

EFFECTIVENESS OF OTAGO EXERCISE ON HEALTH STATUS AND RISK OF FALL AMONG ELDERLY WITH CHRONIC ILLNESS

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Abstract

Falls are a serious consequence of declining physical function. Otago exercise is a strength and balance training program designed to prevent falls and enhance health status among the elderly. This study aimed to investigate the effect of a 12-week Otago exercise intended to reduce the risk of falls and health status among the elderly with chronic illness in the social elderly institution. This quasi-experimental study employed a pre- and post-test design using a control group. The study involved an intervention group (21 respondents) and a control group (21 respondents). The sample used in this study were elderly living in a social elderly institution. The sample was selected using simple random sampling. The data were analyzed using Mann–Whitney test, independent t-test, and Chi-square test. Otago exercise significantly reduced the respondents' risk of falling and enhanced their health status. Significant differences were observed between the two groups in terms of the risk of fall ($p=0.041$) and health status ($p=0.011$). Otago exercise significantly improves the health status and reduces the risk of falling among elderly with chronic illness. The exercise can be recommended for older adults with chronic illness in social elderly institutions and communities.

Keywords: chronic illness, health status, older adults, Otago exercise, risk of fall

Abstrak

Efektivitas Latihan Otago terhadap Status Kesehatan dan Risiko Jatuh pada Lansia dengan Penyakit Kronik. Jatuh adalah konsekuensi serius dari penurunan fungsi fisik. Latihan Otago adalah program latihan kekuatan dan keseimbangan yang didesain untuk mencegah jatuh dan meningkatkan status kesehatan pada lansia. Penelitian ini bertujuan untuk menginvestigasi efek 12 minggu latihan Otago untuk menurunkan risiko jatuh dan meningkatkan status kesehatan pada lansia dengan penyakit kronik di Panti Sosial lansia. Penelitian Quasi-eksperimental ini menggunakan pre-post dengan kelompok kontrol. Kelompok intervensi dan kontrol masing-masing terdiri dari 21 responden. Sampel dalam penelitian ini adalah lansia yang tinggal di UPT Kesejahteraan Sosial Lanjut Usia Budi Agung Kupang. Teknik sampling yang digunakan adalah simpel random sampling. Data dianalisis menggunakan Mann-Whitney test, Independent t-test dan Chi-square test. Latihan Otago secara signifikan menurunkan risiko jatuh dan meningkatkan status kesehatan. Ada perbedaan signifikan antara kedua kelompok dalam hal risiko jatuh ($p=0.041$) dan status kesehatan ($p=0.011$). Latihan Otago secara signifikan menurunkan risiko jatuh dan meningkatkan status kesehatan pada lansia dengan penyakit kronik.

Kata Kunci: lansia, latihan Otago, penyakit kronik, risiko jatuh, status kesehatan

Introduction

The elderly population aged 60 years and above globally increased from 901 million in 2015 to 2.1 billion in 2050 (Dimitroff, 2015; Seah et al., 2019). Indonesian elderly population also increased, following the global trend. Data estimated 23.66 million senior citizens for the 2017

population projections in Indonesia (9.03%). The number of senior citizens are predicted to reach 27.08 million in 2020, 33.69 million in 2025, 40.95 million in 2030, and 48.19 million in 2035 (Statistics Indonesia, 2013; The Ministry of Health Republic of Indonesia, 2017). The increase in the elderly population can provide positive and negative impacts. The positive im-

fact arises if the elderly are healthy, active, and productive. The elderly population can experience burden given their health problems that result in increased health care costs, decreased revenue, increased disability, lack of social support, and non-conducive environment (The Ministry of Health Republic of Indonesia, 2017). The negative impact of such condition poses a burden for the government and the family, who bear the high cost of treatment and care for the elderly.

The elderly are populations at risk of various health problems because of their declining health status with age. The morbidity in the elderly amounted to 24.8% in 2013, increased to 25.05% in 2014, and continually rose to 28.62% in 2015 (The Ministry of Health Republic of Indonesia, 2017). Most of the elderly population experiences pain in less than a week, with the disease duration of 1–3 and 4–7 days for 36.44% and 35.05% of the population, respectively. Meanwhile, the number of elderly who suffer for more than three weeks remains large (14.5%). Elderly visit health facilities generally due to chronic illnesses.

Chronic diseases and decline in health status may be risk factors for falls in the elderly. Various chronic diseases that affect the elderly, such as hypertension, diabetes mellitus, and osteoarthritis, are important risk factors for falls. Every year, approximately 646,000 people die from falls globally, with more than 80% occurring in low- and middle-income countries. Although not fatal, approximately 37.3 million severe falls that require medical attention occur each year (WHO, 2018).

Fall is a preventable event. One way to prevent falls is through training. Otago training is one of the trainings proven to reduce falls by 35% (Abdulrazaq et al., 2018). Otago training focuses on progressive balance, muscle strength, and endurance. Otago trainings conducted in groups are more effective than training Otago performed alone at home (Kyrvalen, Moen, Røysland, & Helbostad, 2014).

Otago training-based training program can improve physical health; however, such programs cannot significantly increase the mental health status (Bjerk, Brovold, Skelton, Liu-Ambrose, & Bergland, 2019). Otago training is helpful, but it has not been studied in Indonesia. Therefore, this study was conducted to determine the effect of Otago training on the health status and risk of falls among the elderly with chronic diseases.

Methods

This study used a quasi-experimental design with pre- and post-approach with control group design. Intervention and control resides in the same location. The sampling technique used in this study was simple random sampling. The calculations provided a sample size of 22 elderly people, but because the study used a control group, the total sample comprised 22 control and 22 treatments. After the intervention of two elderly dropouts, each group included 21 respondents. An elderly of the treatment group left their home and returned to their family, whereas one person from the control group refused to continue participating in the research.

The inclusion criteria for this study were willingness to become respondents, age of 60 years and over, absence of visual impairment, lack of hearing loss, no experience of postural hypotension, regular training, independently (Katz index of independence in activities of daily living = 6), and prior experience of a chronic disease.

Otago training was conducted with 12 movements: (1) warming-up; (2) front knee strengthening; (3) back knee strengthening; (4) side hip strengthening; (5) calf raises; (6) toe raises; (7) sit to stand; (8) heel walking; (9) toe walking; (10) one leg stand; (11) side ways walking; (12) cooling-down. Otago training was conducted twice a week (Tuesdays and Fridays) every 06.30 pm for 12 weeks. Each session was conducted for 40 min including warm-up and cooling-down.

Table 1. Otago Training Procedure

No.	Practice	Description
1.	Warming-up	<ul style="list-style-type: none"> ✓ Sit on a chair and take a deep breath through the nose with both arms raised to the top of the stretch. ✓ Lower the arms and exhale. ✓ Repeat the exercise 10 times.
2.	Front Knee Strengthening	<ul style="list-style-type: none"> ✓ Sit on a chair with a backrest ✓ Gently lift the leg and then lower it; repeat this step 10 times ✓ Perform the same exercise on the other foot
3.	Back Knee Strengthening	<ul style="list-style-type: none"> ✓ Stand while facing a chair ✓ Hold on to the seat and lift the leg backwards while the knees are bent ✓ Repeat the exercise on each leg 10 times
4.	Side Hip Strengthening	<ul style="list-style-type: none"> ✓ Stand while holding on to a chair ✓ Expand the leg to the side and then return to its original position ✓ Repeat the exercise for each leg 10 times
5.	Calf Raises	<ul style="list-style-type: none"> ✓ Stand while holding on to a chair ✓ Strengthen the rests on the calf ✓ Tiptoe and lower the heel hold ✓ Repeat the exercise 10 times
6.	Toe Raises	<ul style="list-style-type: none"> ✓ Stand while holding on to a chair ✓ Slowly raise and then lower the toes ✓ Repeat the step 10 times
7.	Sit to Stand	<ul style="list-style-type: none"> ✓ Start the procedure by asking the elderly to sit on a chair. ✓ Seniors are asked to stand with unaided hand. ✓ This procedure can be repeated 10 times.
8.	Heel Waking	<ul style="list-style-type: none"> ✓ Walk forward heel ✓ Perform 10 steps ✓ Repeat the exercise 10 times
9.	Toe Walking	<ul style="list-style-type: none"> ✓ Walk forward using the toes ✓ Perform 10 steps ✓ Repeat the exercise 10 times
10.	One Leg Standing	<ul style="list-style-type: none"> ✓ Stand on one leg with the other foot placed in the mid-calf. ✓ Hold for 10 s if possible. ✓ Repeat the exercise 5 times on each leg.
11.	Side Ways Walking	<ul style="list-style-type: none"> ✓ Stand with feet pressed together with the knees slightly bent ✓ Spread the legs to the side slowly and with control, and slide one foot first to one side ✓ Move the other leg that has moved closer to the foot ✓ Perform 10 steps each while shifting to one side, and shift back 10 steps to the opposite side. This procedure is repeated 10 times.
12.	Cooling-down	<ul style="list-style-type: none"> ✓ Sit on a chair and take a deep breath through the nose with both arms raised to the top of the stretch. ✓ Lower the arms and exhale. ✓ Repeat the exercise 10 times.

(Liston et al., 2014; Skelton, Skelton, Gawler, & Hannah, 2018)

As many as 24 sessions were performed. Before data collection, each respondent received an explanation of the research objectives, advantages, and possible negative effects of the study and gave their informed consent. The short form 12 health survey (SF-12) was used to measure the health status of the elderly. The

instrument consists of 12 question items that can measure the health status, including physical health status (physical component summary or PCS) and mental health status (mental component summary or MCS) (Ware, Kosinski, Turner-Bowker, & Gandek, 2009). The validity and reliability were 0.363–0.685 and 0.890

(Rekawati, 2014), respectively. The test on 30 elderly people in the community (Riasmini, Kamso, Sahar, & Prasad, 2013) demonstrated a validity of between 0.370–0.732 and 0.863 reliability. SF-12 has been translated and validated in several languages, including Indonesian, and has been used to test the validity and reliability of the general population; it can be applied to cross-cultures, elderly, and internationally tested (Falah, Putranto, Setyohadi, & Rinaldi, 2017). The risk of falling was measured using the observation sheet of Timed Up and Go Test (TUGT). Respondents who perform TUGT procedure begin by sitting on a chair. When the examiner says “start,” then the respondent stands up from a chair, walks to the marked line (within 3 m of the seat), turns and walks back to the previous chair after arriving at the line, and sits down as before. The start and stopped when the elderly sits back. Scores ≥ 12 indicate high risk of falls, whereas scores < 12 denote a low risk of falling (Chow et al., 2019).

The data were analyzed by independent t-test, Chi-square test, and the Mann–Whitney test. Independent t-test was used to determine differences in the mean age and physical and mental health status of the treatment and control groups before and after treatment. Chi-square test was used to determine the different categories of gender, education level, marital status, and disease. Mann–Whitney test was used as an alternative to independent t-test for the data with non-normal distribution. Mann–Whitney test was used to determine differences in the risk of falling, physical health status of the treatment and control groups before treatment, and the risk of falling after treatment (Grove & Gray, 2019; Polit & Beck, 2018).

Results

No difference was observed in the mean age, the risk of falling, health status, and physical and mental health status in both groups of respondents prior to treatment. The mean age was 76.41 years for the treatment group and 71.55 years for the control group. The risk of falls in

both groups was greater than 12 s, indicating a high risk of falling. The average health status of the elderly in the treatment group was 42.40, whereas that for the control group was 44.14. No difference was observed in the categories of gender, education level, marital status, and chronic disease suffered. Slightly more women than men were included in the treatment group. However, in the same treatment group, most respondents achieved primary school education and were widow/widower; both groups suffered from hypertension.

Otago training significantly reduced the risk of falling among the studied elderly ($p= 0.041$). The risk of falls in the intervention group decreased from 14.26 s to 12.05 s and increased from 12.94 s to 13.26 s in the control group. Otago training increased the health status ($p= 0.011$), with the scores in the treatment group increasing from 42.40 into 47.10, and that in the control group decreasing from 44.14 into 42.48. The mental health status scores in the treatment group increased from 43.24 to 49.42 ($p= 0.002$), whereas the physical health status showed no significant increase ($p= 0.556$).

Discussion

Otago training significantly improved the health status of the elderly. The average health status increased in the treatment group compared with the control group. This finding is consistent with the previous study (Wati, Sahar, & Rewawati, 2018) on Lafiska (elderly physical exercise), which consisted of a range of motion trainings, balance trainings, strength training, game sessions, and deep breathing, that can improve the health status of the elderly; however, further analysis of the results showed that Otago training only improved the mental health status, whereas the physical health status did not increase significantly. Results of the analysis showed the increased mental health status (MCS), from 43.24 to 49.42 (6.18 points), observed by the authors. This finding is due to the frequent meeting and interaction of elderly people who follow the Otago training. This condition reduces

Table 2. Characteristics of Respondents Before Otago Training in Social Welfare Institution at Kupang (n= 44)

Characteristics of Respondents	Treatment group (n= 22)	Control group (n= 22)	p
Age (Years): mean (SD)	76.41 (9.26)	71.55 (7.79)	0,066 *
Gender			
Male: n (%)	9 (40.9)	11 (50.0)	0.762 **
Women: n (%)	13 (59.1)	11 (50.0)	
Level of education			
Not schools: n (%)	3 (13.6)	4 (18.2)	
Elementary school (SD): n (%)	11 (50.0)	12 (54.5)	0.925 **
Junior high school (SMP): n (%)	4 (18.2)	3 (13.6)	
High school (SMU): n (%)	4 (18.2)	3 (13.6)	
Marital status			
not Married	3 (13.6)	8 (36.4)	0.135 **
Widow/widower	14 (63.6)	8 (36.4)	
Married	5 (22.7)	6 (27.3)	
Chronic diseases			
Hypertension	12 (54.5)	10 (45.5)	0.925 **
Diabetes mellitus	3 (13.6)	3 (13.6)	
Arthritis	5 (22.7)	6 (27.3)	
Other chronic diseases	2 (9.1)	3 (13.6)	
Risk of falling: mean (SD)	14.26 (4.30)	12.94 (2.66)	0,452 ***
Health status: mean (SD)	42.40 (5.25)	44.14 (5.88)	0.306 *
Physical health status (PCS): mean (SD)	41.57 (7.97)	44.84 (10.31)	0.353 ***
Mental health status (MCS): mean (SD)	43.24 (7.96)	43.45 (8.21)	0.932 *

SD (standard deviation); * Independent t-test; ** Chi-square test; *** Mann–Whitney test

Table 3. Effect of Otago Training on The Risk of Fall, Physical Health Status (PCS), Mental Health Status (MCS), and Health Status of Social Welfare Institution at Kupang (n= 42)

Variables	Group	Mean	SD	p
Risk of Falling	Treatment	12.05	2.96	.041
	Control	13.26	2.35	
PCS	Treatment	44.76	9.82	.556
	Control	43.03	9.19	
MCS	Treatment	49.42	7.80	.002
	Control	41.92	7.19	
Health Status	Treatment	47.10	6.36	.011
	Control	42.48	4.74	

SD (standard deviation)

the time of the elderly for training alone, thereby increasing their mental health capacity through increased social functioning and emotio-

nal role. According to Albornos-Muñoz et al., (2018), Otago training can improve independence and social activities.

The physical health usually declines drastically with age, whereas mental health decreases slowly. Therefore, a variety of training programs are attempted in the early elderly age (60–74 years) for various body systems that can still be maintained and improved. In this study, physical health status (PCS) showed no significant increase, with scores ranging from 41.57 to 44.76 (3.19 points). This finding is attributed to the chronic disease experience of the elderly, which is not a physical training that can improve physical health status significantly. Otago training has no effect on the reduction of symptoms of chronic diseases affecting the elderly.

In this study, the chronic diseases that affected the elderly included hypertension, diabetes mellitus, and arthritis. These conditions are in line with research (Mat et al., 2018) indicating that Otago training for six months caused no reduction in the symptoms of chronic diseases, such as osteoarthritis, affecting the elderly. These results differ from those of other studies (Bjerk et al., 2019) which reported that Otago training-based training programs can improve physical health but cause no significant increase in the mental health status.

Otago training also significantly reduced the risk of falls. The decreased risk of falling was demonstrated through the impairment determined by TUGT. The smaller of TUGT value indicated the lower the risk of falling. Otago training can enhance muscle strength and body balance, thus increasing the speed of the elderly. This result is in line with research by Kiik, Sahar, and Permatasari (2019), showing that 8 weeks of training interventions that focus on body balance can reduce the risk of falls. This training can improve lower extremity muscle strength, body flexibility, balance, and walking speed. Otago training effectively improves balance, functional mobility, lower extremity muscle strength, and functional independence (Kocic et al., 2018).

The analysis showed that the average TUGT value in the treatment group decreased by 2.19

s based on the measurement results 3 months after the intervention, implying that the risk of falling decreased in this group; meanwhile, the control group had increased TUGT value of 0.32 s, indicating the increased risk of falling.

Another research (Shubert et al., 2017) showed that the Otago training conducted for 6 months decreased TUGT value by 4.3 s. Changes in the TUGT value indicates that prolonged Otago training decreases the risk of falls as indicated by the increased or decreased running speed obtained through TUGT.

Otago training needs to be conducted regularly and sustained as a training program to prevent falls in the elderly (Martins et al., 2018). Day (2011) mentioned that good understanding of obedience training sessions and trainings will greatly affect the outcomes of this training. Regularly and dutifully following such practice will result in desirable outcomes. Conversely, failure to train in accordance with the program and guide yields unsatisfactory results.

All the elderly people who follow the Otago training experience chronic diseases. Approximately 91% of elderly experience chronic disease, and 73% suffer from two chronic conditions, such as diabetes, arthritis, hypertension, and pulmonary diseases, seriously endangering the elderly quality of life (Sahar, Setiawan, & Riasmini, 2019). Although the elderly experience chronic diseases, Otago training is still recommended because it is easy to perform and will not result in severe chronic disease conditions.

Conclusions

Otago training improves health status and reduces the risk of falling among the elderly. This training can be recommended for the elderly with chronic illnesses in social institutions and in the community. A long period of Otago training will improve physical health status and will decrease the risk of falling.

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