mean of environment domain scores had increased from 19.93 to 24.36 scores. The mean of total scores had increased from 72.79 to 85.36 scores. The CT group showed a significant increase in all domain

Mae Fah Luang University

of QOL scores and total QOL scores after 4-week training compared to baseline ($p<0.001$) as presented in Table 3.

At baseline and after the 4-week training program, the results were demonstrated in table 4.5 and figure 4.4. That showed the mean of difference quality of life scores changes each domain. The difference quality of life scores after training of BT group was significantly found only in a physical domain ($p<0.05$) from 4 domains of WHOQOL-BREF THAI while the other three domains, psychological, social relationships and environment, were not found any statistically significant compared between BT group and CT group.

DISCUSSION AND CONCLUSION

These improvements are consistent with previous studies that have shown benefits from the simple home-based balance training. (Thiamwong, & Suwanno, 2014; Nithiwat et al.2015; Mesquita et al, 2015) The findings of this study supported conducted by Nithiwat et al. (2015) which study effects of simple home-based balance training within 4 weeks that training group significantly higher of percent change in the balance ability than subject in control group and indicated that the designed balance training program used in their study has shown effects on improving balance ability for the elderly. They explained that training program provided to improve proprioceptive neuromuscular facilitation in elderly.

In a similar study, Sinaei, Kamali1, Nematollahi, & Etminan (2016) who study effects of balance training can improve balance performance and quality of life in elderly within 4 weeks. They reported that improvements in physical function resulting from balance training might stimulate individuals to involved in physical health or social participation and improve quality of life. It can be concluded that balance training could improve the balance by increasing the flexibility and the joints' range of motions in the lower extremities of the subjects in physical function.

The present study, a simple home-based balance training program to obtain benefits from balance exercises should challenge hip-ankle strategies balance reactions by reduction of the base of support, using movements that perturb the center of gravity involved, performed without upper limb support. Improving balance may have associated for improve balance function and physical activity for elderly. (Pernambuco et al., 2012; Karóczi et al., 2014; Sherrington et al., 2008)

Mae Fah Luang University

These physical changes may also be associated with increased quality of life scores in the physical domain which shown in this study. Therefore, this study indicated that the simple home-based exercise program used in the study has shown the successfully beneficial effect by improving balance performance to reduce risks of falls and increase the quality of life in the physical health of elderly within 4th week.

The suggestion for further study. The further study may be studying different sample size, the result was different also. Additionally, the confounding factor of the participant in this study such as the emotions, activities of daily living, social or other factors that if they were enabled to control confounding factor effectively, it would make the study becomes more effective. Further studies are needed to identify optimal duration, frequency, and intensity of balance training.

REFERENCE

Alexander, A. B. (2010). *Functional status, postural stability and falls among older adults with glaucoma*. Institute of Health and Biomedical Innovation. Ph.D. thesis, Queensland University of Technology.

Anne, S., Baldwin, M., Polissar, N. L., & Gruber, W. (1997). Predicting the probability for falls in community-dwelling older adults. Physical Therapy, 77(8), 812-819

Anne, S., Ciol, M. A., Hoffman, J., Dudgeon. B. J., Yorkston, K., & Chan, L. (2009). Falls in the Medicare population: Incidence, associated factors, and impact on health care. Phys Ther, 89(4), 324-332

Assantachai, P., Praditsuwan, R., Chatthanawaree, W., Pisalsarakij, D., & Thamlikitkul, V. (2003). Risk factors for falls in the Thai elderly in an urban community. J Med Assoc Thai., 86(2), 124-130.

Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee I, M., Nieman, D. C., Swain, D. P., & American College of Sports Medicine. (2011). American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. Med Sci Sports Exerc, 43(7), 1334-1359

Mae Fah Luang University

Han, K., Ricard, M. D., & Fellingham, G. W. (2009). Effects of a 4-week exercise program on balance using elastic tubing as a perturbation force for individuals with a history of ankle sprains. J Orthop Sports Phys The, 39(4), 246-255.

Horak, F. B., Henry, S. M., & Shumway-Cook, A. (1997). Postural perturbations: New insights for the treatment of balance disorders. Phys Ther, 77(5), 517-533.

Horak, F. B. (2006). Postural orientation and equilibrium: what do we need to know about neural control of balance to prevent falls?. Age Ageing, 35(Suppl 2), ii7-ii11.

Judge, J. O., Schechtman, K. & Cress, E. (1996).The relationship between physical performance measures and independence in instrumental activities of daily living.The FICSIT Group. Frailty and Injury: Cooperative Studies of Intervention Trials. J Am Geriatr Soc, 4(11), 1332-1341

Karóczi, C. K., Mèszáros, L., Jakab, A., Korpos, A., Kovác1, E., & Gondos, T. (2014). The effects of functional balance training on balance, functional mobility, muscle strength, aerobic endurance and quality of life among community-living elderly people: a controlled pilot study. New Medicine, 1, 33-38.

Lausawatchaikul, P. (1999). Related factors and outcomes of falls in the elderly. thesis. Bangkok: Mahidol University Thailand.

Lin, M. R., Wolf, S. L., Hwang, H. F., Gong, S. Y., & Chen, C. Y. (2007). A randomized, controlled trial of fall prevention programs and quality of life in older fallers. Am Geriatr Soc, 55(4), 499-506.

Lourembam, S, Khuman, P, R., Trivedi, P., Devanshi, B., & Mital, V. (2014). Pilates versus conventional balance training on functional balance and quality of life in elderly individuals: A Randomized controlled study. Scholars Journal of Applied Medical Sciences (SJAMS), 2(1B), 221-226.

Mesquita, L. S. de A., de Carvalho, F. T., Freire, L. S. de A., Neto, O. P., & Zângaro, R. A. (2015). Effects of two exercise protocols on postural balance of elderly women: a randomized controlled trial. BMC Geriatrics, 15, 61

Nithiwat Keeratithaworn, Korakod Panich, Amornpan Ajjimaporn, & Vilai Kuptniratsaikul. (2015). Effect of 4-week simple balance exercise on balance ability in the elderly. Journal of sports science and technology, 15(1), 203-211.

Mae Fah Luang University

Thiamwong, L. & Suwanno, J. (2014). Effects of Simple Balance Training on Balance Performance and Fear of Falling in Rural Older Adults. International Journal of Gerontology, 8(3), 143-146

Sinaei, E., Kamali1, F., Nematollahi, A., & Etminan, Z. (2016). Comparing the effects of balance training with and without cognitive tasks on the quality of life and balance performance in community-dwelling older adults: A single-blind randomized clinical trial. Journal of Rehabilitation Sciences and Research, 4(2016), 91-96

Sherrington, C., Whitney, J. C., Lord, S. R., Herbert, R. D., Cumming, R. G., & Close, J. C. (2008) Effective exercise for the prevention of falls: a systematic review and meta-analysis. J Am Geriatr Soc, 56(12), 2234-2243

Mae Fah Luang University