



Effectiveness of *Lafiska* exercise on risk of fall, balance, and health status in the elderly

Dwi Nurviyandari Kusuma Wati, Junaiti Sahar and Etty Rekawati

Community Nursing Department, Faculty of Nursing, Universitas Indonesia, Indonesia, Jakarta

KEYWORDS

Balance status;
Health status;
Lafiska;
Older adults;
Risk of fall

Abstract

This study aims to investigate the effectiveness of *Latihan Fisik Lansia* "elderly physical exercise" on the balance status, risk of fall, and health status of institutionalized older adults. A quasi-experimental design was applied measuring pre-test and post-test outcomes in a control group to determine the effectiveness of the intervention in the interventional group. Eighty participants from Panti Sosial Tresna Werdha Budi Mulia 1 Cipayung were divided into an interventional group with 39 older adults (70.3 ± 8.13 years) and a control group with 41 older adults (69.88 ± 8.71 years). Trained facilitators guided the exercise during 16 sessions over eight weeks, each having duration of 50 min, with a small group consisting of 10-12 participants. This study used Morse Fall Scale to measure risk of fall, Berg Balance Scale to measure balance status, and SF-12 to measure health status. *Lafiska* had an impact on lowering risk of fall, enhancing balance status, and enhancing health status (P value $< .0001$). *Lafiska* is a viable exercise option for older adults with independent mobility, as well as older adults with assistive devices.

© 2018 Elsevier España, S.L.U. Todos los derechos reservados.

Background

The aging process causes anatomical and physiological degeneration in the human body. The degeneration of sensory, neuron, cognitive, and musculoskeletal systems, as well as physical illness, impact the risk of fall in older adults (Ebersole et al, 2005). Numerous studies have identified risk factors for falls experienced by older adults, including but not limited to dementia, depression, gait and balance disturbances, age, sex, medications, incontinence, and unsafe environments (Wood et al, 2002; Fortinsky et al, 2004; Oliver et al, 2004; Chen et al, 2005; Miceli, 2005; Kose et al, 2005; Staples, 2006). These risk factors are classified into two categories: internal and external factors. Morse (2009)

found that external factors, such as slipping on wet floors, contribute to 14% of all causes of fall incidence, while 78% of the main causes of falling incidence are related to balance. The cause of falling in older adults can thus be determined by risk factors deriving from within older adults themselves; the more such risk factors exist, the higher the risk of a fall occurring.

The act of falling does not often cause severe injury, but it can sometimes cause fractures and even death among elderly (Wati, 2008). The highest amount of falling incidence in older adults is found among those in long-term care, this can add financial costs to curative measures if residents who fall need to be admitted to the hospital (Rubenstein and Josephson, 2006). In 2010, the US Centers for

*Corresponding author.

Email: dwi.nurviyandari@ui.ac.id (D.N.K. Wati)

Disease Control and Prevention reported that 2.3 million older adults in this country experienced injury, and 662,000 among these need to be hospitalized, costing around 30 billion US dollars. Fall prevention programs for older adults living in institutionalized care are an essential and important issue that must be addressed by care providers.

Physical exercise is part of physical activity should be especially scheduled, consisted of structured movements and performed repeatedly to ensure physical wellness (National Institute on Aging, 2010). Physical exercise has been proven effective in enhancing flexibility, muscle strength, balance, and the ability to walk, which actually provides fall prevention for older adults (Lugade, 2011; Krampe, 2010; Iwamoto et al, 2009). Some physical exercises that might be needed for older adults are range of motion exercises, muscle strength exercises, aerobics, swimming, jogging, and any other breathing exercises, such as tai chi. Shubert (2011) called balance exercise a form of intervention that is designed to enhance individuals' balance status. Balance exercise combines both muscle strength and balance. Such exercise is indicated for older adults with lower extremity weaknesses and lowered balance status, as well as those who walk with slow motions.

Group physical exercise enhances not only muscle strength but also health status in older adults. Exercises performed within a group are considered the intervention most appropriate for older adults living in long term care facilities because they can also lower social isolation that might occur due to the long-term effect living in an institution (Molinari, 2002).

Panti Sosial Tresna Werdha (PSTW) Budi Mulia 1 is an elderly care institution that is managed under the provincial government of DKI Jakarta. Currently, there are five PSTW located in DKI Jakarta that accommodates around 1000 abandoned older adults (neglect by their family, neighborhood and did not have any income). PSTW Budi Mulia 1 is located in two different locations: the first is in Cipayung and accommodates 250 residents; the other is in Ciracas and accommodates around 200 residents. A survey from Ediawati (2012) found that 74.1% of residents in PSTW Budi Mulia 1 were at risk of falling. PSTW Budi Mulia 1 is a practice field for nursing students and from an assessment conducted by the students; the risk of fall is the main problem at the facility. The risk factors for this problem include decreased cognitive function, decreased balance status, gait disturbance, and decreased sensory function, as well as unsafe environments such as slippery bathrooms, steps, the unavailability of handrails, and wet floors. Physical exercise conducted at PSTW is aerobic gymnastics performed once a week by the resident and PSTW staff. This type of exercise doesn't match with the residents need and condition that have functional limitation. Most of resident who comes to the exercise can not perform the exercise as well.

Older adults need special physical exercise in accordance with their condition and capability. The type of physical exercise that might be appropriate in general includes four categories: endurance, strength, balance, and flexibility (National Institute on Aging, 2009). Such exercise needs to be performed routinely, under the supervision of trained facilitators, and in smaller groups as a means to restore residents' muscle strength, balance status, and health status.

This study focuses on the development of interventional physical exercise for older adults, which be performed not only by healthy older adults but also by older adults with limited mobility or those who use walking aids or assistance devices. The exercise incorporates range of motion exercises, muscle exercises, balance exercises, breathing exercises, and games within the exercise sequence. The exercise will be thoroughly evaluated based on the significance of its impact on risk of fall, balance status, and health status among residents living in an institutionalized care center.

Method

Research design

This manuscript is a part of interventional study of physical exercise for older adults in Panti Sosial Tresna Werdha Budi Mulia 1 DKI Jakarta. The design of this study was a quasi-experiment with a pre-test and post-test using a control group. Ninety-two participants were eligible to participate. They were divided into two intervention groups. In the last post-test, 12 participants were ineligible due to hospitalizations, not being willing to continue, and being deceased (Figure 1).

Research instruments

The instruments used within this study consist of the Morse Fall Scale (MFS), Berg Balance Scale (BBS), and a 12-question short-form health survey (SF-12). The instruments are official and common instruments often used in research both in Indonesia and abroad. MFS is a simple and fast method commonly used to determine the possibility of fall incidence among older adults; most nurses (82.9%) were able to score the scale quickly without confronting any obstacles, and 54% of them estimated 3 min as the common time needed to assess patients (Morse, 2009). The scale consisted of six variables that were easy and quick to use. MFS is used globally in maintaining acute care, both in hospitals and for longer-term care for patients admitted as inpatients. BBS is a scale consisting of 14 observational items used to judge the balance status of

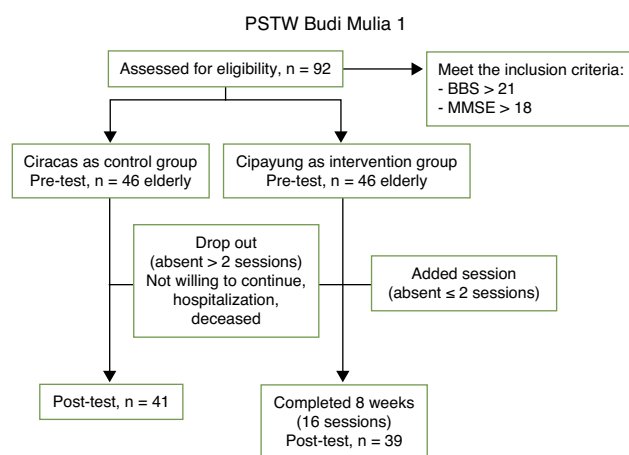


Figure 1 Flowchart of participants through the study. BBS, Berg Balance Scale; MMSE, Mini-Mental State Examination; PSTW, Panti Sosial Tresna Werdha.

the elderly (Blum and Korner-Bitensky, 2008; Health Care Association of New Jersey, 2012). Each observational item has five ordinally scored items on a scale of 0 to 4 (Datta et al, 2009). A score of 0 means inability while a score of 4 means independent. Thus, the lowest total score is 0 and the highest is 56. The measurement of health status was done using a 12-question short-form health survey (SF-12). This is the short form of the SF-36 instrument, which is used to measure both the physical and mental condition of older adults (Lam et al, 2005). The instrument consists of 12 questions, six about physical health and six about mental health. The determination of the score within SF-12 is measured on a scale of 0-100 for each question. A score of 0 means low health status, while a score of 100 means high health status.

Interventional study procedure

Table 1 explains the movements of the *Lafiska* interventions. The exercise was performed for 16 sessions for eight weeks, for duration of 50 min in each session. Older adults were divided into four groups consisting of 10-12 participants guided by two trained facilitators. The facilitators were obliged to conduct early assessments before deciding whether participants were able to participate in the exercise, and they led the whole exercise. *Lafiska* was conducted in a hall to maximize the focus of the participants.

Ethical clearance

Ethical license for the study was obtained from Faculty of Nursing UI's Ethic Committee in March 2015. Permission for the execution of the study at PSTW Budi Mulia 1 Jakarta was also officially obtained from the provincial government of

DKI Jakarta. The study funding was fully obtained from the Faculty of Nursing UI's 2015 Reset Madhya grant. There was no possibility of physical or mental harm to participants; all participants received a proper explanation of the study and signed consent forms to become study participants.

Participants in the interventional group were allowed by the PSTW clinic's physician to participate in *Lafiska*. The control group was taught how to perform *Lafiska* after the interventional group completed the whole intervention.

Statistical analysis

The data were analyzed using SPSS version 17. Due to the data of the study unnormally distributed, the data were analyzed using a nonparametric Man-Whitney U Test. The dependent variables of the study were balance status, risk of fall, and health status. The characteristics of the study consisted of the participants' age, history of fall, and cognitive status, which was measured using the Mini-Mental State Examination.

Results

The new findings identified from this study were that *Lafiska* could be conducted with older adults using assistive devices, such as canes, crutches, and walkers. The characteristic of participants can be identified in Table 2. The mean age of participants in the interventional group was 70.3, while the mean age of those in the control group was 69.88, which falls within the definition of elderly; the maximum age of participants was 94. This indicates that residents participating this study not only fell within the same age range but also were

Table 1. *Latihan Fisik Lansia (Lafiska)*

Types of exercise	Details of movements	Equipment
Range of motion exercise (15 min)	Head movement: side to right, left Shoulder and arm movement: arm, elbow Shoulder and arm movement: upper shoulder, lower shoulder Back movement: Sitting down while taking a bow Shoulder and waist movement: sitting while rotating shoulder Feet movement: walking on the spot	A chair with a backrest
Balance exercise (10 min)	Standing on one foot Balancing stick Walking from heel to toes Walking exercise	A chair with backrest, block (20 cm × 10 cm × 5cm), a 1-m straight stick
Muscle strength exercise (10 min)	Upper arm Lower arm Upper thigh Lower feet	One-kilogram dumbbell, a chair with a backrest
Games session* (10 min)	Throwing and catching a ball Kicking a ball into goalpost Kicking a ball towards bottles of mineral water Throwing a ball into the basket	A chair with backrest, ball, basket, bottles of mineral water
Deep breathing (5 min)	Pursed lip breathing while spreading both arms	A chair with backrest
*Choose 1 game per session.		

Table 2 Participant characteristics

Variable	Measurements ^a	
	Intervention group (n = 39)	Control group (n = 41)
Age (years) ^a	70.3 (8.13)	69.88 (8.71)
Sex (% men)	51.5	58.5
Experience with falls (% yes)	15.2	12
Cognitive status ^b	25.37 (2.37)	26.91 (2.38)

^a Unless otherwise indicated measurements are presented as mean (standard deviation).
^b Measured using Mini-Mental State Examination.

normally distributed. The mean age of participants in other study in the community was lower; this occurred because older adults conducting activities outside their houses were for the most part not physically compromised.

The number of male participants was higher than the number of female participants (interventional group = 51.5%; control group = 58.5%). There are more female residents, yet the numbers were not in line with cognitive abilities and level of independence; thus, many female residents did not meet the criteria to take part in the study.

Data on the risk of falls was obtained from the pre-test and post-test by using the first item measured in MFS. The interventional group had a higher frequency of falling incidence (15.2%) compared with the control group (12%). During the interventional session, a fall occurred within the interventional group, yet the participant was not physically harmed, suffered no injury and was able to continue to participate. The mean cognitive status of participants was within an acceptable range for good cognitive ability, although some participants had the minimum score of 21, meaning that they were within the range of mild cognitive impairment. Cognitive status of residents living in PSTW Budi Mulia 1 tends to low scores due to the educational background of the residents and their inability to read and write.

The data analysis mentioned above indicated that all participants had good mobility, even though some used walking aids. It also indicated that no participant had a BBS score below 21. The *Lafiska* intervention required participants whose mobility was not compromised. The mean balance score of the interventional group was lower (48.13) compared with the mean balance score of the control group

(49.46). After *Lafiska* was executed, the mean balance score of interventional group (53.44) was higher compared with that of the control group (50.88).

Morse Fall Scale has score range of 0-105. A score of 0 indicates no risk of fall, while a score of 105 indicates a high risk of fall. The mean score for risk of fall within the control group indicated that no change occurred (32.8) between the pre-test and the post-test. On the other hand, in the interventional group, the risk of fall score changed. The score, which initially was classified as medium risk of fall (mean = 30.87) reduced to no risk of fall (mean = 12.95).

The health status of participants in the control group was higher (38.34) compared with the interventional group (37.47) before the intervention was given. However, after the intervention, the mean score of the health status of the interventional group was heightened and higher (51.51) compared with the mean health status of the control group (39.54). Table 3 explains the mean, median, standard deviation, and minimum-maximum score of the dependent variables of the study.

The outcome of the analysis above shows that the *Lafiska* intervention had a significant impact on all three dependent variables: balance status, risk of fall, and health status ($P < .05$), while the control group experienced no significant change in the same dependent variables ($P > .05$).

Discussion

Participants in the study were of an age near national life expectancy. Life expectancy in Indonesia from 2010-2015

Table 3 Quantitative outcome measures

Test	Interventional group (n = 39)				Control group (n = 41)			
	Pre-test ^a	Post-test ^a	MD	P value ^b	Pre-test ^a	Post-test ^a	MD	P value ^b
Balance status	48.13 (5.65)	53.44 (3.761)	-5.31	< .0001*	49.46 (5.72)	50.88 (5.33)	-1.42	.299
Risk of fall	30.87 (32.8)	12.95 (13.75)	17.92	< .0001*	32.8 (20.68)	32.8 (17.25)	0.00	.95
Health status	37.47 (3.65)	51.51 (3.49)	-14.04	< .0001*	38.34 (3.77)	39.54 (3.49)	-1.2	.116

MD, mean difference.
^a Measurement presented as mean (standard deviation).
^b Significant P value > .05;

was 70.1 years old (BPS, 2013). This indicates that the residents living in institutionalized care have the same characteristic as most other older adults in the country. Numerous social and health facilities are provided by PSTW to enhance residents' life expectancy, which is one of the indicators of national health status.

There were more male participants in both the control group and the interventional group. From investigators' observations, the number of female residents living in PSTW is actually higher than the number of male residents. However, males and females do not have equal health conditions, mobilization ability, and fine cognitive ability.

Exercise for older adults has been recognized to be beneficial for enhancing their physical and psychological health. This is the very first time *Lafiska* has been investigated and directly implemented with residents living in institutionalized care as an interventional method for overcoming risk of fall. Numerous risk factors have been identified in previous studies, which show that gait and balance contribute to 17% of the risk of fall (Ambrose et al, 2013).

Strategies to lower the risk of fall in older adults include multiple factors, as established by the aforementioned risks factors found in previous studies. The development of any kind of exercise to lower the risk of fall and improve the balance status of older adults has been investigated many times. Recommended exercises include tai chi, computer balance training, chair training, progressive strength and balance training, seated stepping exercise, steady state walking, dance therapy, treadmill training, whole-body vibration and balance exercise for older adults (Pollock et al, 2012; Kiik, 2015; Shema et al, 2014; Krampe, 2010; Gobbo, 2013; Taguchi, 2009).

Lafiska was developed by the investigators through a literature review, field observations, and discussion with nurses actually providing physical exercise to residents. Physical exercise can not only enhance someone's physical condition, but also to have a positive impact on their psychological well being. The result of this study has shown that *Lafiska*, which consists of muscle strength exercises, range of motion exercises, balance exercises, breathing exercises, and game sessions, significantly enhanced balance and health status while lowering the risk of fall among residents living in PSTW di DKI Jakarta.

Physical exercise for older adults should consist of endurance strength, balance, and flexibility (National Institute on Aging, 2010). *Lafiska* has incorporated these four aspects. Moreover, this exercise is designed to be performed with residents using mobilization tools.

This study is in line with the previous study conducted by Pollock et al (2012), which also conducted muscle strength and balance exercises, together with whole-body vibration therapy, with 38 residents for 24 sessions of 60 min each within eight weeks. The results of the Pollock et al (2012) study indicated that participants' balance status was enhanced, the danger of fall was lowered, and health status as reflected by the SF-12 was also enhanced (significant $P < .005$.) After 1 h of balance and muscle strength exercise, the exercise also provided vibrations to both feet for another 5 min.

Lafiska showed a significant positive impact on enhancing balance status, lowering risk of fall, and enhancing the health status of participants. The participants were thrilled to take part in each session, and the more independent the

residents became, the more positive the reflected outcome. The participants stated that every time they finished doing exercises, they were able sleep well and to move their feet without experiencing an aching sensation, as well as to walk more firmly.

Conclusions

Lafiska is a type of exercise that can be performed by older adults with independent mobility, as well as older adults using mobility tools. This exercise is performed among a group consisting of 10-12 older adults guided by trained facilitators. *Lafiska* was found to lower risk of fall, enhance balance, and enhance the health status of older adults.

Acknowledgment

Our greatest gratitude is for the Faculty of Nursing Universitas Indonesia as the main sponsor of the Reset Madhya 2015. We also have enormous appreciation for the head and all the staff of PSTW Budi Mulia 1. Thank you to Fitria Kusuma Dewi, Umami Malik Balqis, Achmad Reza Mardian, and Amye Dedio Hutagalung for your helpful cooperation, teamwork, and support during the process of this research.

References

- Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: A review of the literature. *Maturitas*. 2013;75:51-61.
- Anderson ET, McFarlane J. Community as partner theory and practice in nursing. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2011.
- BAPPENAS. BPS: Proyeksi Penduduk Indonesia 2010-2035; 2011[update 2011 January 23, cited 2014 January 23]. Available at: http://www.bappenas.go.id/files/5413/9148/4109/Proyeksi_Penduduk_Indonesia_2010-2035.pdf.
- Blum L, Korner-Bitensky N. Usefulness of the Berg Balance Scale in stroke rehabilitation: a systematic review. *Phys Ther*. 2008;88: 559-66.
- Center for Disease Control and Prevention. A CDC compendium of effective fall intervention. Atlanta: National Center for Injury Prevention and Control; 2010.
- Center for Disease Control and Prevention. Preventing falls: How to develop community-based fall prevention programs for older adults. Atlanta: National Center for Injury Prevention and Control; 2008.
- Chen JS, March LM, Schwarz J, Zochling J, Makaroff J, Sitoh YY, et al. A multivariate regression model predicted falls in residents living in intermediate hostel care. *J Clin Epidemiol*. 2005;58:503-8.
- Datta S, Lorenz DJ, Morrison S, Ardolino E, Harkema SJ. A multivariate examination of temporal changes in Berg Balance Scale items for patients with Asia Impairment Scale C and D spinal cord injuries. *Arch Phys Med Rehabil*. 2009;90:1208-17.
- Ebersole P, Hess P, Touhy T, Jett K. Gerontological nursing & health aging. 2nd ed. St. Louis: Mosby; 2005.
- Eidiawati E. Descriptive study of the independent level and risk for fall of the residents of PSTW in Jakarta [unpublished Bachelor's Thesis]. Universitas Indonesia; 2012.
- Fortinsky RH, Iannuzzi-Sucich M, Baker DI, Gottschalk M, King MB, Brown CJ, et al. Fall-risk assessment and management in clinical practice: Views from healthcare providers. *J Am Geriatr Soc*. 2004;52:1522-6.

- Iwamoto J, Suzuki H, Tanaka H, Kumakubo T, Hirabayashi H, Miyazaki Y, et al. Preventative effect of exercise against falls in the elderly: a randomized controlled trial. *Osteoporos Int.* 2009;20:1233-40.
- Karamanidis K, Oberländer KD, Niehoff A, Epro G, Brüggemann GP. Effect of exercise-induced enhancement of the leg-extensor muscle tendon unit capacity on ambulatory mechanics and knee osteoarthritis markers in the elderly. *PLoS One.* 2014;9: e99330.
- Kiik SM. Pengaruh latihan keseimbangan (LKS) lansia terhadap keseimbangan tubuh, risiko jatuh, status kesehatan dan kualitas hidup lansia di kota Depok [unpublished Master Thesis]. Universitas Indonesia; 2015.
- Kobayashi N, Kusuma Wati DN, Yamamoto M, Sugiyama T, Sugai Y. Severity of dementia as a risk factor for repeat falls among the institutionalized elderly in Japan. *Nurs Health Sci.* 2009;11:388-96.
- Krampe J. Dance-based therapy to decrease fall risk in older persons [Doctoral Thesis]. University of Missouri; 2010.
- LaStayo PC, Ewy GA, Pierotti DD, Johns RK, Lindstedt S. The positive effects of negative work: increased muscle strength and decreased fall risk in a frail elderly population. *J Gerontol A Biol Sci Med Sci.* 2003;58:M419-24.
- Lugade VA. Balance control and stability during gait - an evaluation of fall risk among elderly adults [dissertation]. Eugene: University of Oregon; 2011.
- Maryam RS. Impact of physical balance exercise towards the balance status of the residents in pantisosialtresnawerdha wilayah pemda DKI Jakarta 2009 [unpublished Thesis]. Universitas Indonesia; 2009.
- Miceli DG. Falls associated with dementia: how can you tell? *Geriatr Nurs.* 2005;26:106-10.
- Miller CA. Nursing care of older adults: Theory and practice. Philadelphia: JB. Lippincot; 2004.
- Molinari V. Group therapy in long term care sites. *Clin Gerontol.* 2002;25:13-24.
- Morse JM. Preventing patient falls: Establishing a fall intervention program. 2nd ed. New York: Springer Publishing Company; 2009.
- Pollock RD, Martin FC, Newham DJ. Whole-body vibration in addition to strength and balance exercise for falls-related functional mobility of frail older adults: A single-blind randomized controlled trial. *Clin Rehabil.* 2012;26:915-23.
- Rubenstein LZ, Josephson KR. Falls and their prevention in elderly people: What does the evidence show? *Med Clin North Am.* 2006;90:807-24.
- Sakamoto K, Nakamura I, Hagino H, Endo N, Mori S, Muto Y, et al; Committee on Osteoporosis of The Japanese Orthopaedic Association. Effects of unipedal standing balance exercise on the prevention of falls and hip fracture among clinically defined high-risk elderly individuals: a randomized controlled trial. *J Orthop Sci.* 2006;11:467-72.
- Shema SR, Brozgol M, Dorfman M, Maidan I, Sharaby-Yeshayahu L, Malik-Kozuch H, et al. Clinical experience using a 5-week treadmill training program with virtual reality to enhance gait in an ambulatory physical therapy service. *Phys Ther.* 2014;94:1319-26.
- Shubert TE. Evidence-based exercise prescription for balance and falls prevention: a current review of the literature. *J Geriatr Phys Ther.* 2011;34:100-8.
- Staples S. Comprehensive rehabilitation for older persons with dementia. *Top Geriatr Rehabil.* 2006;22:197-212.
- Tideiksaar R. Falling in old age: Its prevention and management. 4th ed. New York: Springer Publishing Company; 2010.
- Wati DN. Severe dementia as a risk factor for repeat faller among the elderly living in the long-term care facilities in Japan [unpublished Master Thesis]. Kagoshima, Korimoto; Kagoshima University; 2008.
- Wood BH, Bilclough JA, Bowron A, Walker RW. Incidence and prediction of falls in Parkinson's disease: a prospective multidisciplinary study. *J Neurol Neurosurg Psychiatry.* 2002;72:721-5.