

Associations between the settings of exercise habits and health-related outcomes in community-dwelling older adults

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Abstract. [Purpose] The purpose of this study was to examine the associations between the settings of exercise habits and health-related outcomes in community-dwelling older adults. [Subjects] A total of 304 Japanese community-dwelling older adults (70.3 ± 4.1 years; 113 males and 191 females) participated in this study. [Methods] Demographic characteristics, medical conditions, exercise habits, and health-related outcomes were assessed by face-to-face interviews and self-reported questionnaires. Older adults who had exercise habits were classified into two groups: individual- and group-based exercise habits groups, and the health-related outcomes were compared between groups. [Results] The scores for the Geriatric Depression Scale, exercise self-efficacy, and dietary variety of older adults who had group-based exercise habits were better than those of older adults who had individual-based exercise habits. In addition, the exercise settings (individual- and group-based) were significantly associated with scores for the Geriatric Depression Scale (odds ratio = 0.76) and exercise self-efficacy (odds ratio = 1.26), even after adjusting for age and gender. [Conclusion] These results implied that habitual exercise in group settings may have an effective role in promoting exercise self-efficacy and mental health.

Key words: Exercise habits, Group exercise, Exercise self-efficacy

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INTRODUCTION

Regular physical activity and exercise habits facilitate healthy aging, improve functional capacity, and prevent disease in older adults. Previous studies have shown that exercise habits maintain muscle strength^{1, 2)} and physical performance³⁾ in older adults. For example, Akune et al. reported that exercise habits in middle age were significantly associated with grip strength, gait speed, one-leg standing time, and the prevalence of sarcopenia in older age³⁾. Regular physical activity was also associated with a lower incidence of morbidity of major chronic diseases, such as coronary heart disease^{4, 5)} and type 2 diabetes⁶⁾. On the other hand, Lee et al. quantified the effects of physical inactivity on major non-communicable diseases by calculating population attributable fractions associated with physical inactivity. They estimated that physical inactivity causes 6% of the burden of disease from coronary heart disease, 7% of that

from type 2 diabetes, and 10% of that from breast cancer and colon cancer and that elimination of physical inactivity would increase the life expectancy of the world's population by 0.68 years⁷⁾. In addition, some recent studies have found that physical activity and exercise are associated with cognitive function^{8–10)}, mental health¹¹⁾, and health-related quality of life^{12, 13)}. Therefore, it is important to maintain regular physical activity and exercise habits.

On the basis of these reports, recommended contents of regular exercise have reached a high level of consensus. For instance, the Japanese Ministry of Health, Labour and Welfare gives clear reference values for intensity, duration, and frequency of habitual exercise required for the good health of older adults in *Physical Activity Reference for Health Promotion 2013*¹⁴⁾. However, little is known about differences in the detailed characteristics of health-related outcomes, including medical conditions, depression, dietary variety, functional capacity, fall history, self-efficacy, and self-rated health, between exercise and non-exercise groups or between individual- and group-based exercise groups. We hypothesized that individual- and group-based exercise habits could have different roles with respect to health-related outcomes in older adults, because different effects between individual- and group-based exercise have reported in some exercise intervention studies^{15, 16)}.

The purpose of this study was to examine the associations

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between the settings of exercise habits and health-related outcomes in community-dwelling older adults.

SUBJECTS AND METHODS

Subjects

A total of 304 Japanese community-dwelling older adults (70.3 ± 4.1 years, 113 males and 191 females) participated in this study. All participants were ambulatory and independently performed activities of daily living. Participants were excluded if they were hospitalized for longer than 1 week during the 3-month period before the study. Participants were also excluded if they were diagnosed with stroke, Parkinson's disease, depression, or dementia. We also excluded participants with a Mini Mental State Examination (MMSE) score below 20 from analyses^{17, 18}. Finally, we analyzed the data of 266 participants who had completed the study's face-to-face interviews and self-reported questionnaires. The ethical aspects of the study were approved by the Sapporo Medical University Hospital Ethics Committee (Approval No. 24-2-43). We obtained written informed consent from each patient before study initiation.

Methods

Demographic characteristics (i.e., age, gender, annual income, and education level), medical conditions (i.e., hypertension, heart disease, and diabetes mellitus), exercise habits, and health-related outcomes were measured using face-to-face interviews and self-reported questionnaires. Health-related outcomes included the Motor Fitness Scale (MFS), MMSE, Geriatric Depression Scale (GDS), frequency of going outdoors, an 11-item food frequency score, the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC), history of falls, level of exercise self-efficacy, and self-rated health. Exercise habits were defined as engaging in exercise more than three times a week for at least 30 minutes a time. Participants who reported exercise habits were asked about their attendance at group-based exercise using an additional question: "Are you performing group exercise regularly?"

To estimate levels of physical function, the MFS was measured. This scale consisted of 14 items including mobility, strength, and balance. It has been reported to be highly reliable ($\alpha = 0.92$ and test-retest = 0.92)¹⁹. The MMSE was assessed as a measure of general cognitive function²⁰. Depressive symptoms were assessed using the 15-item GDS, which requires yes/no responses to questions about depression²¹. To estimate mobility outside the home, participants were asked the frequency of going outdoors per week, and the responses were recorded on an 8-point scale ranging from "seven days per week" (7) to "less than once per week" (0). The 11-item food frequency score was used to assess dietary variety. It consists of 11 main food groups (fish, meat, eggs, milk, milk products, beans, vegetables, seaweed, potatoes, fruits, and lipids) and participants were asked the frequency of eating these foods in the course of a week using a 4-point scale ranging from "nearly every day" (1) to "very little" (4). Total scores were used (score range 11–44), with lower scores indicating higher dietary variety. The TMIG-IC consists of 13 items regarding high-level functional capac-

ity (5 items for instrumental self-maintenance, 4 items for intellectual activity, and 4 items for social role). The validity and reliability of this index have been previously verified and it is widely accepted in Japan as a tool to assess functional capacity²². History of falls was assessed using the following question: "In the past 1 year, have you had any falls including a slip or a trip in which you lost your balance and landed on the floor or ground or a lower level²³?" The level of exercise self-efficacy was measured on a scale that assessed a participant's confidence in engaging in exercise when faced with common barriers. Participants rated their levels of confidence on a scale of 1 to 5 in terms of their ability to exercise under the following conditions: tiredness, bad mood, lack of time, holidays, and poor weather conditions. The test-retest reliability (2 weeks) of this scale has been reported (intra-class correlation coefficient = 0.90)²⁴. Self-rated health was assessed by asking respondents to describe their health status using a 4-point scale ranging from "very good" (1) to "very poor" (4).

Participants were divided into two groups: a habitual exercise group and a non-exercise group. Then, we classified participants who had exercise habits into two groups according to settings of exercise habits: individual-based exercise habits group and group-based exercise habits group. Mann-Whitney U tests (for continuous variables) and χ^2 tests (for categorical variables) were performed to compare variables. First, a comparison was made between the habitual exercise group and non-exercise group; then a comparison was made between the individual- and group-based exercise habits groups. In addition, logistic regression analysis was performed to identify the relationships between the settings of exercise habits and health-related outcomes. Crude odds ratios (OR) were calculated for each of the health-related outcomes with significant differences in the comparison between the individual- and group-based exercise habits groups (model 1). In addition, logistic regression analysis was performed adjusted for age and gender (model 2). All statistical analyses were performed using IBM SPSS Statistics 19.0 (IBM Japan Ltd., Tokyo, Japan). The threshold for statistical significance was defined as $p < 0.05$.

RESULTS

One hundred fifteen (43.2%) participants had exercise habits. Sixty (22.6%) participants had individual-based exercise habits, and fifty-five (20.7%) had group-based exercise habits. The scores for the MFS, exercise self-efficacy, and self-rated health of participants who had exercise habits were significantly better than those of participants who had no exercise habits (Table 1). The scores for exercise self-efficacy, the food frequency score, and the GDS of participants who had group-based exercise habits were significantly better than those of participants who had individual-based exercise habits. Participants who had group-based exercise habits had significantly higher ratio of females (Table 2).

Logistic regression analysis revealed that differences in the settings of exercise were significantly associated with the GDS scores (OR = 0.76 , 95% CI = 0.65 – 0.90 ; $p < 0.01$) and level of exercise self-efficacy (OR = 1.26 , 95% CI = 1.11 – 1.44 ; $p < 0.01$), even after adjusting for age and gender.

Table 1. Comparison of characteristics between the non-exercise and habitual exercise groups

		Non-exercise (n = 151)	Habitual exercise (n = 115)
Age	(years)	70.3 ± 4.2	70.1 ± 3.8
Gender	(female, %)	99 (65.6)	74 (64.3)
Medical conditions	(yes, %)		
Hypertension		74 (49.0)	58 (50.4)
Heart disease		26 (17.2)	14 (12.2)
Diabetes mellitus		27 (17.9)	15 (13.0)
Annual income	(≥1 million yen, %)	101 (66.9)	78 (67.8)
Education level	(years)	11.6 ± 2.2	11.8 ± 2.3
MFS	(score)	11.4 ± 2.7	12.1 ± 2.1**
MMSE	(score)	26.6 ± 2.4	26.9 ± 2.1
GDS	(score)	4.3 ± 3.0	3.7 ± 2.9
Frequency of going outdoors	(days/week)	4.3 ± 2.0	4.4 ± 1.9
Food frequency score	(score)	24.4 ± 5.9	23.2 ± 4.4
TMIG-IC	(score)	12.0 ± 1.2	12.1 ± 1.1
History of falls	(yes, %)	38 (25.2)	23 (20.0)
Exercise self-efficacy	(score)	13.9 ± 4.4	17.3 ± 3.7**
Self-rated health	(1–4)	2.3 ± 0.6	2.1 ± 0.5**

Data are expressed as means ± standard deviation and frequencies (%).

MFS: Motor Fitness Scale; MMSE: Mini Mental State Examination; GDS: Geriatric Depression Scale; TMIG-IC: Tokyo Metropolitan Institute of Gerontology Index of Competence

*p < 0.05; **p < 0.01; p values based on the Mann-Whitney U test for continuous variables and χ^2 test for categorical variables

Table 2. Comparison of characteristics between individual- and group-based exercise habits

		Individual-based exercise habits (n = 60)	Group-based exercise habits (n = 55)
Age	(years)	69.9 ± 3.8	70.3 ± 3.8
Gender	(female, %)	30 (50.0)	44 (80.0)**
Medical conditions	(yes, %)		
Hypertension		34 (56.7)	24 (43.6)
Heart disease		7 (11.7)	7 (12.7)
Diabetes mellitus		10 (16.7)	5 (9.1)
Annual income	(≥1 million yen, %)	42 (70.0)	36 (65.5)
Education level	(years)	12.1 ± 2.5	11.5 ± 1.9
MFS	(score)	12.0 ± 2.2	12.1 ± 2.0
MMSE	(score)	26.6 ± 2.2	27.1 ± 2.0
GDS	(score)	4.5 ± 3.0	2.8 ± 2.6**
Frequency of going outdoors	(days/week)	4.2 ± 2.0	4.6 ± 1.7
Food frequency score	(score)	23.9 ± 4.3	22.3 ± 4.4**
TMIG-IC	(score)	11.9 ± 1.3	12.2 ± 0.9
History of falls	(yes, %)	11 (18.6)	12 (21.8)
Exercise self-efficacy	(score)	16.4 ± 4.0	18.2 ± 3.1**
Self-rated health	(1–4)	2.1 ± 0.6	2.0 ± 0.4

Data are expressed as means ± standard deviation and frequencies (%).

MFS: Motor Fitness Scale; MMSE: Mini Mental State Examination; GDS: Geriatric Depression Scale; TMIG-IC: Tokyo Metropolitan Institute of Gerontology Index of Competence

*p < 0.05; **p < 0.01; p values based on the Mann-Whitney U test for continuous variables and χ^2 test for categorical variables

Table 3. Odds ratios for the relationships between differences in exercise settings and health-related outcomes

Independent variables	Model 1 (crude)		Model 2 (adjusted)	
	OR	95% CI	OR	95% CI
GDS	0.80**	0.69–0.92	0.76**	0.65–0.90
Food frequency score	0.92	0.84–1.00	0.93	0.85–1.02
Exercise self-efficacy	1.16*	1.03–1.29	1.26**	1.11–1.44

Exercise settings of exercise habits were dummy coded (individual-based exercise habits = 0, group-based exercise habits = 1). Model 2 was performed adjusting for age and gender.

OR: odds ratio; CI: confidence intervals

* $p < 0.05$; ** $p < 0.01$

However, food frequency scores were not significantly associated with the settings of exercise habits (Table 3).

DISCUSSION

The present study examined the associations between the settings of exercise habits and health-related outcomes in community-dwelling older adults. With regard to the presence of exercise habits, the scores for physical functions, exercise self-efficacy, and self-rated health of participants who had exercise habits were significantly better than those of participants who had no exercise habits. Previous studies found that good exercise habits were associated with good physical fitness^{3, 25}) and good self-rated health²⁶), which is congruent with the results of the present study. Self-efficacy is one of the principal Social Cognitive Theory constructs and is defined as an individual's beliefs about his/her own ability to engage in a task successfully to obtain a desired outcome²⁷). Marcus et al. proposed assessment of the level of exercise self-efficacy to determine self-efficacy related to exercise behaviors²⁸). Previous studies have shown the relationship between the level of exercise self-efficacy and the stage of change for exercise behaviors^{29, 30}). Therefore, we have confirmed the importance of self-efficacy for good exercise habits in community dwelling older adults.

With regard to the settings of exercise habits, we also compared health-related outcomes between different settings of exercise habits. The scores for dietary variety of participants who had group-based exercise habits were significantly better than those of participants who had individual-based exercise habits. This result is in line with a previous study that demonstrated that good exercise habits were associated with good dietary habits³¹). The scores for the GDS and exercise self-efficacy of participants who had group-based exercise habits were significantly better than those of participants who had individual-based exercise habits. In addition, logistic regression analysis indicated significant benefits of group-based exercise habits on GDS scores and level of exercise self-efficacy; this remained significant after adjusting for age and gender. We considered several reasons for this finding. First, group exercise has a potentially positive effect on mental aspects. Yokoyama et al. reported that subjects who had participated in a group-based exercise program showed significantly higher achievement satisfaction and self-efficacy compared with those who had participated in an individual-based exercise program during a 3-month inter-

vention study. The authors considered that the group-based exercise program provided participants with opportunities to compare their levels of physical fitness or exercise acquisition, resulting in new motivation¹⁵). Similarly, the GDS scores and level of exercise self-efficacy might have been particularly influenced by participation in an exercise group in a positive way in the present study. Second, group exercise might build a social support network. For older adults, group-based physical activities (e.g., Tai Chi, folk dancing, jogging, hill walking) can provide important opportunities to bond with close friends and family and bridging individuals, which might help in daily functioning³²). It is known that social support affects exercise self-efficacy, so participation in group activity might promote exercise efficacy regardless of whether the activity includes any exercise. Third, differences in the settings of exercise might influence adherence to exercise habits. It is known that group-based exercise programs tend to demonstrate higher levels of adherence to exercise than individual-based exercise programs³³). Therefore, high continuity of exercise might have increased the benefit of exercise habits in participants who reported group-based exercise habits in the present study. For these reasons, group-based exercise habits have important implications for health promotion in community-dwelling older adults.

Our study had several limitations. First, this study was cross-sectional, so it cannot demonstrate causation between exercise habits and health-related outcomes. Therefore, more prospective data are needed to determine the relationship between group-based exercise habits and level of exercise self-efficacy and depressive symptoms. Second, we did not investigate the details of the exercise, such as intensity, duration, and frequency of exercise, and thus further studies would be required to reveal the quantitative relationships between amounts of habitual exercise in group settings and health-related outcomes.

In conclusion, we found that group-based exercise habits were associated with lower levels of depressive symptoms and higher levels of exercise self-efficacy compared with individual-based exercise habits in community-dwelling older adults. These results implied that habitual exercise in group settings may have an effective role in promoting exercise self-efficacy and mental health. Our study results extend our current understanding of the benefits of exercise habits on health promotion in community-dwelling older adults.

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