



Short Communication

Effective Strategy of the Multicomponent Exercise Program for Older Individuals in a Depopulated Rural Region

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SUMMARY

The aim of this study was to examine whether the multicomponent exercise program based on an independent home-training can become effective strategy for Japanese older people in a depopulated rural region. Twenty participants over 65 years old without cognitive impairment exercised for 90-min a day, once per 2 weeks for 6 months, according to education regarding an independent home-exercise. The exercise program was conducted under multitask conditions to cognition, including an aerobic exercise. Physical and cognitive measurements were carried out at baseline and after the 6-month intervention. The physical measurement consisted of four domains, and the cognitive evaluation included four domains. 12 older adults (age mean: 76.9 years, % female: 91.6%) completed the 6-month follow-up. According to statistical analyses, the walking speed was significantly faster, and the executive function also had significantly increased after the intervention. Our findings suggest that the multicomponent exercise program based on home-training can be effective for enhancements of the gait ability and the executive function for older individuals in a depopulated rural region.

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1. Introduction

Effects of a multicomponent exercise have been commonly recognized in older individuals with or without mild cognitive impairment (MCI), particularly including improvements of memory and executive function on cognition.^{1–4} Of such backgrounds, our preliminary study has reported that the multicomponent exercise program may enhance memory function in older individuals in a depopulated rural region.⁵ Typically, although the exercise group has been assembled in one place and has exercised for 60 to 90-min a day, 2 to 4 days a week for 6 months,^{1–3} these situations seem to be extremely difficult for older adults in a underpopulated rural area in Japan because of the limitation of transport access. Thus, it is a substantial challenge to make rehabilitative strategy regarding how older individuals in a depopulated area establish the exercise program. The aim of this study was to clarify if the multicomponent exercise program based on the independent home-training can become effective strategy for Japanese older people in a depopulated area, in comparison with our preliminary study.

2. Methods

20 participants were recruited making public by bulletin from adults over 65 years old in Oga city (a total population and a rate aged over 65 years in 2017 was, in order, 27,141 people and 44.0%),

getting informed consent for the present study. All the participants have no history of neurological and other serious health problems, not classified into the MCI by Clinical Dementia Rating.⁶ The exercise program was performed for 90 min, once per 2 weeks for 6 months, based on the protocol of Suzuki et al. study (2013). A 90-min exercise program was practiced for the participants, comprised of 10 min of stretching, 20 min of muscle strength exercise, and 60 min of aerobic exercise, postural balance and dual-task training. One trained occupational therapist in geriatric rehabilitation supervised for each session. Physical and cognitive measurements were performed at baseline and after the 6-month intervention. The physical measurement consisted of the 10 meter walking test, the timed up and go test, the grip strength and the five-repetition sit-to-stand test. The cognitive evaluation also included word recognition as memory, the tablet version of trail making test-part A (TMT-A) & part B (TMT-B) and the tablet version of the symbol digit substitution task, using the National Center for Geriatrics and Gerontology functional assessment tool.⁷ All the participants were instructed in how to apply the multicomponent exercise to independent home-training, using the textbook with photos and the DVD video. According to these instructions, the participants practiced the exercise program continuously throughout 6 months. The Wilcoxon signed rank test was applied to compare the results between pre- and post-tests. A variation (Δ) between the pre- and post-tests for the preliminary and the present studies was analyzed by The Mann-Whitney test. This study was approved by the ethics committee of the Department of Health Sciences, Akita University (approval No. 1769).

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Table 1

The comparison of pre- and post-test in the participants, and variations between the present and the preliminary studies.

	the present study (N = 12)		Kume et al. (2017) (N = 7)		p				
	Mean	SD	Mean	SD					
Demographic data									
Age (year)	76.9	3.9	68.3	2.8	p < 0.001				
Education (year)	10.8	1.7	10.6	2.6	0.86				
Gender (% female)	92%		100%		0.63				
Exercise condition	90 min, once per 2 weeks, 6 months		90 min, once per 1 week, 6 months		@				
	Pre-test	Post-test	p	$\Delta 1$	Pre-test	Post-test	p	$\Delta 2$	$\Delta 1$ vs $\Delta 2$, p
	Median (IQR)	Median (IQR)			Median (IQR)	Median (IQR)			
10 meter walking test (s)	6.3 (1.8)	5.6 (0.9)	0.003**	-0.6 (0.6)	no data	no data	-	-	-
Timed up and go test (s)	6.3 (1.9)	6.3 (1.1)	0.27	-0.2 (1.0)	5.7 (0.4)	5.9 (0.6)	0.31	0.3 (0.5)	0.20
Grip strength (kg)	23.5 (5.6)	25.1 (6.0)	0.45	0.8 (3.6)	20.3 (5.8)	22.6 (6.6)	0.18	1.0 (4.2)	0.50
Five-repetition sit-to-stand test (s)	7.8 (2.0)	6.4 (1.9)	0.003**	-1.7 (1.2)	6.7 (2.2)	6.2 (1.2)	0.09	-1.0 (1.4)	0.11
Word recognition (score)	10.7 (4.1)	11.2 (3.8)	0.43	0.2 (5.0)	10.3 (5.7)	14.7 (6.3)	0.03*	2.3 (2.8)	0.22
Tablet version of TMT-A (s)	24.5 (8.3)	24.5 (6.3)	0.91	-1.5 (10.3)	16.0 (19.0)	19.0 (16.0)	0.92	-1.0 (6.0)	0.93
Tablet version of TMT-B (s)	48.0 (67.0)	43.0 (16.3)	0.02*	-5.0 (51.8)	28.0 (21.0)	30.0 (29.0)	0.40	0 (8.0)	0.005 ^{††}
Tablet version of SDST (score)	34.0 (7.0)	35.5 (7.0)	0.40	1.5 (8.3)	48.0 (20.0)	48.0 (20.0)	0.14	0 (4.0)	0.13

The symbol of Δ means a variation between pre- and post-tests for each study.

SD, standard deviation; IQR, interquartile range; SDST, Symbol Digit Substitution Task; TMT, Trail Making Test.

* p < 0.05; ** p < 0.01; the Wilcoxon signed rank test, ^{††} p < 0.01; the Mann-Whitney test.

3. Results

12 participants completed the 6-month follow-up. Table 1 indicates the results of pre- and post-test, and the Δ for the present ($\Delta 1$) or the preliminary study ($\Delta 2$). Most importantly, the required time $\Delta 1$ of TMT-B (median, interquartile range: -5.0, 51.8) was significantly shorter than the $\Delta 2$ (0, 8.0) (p = 0.005).

4. Discussion

The results of this study suggest that executive function and the gait ability were significantly enhanced after the intervention, lending support to results of previous studies.^{2,5,8} Additionally, our findings including comparison with the previous preliminary study may indicate that instructions of independent training using audio-visual education can be more effective strategy for enhancements of executive function brought by the multicomponent exercise program.^{2,9} In conclusion, these findings support the view that the multicomponent exercise program is applicable for the improvements of cognitive and physical function in older people living in a depopulated rural region. However, the limitations of this study were the small-sized sample, no control group and the high drop-out rate, which needs to be considered in the future study.

Conflict of Interest

All the authors have no conflict of interest to declare.

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