



Effectiveness of a Theater Program Intervention on the Cognitive, Physical, and Social Functions of Elderly People Living in the Community: A Pilot Survey

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Abstract

Background: In recent years, theatrical approach has been reported to improve the health promotion of the older adults. Our study aimed to clarify the effects of a theater program intervention on the cognitive, physical, and social functions of older adults living in the community.

Methods: Of the 43 participants, they were assigned to the control group and theatre intervention group, each group received intervention for three months. We compared participants' pre-test and post-test physical, cognitive, and social functioning results of the program. Moreover, the amount of change in physical and cognitive items in the control and theater groups was compared.

Results: A comparison of pre-test and post-test results showed significant improvements in the UWS and physical and social frailty for the control and theatre group. Furthermore, amount of the change in UWS in the theatre group was significantly higher than in the control group.

Conclusion: In conclusion, we have shown that a theatrical intervention can be as effective as the multicomponent exercise recommended, the theatrical approach was suggested to be effective in improving social frailty.

Keywords: Theater program intervention; Older adults; Frailty

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Introduction

Worldwide countries moving from a state of high fertility, high mortality, and a predominance of a young population to a condition characterized by low fertility, low mortality, and the preponderance of an old population, the aging process of the world population is happening faster than in the past [1]. Japan is likewise aging more rapidly than any other country, the percentage of the population aged 65 and over reached 23% in 2009, the highest in the world. Furthermore, by 2030, one in three people will be 65 or older, and one in five will be 75 or older [2]. Deterioration in physical and cognitive health with aging increases the risk of developing disability in older adults. Older adults remain at great risk for cognitive decline and, as a result, for increasingly poor quality of life. As for those reasons, previous studies have shown that (a) a decline in information-processing speed, (b) failure to engage in elaborative processing, (c) deficits in various types of problem-solving ability, (d) decrease in working memory capacity, and (e) lack of controllability [3-8]. Suzuki et al. developed an intervention program in the form of a dual task in which physical exercise and cognitive tasks are performed simultaneously [9]. Dual tasks require executive functions that are particularly important for Activities of Daily Living (ADL). Doi et al. reported that increased prefrontal activation during dual-tasks correlated with executive function in elderly patients with MCI [10]. Other previous studies have also shown that interventions using dual-task training may be a promising approach for MCI patients [11,12]. In our previous study also showed that our multi-component program could improve the cognitive and physical functions of older adults in community dwellers [13].

On the other hand, participation in cultural activities has recently been associated with cognitive function and other health outcomes. Cultural activities include daily events for enjoyment, entertainment, recreation, or social contribution [14]. Participation in cultural activities can be "passive" or "active," interestingly, active cultural participation has been shown to be more effective

in cognitive function than passive participation [15]. In recent years, theatrical approaches have been reported to improve the health and cognitive function of older adults through active cultural participation [16-18]. However, most of the studies reported to date have focused on cognitive function. Theatrical approaches may have a positive impact on physical and social function because they promote rich experiences and interaction among participants. The purpose of this study was to clarify the effects of a theater program intervention on the cognitive, physical, and social functions of older adults living in the community.

Materials and Methods

Participants

Participants were recruited in Akita prefecture, Japan. Our study was performed from June to October 2022. The participants aged 65 years old or over, had the ability to walk independently and living at home without personal assistance. The exclusion criteria were dementia, major depression, severe hearing or a visual impairment, stroke, Parkinson's disease, another neurological disease, intellectual disability, need for support of care as certified by the Japanese public long-term care insurance system due to disability, and inability to complete cognitive tests at the baseline assessment. The demographic data comprised age, gender, education, and health variables including Body Mass Index (BMI) [kg/m²].

Intervention

Of the 43 participants who gave informed consent, they were assigned to the control group and theatre intervention group. Each group also received a 90-minute program once every two weeks for three months.

Multicomponent exercise program for the control group

As previously reported [9], a multicomponent exercise intervention was performed, where cognitive training was incorporated into the sessions combined with resistance and aerobic training. The control group was conducted by health and fitness instructors or trained care workers. The content of the program is to maintain and improve ADLs and lead to preventive care for the elderly. Each session included as follows; first, started with bending exercises such as per and lower limb stretching. After that, physical training was 10 min of aerobic exercises with cognitive stimulation and 20 min of resistance exercises with cognitive stimulation. The therapist adjusted the level of aerobic exercise and resistance exercises according to each participant's ability, and the participant rested when needed. The cognitive exercises included dual-task training.

Theatre intervention group

The theatrical intervention consisted of a basic program and an application program, and was conducted by longtime theater professionals and teaching staff. The basic program consisted of stretching, aerobic exercise, and vocal and emotional expression exercises for 30 min. Emotional expression exercises involved rhythmically imitating the words and emotions (anger, joy, sadness, etc.) of the instructional staff (Figure 1). The application program included chorus practice, dance, and dialogue practice based on a script created by the participants. The theatre script was produced by the Warabiza, but the lyrics to the theme song were written by the participants themselves (Figure 2). In addition, participants prepared their own costumes and props to be used in the play.

Assessment and outcome

We evaluated a physical performance consisting of grip strength (kg) and usual walking speed (m/s). Four cognitive subtests of the National Center for Geriatrics and Gerontology Functional Assessment Tool (NCGG-FAT) [19] were also assessed for each participant. Cognitive subtests are indicated as follow;

Components of NCGG-FAT

The computerized multidimensional neurocognitive test was performed on an iPad (Apple, Cupertino, CA, USA) with a 9.7-inch touch display. The task instructions were presented with a letter size of at least 1.0 × 1.0 cm² on the display. For this study, a trained operator supported each participant by setting up the tablet PC and running each test. Participants completed the NCGG-FAT subtests as follows.

Tablet Version of Word Recognition (WR): This test is comprised of two computerized tasks of immediate recognition and delayed recall. In the first task of immediate recognition, participants were instructed to memorize 10 words, each of which was displayed for 2 s on the tablet PC. After that, a total of 30 words including 10 target and 20 distracter words were shown to participants, and they were required to select the 10 target words immediately. This task was repeated for three trials. The average number of correct answers was recorded as a score ranging from 0 to 10. In another task, participants were asked to correctly recall the 10 target words after 20 min. The number of correctly recalled target words was scored ranging from 0 to 10. Finally, we calculated the sum score of the two tasks of immediate recognition and delayed recall.

Tablet Version of Trail Making Test Version A (TMT-A) and Version B (TMT-B): In the Trail Making Test Version A (TMT-A)



Figure 1: Emotional expression exercises.



Figure 2: Meeting to create theme song lyrics.

Table 1: Comparison of participant characteristics between Control and Theatre group.

	Control group n=25		Theatre group n=18		p value
	Median	IQR	Median	IQR	
Gender (% female)	88.0		50.0		0.000*
Age (year)	73	6	71.5	9	0.407
Education (year)	12	2	14	4	0.286
BMI (kg/m ²)	22.2	3.3	22.2	8.7	0.506

*p<0.01, Mann-Whitney test, χ^2 test

task, participants were instructed to touch the target numbers in a sequence as rapidly as possible. Target numbers from 1 to 15 were randomly displayed on the tablet panel. In addition, the Trail Making Test Version B (TMT-B) instructions required participants to touch target numbers (e.g., 1–15) and letters in turn.

Tablet Version of Symbol Digit Substitution Task (SDST): In the Symbol Digit Substitution Task (SDST), nine pairs of numbers and symbols were shown in the upper part of the tablet display. A target symbol was shown in the center of the tablet panel, and selectable numbers were displayed at the bottom. Participants were asked to touch the number corresponding to the target symbol shown in the central part of the tablet display as rapidly as possible. The number of correct numbers within 90 s was recorded.

Criteria of physical frailty

Frailty status was defined based on five dimensions of the Fried frailty index, including i) shrinking, ii) exhaustion, iii) low level of activity, iv) weakness, and v) slowness, 0 for robust, 1 to 2 for prefrail, and 3 to 5 for frail, and the frailty [20].

Criteria of social frailty

Makizako's social frail index was applied for this study, consisting of i) Living alone (yes), ii) Talking with someone every day (no), iii) Feeling helpful to friends or family (no), iv) Going out less frequently compared with last year (yes), v) Visiting friends sometimes (no), 0 for robust, 1 for social prefrail, and 2 to 5 for social frail. According to the change of social frail status at the following-up period, robust persons classified at the baseline were grouped into three categories, such as robust, social prefrail, and social frail [21].

Statistical analysis

We compared the control group and theatre group in demographics for age, gender, education, and BMI by using the Mann-Whitney test. Next, The Wilcoxon signed-rank test was applied to compare the results of physical function and UWS, GS,

WM, TMT-A & B, and SDST between pre-test and post-test of this program for participants. The Wilcoxon signed rank test was applied to compare the results of the physical frailty ratio and social frailty between pre-test and post-test. Moreover, the Mann-Whitney test was applied to compare amount of change the physical and cognitive items for the control group and theatre group. SPSS Version 27.0 for Windows (SPSS INC., Chicago, IL, USA) was used for the analysis, and the level of significance was set at p=0.05.

Results

The 43 participants were divided into 25 from the control group (mean age, 72.1 years) and 18 from the theatre group (mean age, 70.7 years). The comparison demographics of participants for the control group and the theatre group were shown in Table 1. According to the result of χ^2 test, the theater group had a significantly higher percentage of males. Table 2 lists the results of physical functions and cognitive functions for the pre-test and the post-test. The Wilcoxon signed-rank test was used to analyze the differences between pre-test and post-test and revealed significant differences in the UWS (p<0.05) for the control group, and the UWS (p<0.01) for the theatre group, however, there was no significant improvement in cognitive function both the control group and the Theatre group. Next, comparisons of the physical frailty and social frailty for the control group and the theatre group at the pre-test and the post-test were shown in Table 3. As a result of the Wilcoxon signed rank test, physical frailty, and social frailty improved significantly after the intervention in the control group (physical frailty; p<0.01, social frailty; p<0.05) and theatre groups (physical frailty; p<0.05, social frailty; p<0.01).

Finally, as a result of the Mann-Whitney test was applied to compare the amount of change in the physical and cognitive items for control group and theatre group, the amount of the change in UWS in the theatre group was significantly higher than in the control group (p<0.05) (Table 4).

Discussion

This study population was a significantly higher percentage of males for the theatre group than control group. Previous studies have similarly reported that social exchange is less likely in male older adults, thus theatre interventions may be effective in increasing male participation [22].

This study sought to determine whether 3 months of theater training would enhance aspects of cognitive functions and physical functions essential to independent living. The results, the theatre group and control group were improved significantly the UWS from

Table 2: Comparison of physical and cognitive function pre-test and post-test in each group.

	Control group (n=25)					Theatre group (n=18)				
	pre-test		post-test		p value	pre-test		post-test		p value
	Median	IQR	Median	IQR		Median	IQR	Median	IQR	
GS (kg)	24.9	5.4	25	8.5	0.628	26.6	14.1	25.9	12.2	0.897
UWS (m/S)	1.43	0.17	1.52	0.18	0.013*	1.27	0.22	1.35	0.36	0.009**
WM (point)	13.4	1.6	14	2.8	0.203	14.2	2.7	14.2	3.1	0.339
TMT-A (sec)	1.2	0.25	1.2	0.2	0.071	1.17	0.38	1.4	0.38	0.092
TMT-B (sec)	1.9	0.95	1.7	0.8	0.073	2.1	0.58	1.83	0.83	0.917
SDST (point)	46	8	46	11	0.411	48.5	10	48.5	11	0.425

*p<0.05; **p<0.01; Wilcoxon signed rank test

GS: Grip Strength; UWS: Usual Walking Speed; WM: Word list Memory; TMT-A: Trail Making Test A version; TMT-B: Trail Making Test B version; SDST: Symbol Digit Substitution Test

Table 3: Comparison of the physical frailty and social frailty for the control group and the Theatre group at the pre-test and the post-test.

	Control group		p value	Theatre group		p value
	pre-test	post-test		pre-test	post-test	
Physical frailty (%)						
Robust	68	76	0.001*	22.2	50	0.023*
Pre-frailty	28	24		77.8	50	
Frailty	4	0		0	0	
Social frailty (%)						
Robust	20	16	0.008**	44.4	61.1	0.007**
Pre-frailty	40	40		50	38.9	
Frailty	40	44		5.6	0	

*p<0.05; **p<0.01; Wilcoxon signed rank test

Table 4: Comparison of amount of change the physical and cognitive items for the control group and the Theatre group.

	Control group n=25		Theatre group n=18		p value
	Median	IQR	Median	IQR	
GS (kg)	0.5	8.8	0.2	0.2	0.19
UWS (m/S)	0	0.14	0.1	0.23	0.026*
WM (point)	0.4	2.2	0.7	3.7	0.461
TMT-A (sec)	0	0.2	0.1	0.37	0.075
TMT-B (sec)	0	0.4	0.1	0.98	0.411
SDST (point)	2	11	1	10.8	0.804

GS: Grip Strength; UWS: Usual Walking Speed; WM: Word list Memory; TMT-A: Trail Making Test A version; TMT-B: Trail Making Test B version; SDST: Symbol Digit Substitution Test

pre-test to post-test. Especially, amount of the change in UWS in the theatre group was significantly higher than in the control group from pre-test to post-test. Pua et al. were reported that walking speed is strongly associated with balance ability and agility. In other words, we believe that walking speed improves when both balance capacity and agility are combined [23]. The theatrical approach in this study may have been effective in improving gait speed because it incorporated dynamic and quick rhythmic movements, as well as mid-back posture and crouching movements in the play (Figure 3). On the other hand, WM and SDST for cognitive function showed a trend toward improvement after the intervention, but no statistically significant improvement was observed. However, because this participant consisted of healthy, independent-living participants, the cognitive functions were quite high to start with, and ceiling effects might have been present. Theatrical training requires the simultaneous execution of the characters' lines and accompanying actions. The ongoing practice of this kind of complex multitasking may improve the efficiency of real-world dual-task processing. Therefore, we would like to further increase the number of participants and conduct further validation with participants with cognitive decline, such as MCI.

Most interesting in this study, the significant improvement in physical frailty after the intervention, especially was that the improvement in social frailty was markedly more pronounced in a theatre group. Several previous studies have found that increasing age, cognitive impairment, obesity, presence of multiple diseases, low education, and hospitalization are risk factors for worsening frail status, whereas increased physical activity, women, overweight, low alcohol intake, higher education, living alone, and low baseline disability increase the likelihood of improving frailty [24-27]. Although factors

other than training need to be examined in detail, theatrical training may provide similar physical frailty improvement benefits as multi-component training. As Japan's population ages at an accelerated rate, social challenges faced by the elderly are increasing, and social frailty resulting from social challenges is attracting more attention. Also, the emergency situation of thorough social distancing during the COVID-19 pandemic has consequently affected the spread of the epidemic, and our previous study also reported an increase in social frailty after the COVID-19 expansion [28]. Moreover, Makizako et al. reported that among independent community-dwelling older adults who are not physical frail, those who are socially frail may be at greater risk of developing physical frail in the near future, and social frail may precede (and lead to the development of) physical frail [21]. Therefore, prevention and improvement of social frailty is considered an important issue in aging society around the world. Jasmine et al. were reported that evidence on the effectiveness of complex interventions targeting reduction in social vulnerability for improving health related outcomes (mortality, function, cognition, subjective health and healthcare use) in older adults living in the community [29]. According to that report, social support and strengthening the community in which elderly people live in the area are necessary to improve social frailty, and furthermore, reducing social frailty may also help improve the condition of their health [30,31]. Seeman et al. were identified that theater requires each person to perform in front of everyone and that a very powerful group dynamic was created when everyone experienced the same play. The participants in this study were also able to join forces and make friends to accomplish a play, and furthermore, not a single person dropped out. We have confirmed that theater programs can engage and motivate the elderly, and we have also shown that they can strengthen bonds in social situations.

The present study had several limitations. First, the sample sizes for both the control group and Theatre group were quite small. In a further study, we plan to increase the sample size. Second, the participants were not blind to interventions, and this study lacked a control group with no treatment. Case-control comparisons with blinding are needed in addition to before and after the intervention. Third, participants in this study may be healthful and higher cognitive function than non-participants. These requirements should be adjusted for further additional research in the future.

Conclusion

We have shown that a theatrical intervention can be as effective as the multicomponent exercise recommended in previous frailty prevention. Furthermore, the theatrical intervention was suggested to be effective in strengthening the community of participants, and improving social frailty. Therefore, theatrical intervention needs to be further studied to become a new intervention method for the prevention of frailty. Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

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