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Original Article

Comparison of Modified OTAGO Training Program and Walking Training on Physical Performance in Pre-Frail Elderly

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Abstract

Background : Multicomponent training program like OTAGO is considered to improve the physical performance of pre-frail elderly, thereby reducing risk of fall. The Short Physical Performance Battery (SPPB) is a combination test that assesses physical performance and becomes a fall risk screening test for pre-frail elderly. This study aimed to compare the modified OTAGO to walking training on physical performance as measured by SPPB in the pre-frail elderly.
Methods : This was an observational study with a cross-sectional design. The data were taken from the previous study including pre-frail subjects in Prolanis, Gunung Pati area, Semarang before and after giving intervention (modified OTAGO vs walking training) for 6 weeks. The SPPB score was measured from balance function test, chair stand test, and 4-meter walking test before and after the intervention. Data analysis was using SPSS ver 20.0. Paired sample T-test and Wilcoxon signed ranks test were used to analyze the SPPB score before and after interventions in the modified OTAGO and walking training group, respectively. Mann-Whitney U was used to analyze the difference in the average improvement of SPPB score.
Results : There was a significant improvement in SPPB score before and after interventions either in modified OTAGO (p=0.013) or walking training (p=0.013). No significant difference was found in the average improvement of SPPB score in both groups (p=0.826).
Conclusion : Both modified OTAGO and walking training intervention can improve the physical performance of pre-frail elderly. The modified OTAGO training is not superior in improving physical performance compared to walking training.

Keywords : Modified OTAGO training, Walking training, Pre-frail, SPPB

INTRODUCTION

Physical and cognitive functions are known to decline with age. These are worsened by other deteriorations in various functions needed for optimum physical performance, thereby increasing the risk of falling and other risks related to falls.[1,2] Falls in the elderly cause loss of independence, hospitalization due to trauma, death related to injuries and fractures, decreased quality of life, and increased health care costs.[3] The prevalence rate of falls in pre-frail elderly is higher than in frail elderly. It is because they spend more time walking than frail elderly. Pre-frail elderly was diagnosed based on the Fried Frailty Phenotype criteria, 1 to 2 out of 5 criteria (grip strength, walking speed, fatigue, physical activity, unexplained weight loss).[4,5] Meanwhile, frailty is a dynamic process, where a person can experience a transition to frailty status, namely fit/robust, pre-frailty, and frailty. Pre-frailty is a predisposing condition before frailty occurs. A recent systematic review of the global prevalence of elderly people with pre-frailty and frailty in the community ranged from 34.6–50.9% and 4.9–27.3%, respectively. Asian countries record a higher prevalence range of pre-frailty (40-72%) and frailty (5-28%) than the global range.[6] This condition is consistent with the findings of a multicenter study in Indonesia which found a pre-frail prevalence of 61.6% and 25.2% of frail.[7]

One of the combined tests used to assess physical performance and become a fall risk screening test in the elderly is the Short Physical Performance Battery (SPPB). This test measures several physical performance tasks (such as chair stand or sit to stand, standing balance or balance function, and gait speed during walking).[8] The SPPB is highlighted as a diagnostic criterion for geriatric syndromes.[9] In a multicenter study, the SPPB (score ≥3 and ≤9) was used to detect low physical performance in physical frailty and sarcopenia.[10] The SPPB is also recommended by the European Working Group on Sarcopenia in Older People (EWGSO2) as a measure to identify declines in physical performance (SPPB score ≤ 8 points) as part of the algorithm for screening and diagnosing severe sarcopenia.[11]

The exercise programs designed to improve physical performance and prevent falls in the elderly have been investigated in several substantial studies in recent decades. Clinical evidence of the effectiveness of fall prevention–specific exercise types and minimum interventions has been summarized in systematic reviews.[6,7] However, determining the best training program design for individual sub–groups is still challenging. A type of multicomponent exercise program (strengthening, balance, and resistance training) with specific doses according to the recommendation (at least twice per week) is the modified OTAGO training program.[12–14] Based on a quasi-experimental study that compared the control group and the multicomponent exercise group concluded that this exercise program is safe and possible to be given to pre-frail elderly and can improve frailty status, functional performance and muscle strength.[15] A previous randomized controlled trial concluded that OTAGO exercise can reduce the incidence of falls, improve balance and physical performance in elderly people over 65 years old.[16] The OTAGO exercise is a multicomponent exercise consisting of resistance, balance, and aerobic exercise (walking). The walking training on the OTAGO exercise program target the duration up to 30 minutes, at a normal pace, divided into several shorter sessions, for example three 10-minute sessions, at least twice a week.[17] Walking is a form of the simplest aerobic exercise that can be given to the pre-frail elderly. To the best of our knowledge, there is no study that compare modified OTAGO training (including resistance, balance, and walking exercises) and walking training only in pre-frail elderly.

Thus, this study aims to compare the modified OTAGO training and walking training intervention on the physical performance measured by SPPB score in pre-frail elderly.

METHODS

This was an observational study with a cross-sectional design. Samples of this study were data from the previous study conducted in May – June 2021 which investigated a comparison between the modified OTAGO training program and walking training on balance function, including the chair stand test, and gait speed. In the previous study mentioned, subjects who were actively participated *in Program Pengelolaan Penyakit Kronis (Prolanis)* at the Gunung Pati Clinic and Gunung Pati Primary Care Center, Semarang and met the inclusion criteria were recruited. There were 31 pre-frail subjects who were recruited and randomized using sealed envelope randomization to be divided into the OTAGO training group and walking training group.

The data that did not meet the complete information of age, sex, amount of medication, body mass index (BMI), mini nutritional status (MNA), frailty phenotype as well as data of balance function, chair-stand, and 4-meter walk test before and after intervention were excluded from this study.

The assessment of physical performance by using SPPB was obtained from previous data on the balance function, 5 times chair stand, and 4-meter walking. The balance function data had a range of scores 0 to 4. The 4-meter walking data had a score range of 1-4 points (score 1 if > 8.7 seconds, 2 if 6.21–8.7 seconds, 3 if 4.82–6.2 seconds, 4 if <4.82 seconds). The 5 times chair stand test had a range of score from 0-4 points (point 4 if the time data obtained was <11.19 seconds, point 3 if it was 11.2–13.69 seconds, point 2 if it was 13.7–16.69 seconds, 1 if it was >16.7 seconds, and 0, if it was >60 seconds). Thus, the highest SPPB score was 12 and the lowest was 0.

The SPPB data were obtained from all the data before and at the end of the 6th week of the intervention.

The data gathered were analyzed descriptively and analytically using IBM SPSS Version 20.0 software. The paired-sample T-test and Wilcoxon signed ranks test were used to analyze the SPPB score data before and after modified OTAGO training and walking training intervention, respectively. The Wilcoxon test was also used to analyze the frailty phenotype score before and after intervention in each group. The Mann-Whitney U was used to analyze the differences in the mean increase of SPPB score and frailty phenotype score reduction in both groups.

This study has been reviewed and approved by the Health Research Ethics Commission (KEPK), Faculty of Medicine, Diponegoro University with Document No. 417/EC/KEPK/FK-UNDIP/XII/2022. The data gathered in this study was part of a previous study conducted in May-June 2021 with Document No. 76/EC/KEPK/FK-UNDIP/III/2021.

RESULTS

Thirty-one data of pre-frail elderly of Prolanis Gunung Pati Semarang were gathered. Five out of 31 data were excluded due to incomplete data (no data of post intervention). The consort diagram of data sample selection was shown in Figure 1.

The previous data on demographic and clinical characteristics in both groups were shown in Table 1. The table showed the results of the homogeneity test of demographic characteristics consisting of age, sex, number of medications, MNA (Mini Nutritional Assessment), and frailty phenotype score which indicates pre-frail. There was no significant difference between the modified OTAGO training group and the walking training group, with a p-value >0.05. Demographic characteristics in both groups were homogeneous.

The mean of frailty phenotype score in the two groups before intervention was not significantly different, with a p>0.05 (p = 1.000). The data result of frailty phenotype scores before and after intervention showed a significant difference in the modified OTAGO group (p=0.001), but not in the walking group (P=0,023). The delta reduction of frailty scores in the OTAGO and walking groups was -1.00 ± 0.43 and -0.38 ± 0.51, as it was shown in Figure 2. The delta reduction was significantly different between modified OTAGO and walking group (p=0.005).

The analysis result of the SPBB score data before and after the modified OTAGO training and walking training intervention can be seen in Table 2. The mean or average value of the test before and after the modified OTAGO training intervention was 7.69 and 8.77, respectively. Paired samples correlations of SPPB score data of the modified OTAGO training intervention was 0.666 with a probability value of 0.013. A correlation of 0.666 indicates a moderate relationship before and after the modified OTAGO training intervention. While in walking training, the mean value of the test before and after the intervention was 7.62 and 8.85, respectively. This shown a significant improvement of SPPB score before and after walking training with the probability value of 0.013.

The analysis of differences in the average improvement of SPPB score in both groups yielded a p-value of >0.05 as it was shown in Table 3.

The analysis result did not show a significant difference of SPPB score improvement between the modified OTAGO and walking control groups.

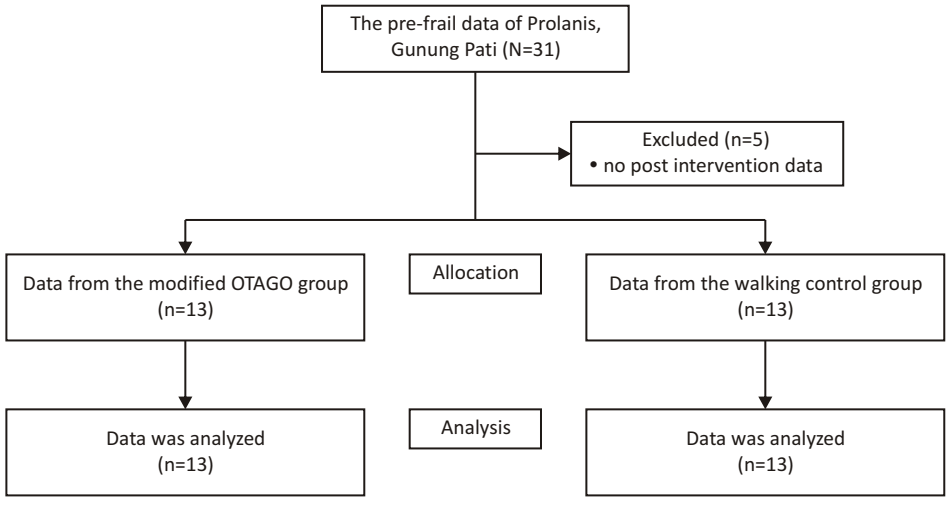

Figure 1. Consort diagram of data sample selection

TABLE 1
The characteristics of previous data subjects

Variable	Group		p
	Modified OTAGO group	Walking control group	
Age	65.00 ± 3.85	65.15 ± 5.97	0.659‡
Sex			
Male	5 (38.5%)	6 (46.2%)	0.691¥
Female	8 (61.5%)	7 (53.8%)	
Amount of medication	2.46 ± 1.27	2.69 ± 1.18	0.605‡
BMI	23.94 ± 3.32	23.65 ± 2.63	0.804§
MNA	12.38 ± 1.39	12.08 ± 1.12	0.426‡
Frailty Phenotype Score	1.31 ± 0.48	1.31 ± 0.48	1.000‡

*Significant (p<0.05); ¥Chi square; §Independent t; ‡Mann Whitney; BMI : Body mass index; MNA: Mini Nutritional Assessment

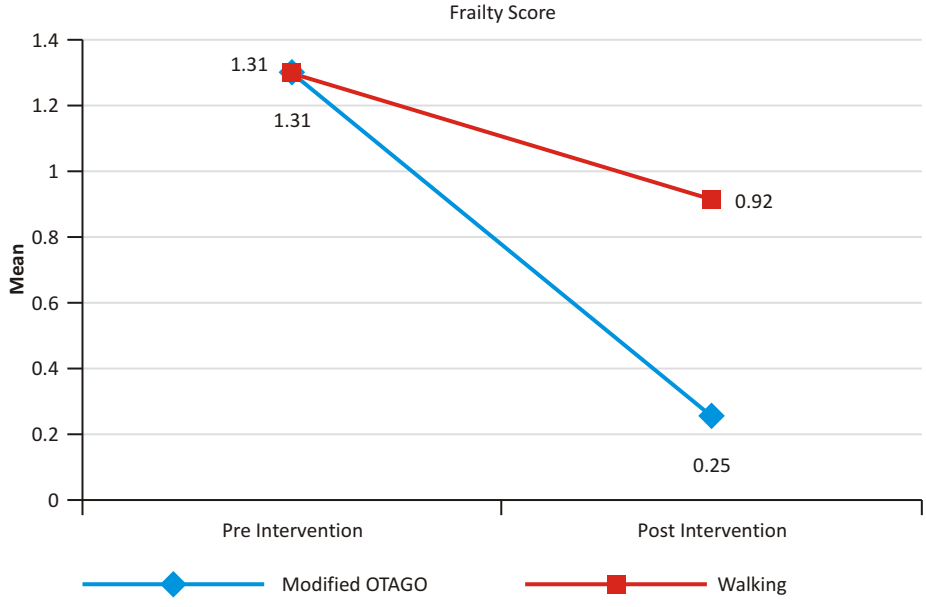

Figure 2. The mean of delta reduction of frailty scores pre- and post- intervention

DISCUSSION

The mean age of subjects in our study was 65 years old. Our previous mentioned study applied more than 60 years old as one of the inclusion criteria. The previous study stated that the prevalence of pre-frail in Indonesia at the age of more than 60 years is 61,6%.[7]

The gender data revealed that female was frequent than male, in both modified OTAGO group and walking control group. Our finding was consistent with data from the Indonesian Central Bureau of Statistics in 2020 that states the prevalence of female elderly is higher than that of male, which is 52.35%. Life expectancy and the percentage of health complaints were also found to be higher in female elderly by 52.31% compared to male.[18]

The maximum number of drugs used by subjects in both groups is 4 drugs. This amount is less than the limit for the number of drugs that might affect the SPPB score. Drug use of ≥ 5 drugs per day can cause drug interactions, and disease interactions that affect balance control, increase the risk of falling in the elderly, and indirectly affect the SPPB score.[19–21]

Body mass index between the two groups in this study is comparable. Previous investigator did not include BMI as inclusion criteria specifically, where BMI data was integrated in the MNA scoring section. From the

TABLE 2
Analysis of SPPB score in modified OTAGO and walking group data

Groups	SPPB score		P-value
	Before	After	
Modified OTAGO training	7.69 ± 1.84	8.77 ± 1.09	0.013*
Walking training	7.62 ± 1.71	8.85 ± 1.41	0.013*

*Significant (p<0.05); ¥Chi square; §Independent t; ‡Mann Whitney; BMI : Body mass index; MNA: Mini Nutritional Assessment

TABLE 3
Difference of average improvement of SPPB score in modified OTAGO and walking training

Groups	SPPB score improvement#	P-value
Modified OTAGO training	1.08 ± 1.38	0.826
Walking training	1.23 ± 1.30	

#Score improvement = SPPB score after intervention – SPPB score before intervention

data, it is shown that the average pre-frail elderly classified as overweight based on Asia-Pacific classification. Meanwhile, the MNA score did not show a malnutrition status in both groups. The presence of malnutrition significantly affects the development of frailty. It is also related to dynamic balance performance and physical performance in the elderly.[22]

Comparison of the delta score of frailty phenotype before and after intervention between the two groups showed that the subjects who received the modified OTAGO experienced statistically significant reduction score of frailty phenotype compared to the walking group. This result is in line with the study on multicomponent training in which the components of exercise are similar to modified OTAGO training. That training consisting of aerobic exercise, resistance exercise using *Theraband* and balance exercise showed an improvement in frailty phenotype scores after 12 and 24 weeks of training when compared to the control group.[23]

In this study, the two intervention groups showed a significant correlation between the improvement of SPPB scores before and after each training. A previous study on pre-frail elderly that evaluated using a graphic sensor and SPPB score found that there was a slower decline of performance in the OTAGO group than in the control group, even though the capacity of both groups increased.[21] Meanwhile, a study with 65 elderly in the community who measured physical performance by SPPB separately found no improvement in the static balance between groups. There was a decreasing time performance of the chair stand test and no improvement in the walking speed.[24] Our study did not measure SPPB scores separately but compared the total data scores obtained before and after the intervention.

Few studies have provided walking therapy for pre-frail elderly. A study involving 81 participants in 9 nursing homes in Spain provided walking training as a control in a multicomponent exercise intervention. In that previous study, it was found that walking training did not give better improvement on SPPB score than multicomponent training.[25] Different from the walking training given in the modified OTAGO group, our previous investigator gave the walking training group a step-based walking, recorded with a pedometer, and supervised every week. Our previous investigator only provided the number of steps during walking training but did not consider the daily number of steps.

Both data from modified OTAGO and walking training in our study showed a significant improvement in SPPB scores. The difference in score improvement between groups did not show a significant result. Providing physical activity in various forms can improve the SPPB score. The Lifestyle Interventions and Independence for Elders (LIFE) Study involving 1635 adults aged 78.9±5.2 years who were given moderate levels of physical activity showed a significant improvement in SPPB scores compared to the group that was only given health education.[26]

In this study, it is shown that the group given the modified OTAGO training experienced a significantly greater reduction in frailty phenotype scores than the group that was given the walking training only. However, both groups showed a significant improvement in physical performance scores as measured by SPPB. As mentioned in the previous review studies that the structured physical activity not only improves physical performance but also offers other benefits like increasing mobility.[27,28] We believe that the

multicomponent training like the modified OTAGO which include the walking training as one of its components will be more beneficial in improving the physical performance as well as reduction of frailty phenotype score. Apart of that, other factors such as habits, availability of the equipment, compliance and clinical conditions of each elderly can influence the selection of the appropriate training for them.

Nevertheless, this study has some limitations in terms of the small number of data collected from our previous study. Some of the data collected are not complete due to unavailable data of post-intervention. The components in the SPPB score are not analyzed separately and other factors that cannot be ruled out may affect the physical performance of pre-frail elderly.

CONCLUSION

Both modified OTAGO and walking intervention can improve the physical performance of pre-frail elderly. Compared to walking training, the modified OTAGO training is not superior in improving physical performance in pre-frail elderly.

Studies that compare modified OTAGO training and walking training with more objective measurements involving bigger samples and considering other factors affecting SPPB scores are still needed.

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