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Original Article

Instrumental activities of daily living and number of daily steps in frail older females

Suguru Ando, PT, MSc[1, 2)*], Yumi Higuchi, PT, PhD[1)], Tomomi Kitagawa, PT, MSc[1)], Tatsunori Murakami, PT, MSc[1)], Emiko Todo, PT, MSc[1)], Tetsuya Ueda, PT, PhD[1)]

[1)] *Graduate School of Comprehensive Rehabilitation, Osaka Prefecture University: 3-7-30 Habikino, Habikino-shi, Osaka 583-0855, Japan*
[2)] *Department of Physical Therapy, Faculty of Health Science, Aino University, Japan*

Abstract. [Purpose] Reportedly, males take fewer steps than females among frail older adults. The step count of frail older adults may be influenced by domestic roles in the instrumental activities of daily living. In this study, we aimed to investigate the association between instrumental activities of daily living and the number of steps in frail older females. [Participants and Methods] In this cross-sectional study, we included 27 frail older females aged 84.4 ± 6.5 years who attended a day-care center. We used the Fillenbaum's instrumental activities of daily living screener and measured the number of steps using an accelerometer, functional independence measure, grip strength, and short physical performance battery. We investigated the association between instrumental activities of daily living and daily steps. Furthermore, we compared the outcomes of the differences in the independence using a subscale of instrumental activities of daily living. [Results] Instrumental activities of daily living and step counts showed a significant correlation. Participants dependent on meal preparation and housework took significantly fewer steps per day. The dependence of their activities also caused low functional independence measure and weak grip strength. [Conclusion] In frail older females, decreased ability for instrumental activities of daily living were associated with fewer steps. Domestic roles may increase the daily steps in frail older adults.

Key words: Instrumental activities of daily living, Daily steps, Frail older adults

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INTRODUCTION

Independence of activities of daily living (ADL) reflects a high level of activity[1)]. Independent living ability of frail older adults is generally measured in questionnaires known for Instrumental ADL (IADL)[2, 3)]. IADL is a higher-order physical activity than Basic ADL (BADL) and refers to the cognitive function and the necessary activity ability to lead an independent life[4–6)]. One of the most convenient indices for measuring physical activity is the number of steps taken[7–9)]. However, the association between IADL and number of steps has not been reported. Since IADL reflects higher living activities, it is important to investigate whether it is independent in order to comprehend the level of physical activity in frail older adults.

We investigated the number of steps taken by frail older adults by gender during the attending and non-attending days in the day-care center[10)]. As a result, it was reported that males were lower in number of steps than females on non-attending days. Previous studies have reported that males have less IADL than females[11)]. Based on the results of our previous research, the difference in the domestic roles represented by IADL was considered to be influenced by the number of steps.

The number of steps of frail older adults may be not affected by gender but is influenced by the independence of IADL. Therefore, we hypothesized that the number of steps would be reduced in those who decreased in IADL ability. The purpose of this study was to investigate the association between the instrumental activities of daily living and the number of daily steps in frail older females.

*Corresponding author. Suguru Ando (E-mail: s-ando@pt-u.aino.ac.jp)

PARTICIPANTS AND METHODS

In total, 27 frail older females attending a day-care center were asked to participate in this cross-sectional study. Participants were recruited from three day-care centers, of which two are in Osaka Prefecture and one is in Shiga Prefecture. Inclusion criteria were as follows: aged 65 years or older; able to walk indoors by themselves (regardless of the use of auxiliary tools); able to understand the purpose of the study; and willingness to provide consent. Exclusion criteria were as follows: pacemaker implantation and Mini-Mental State Examination (MMSE) score under 24.

A verbal explanation of the purpose of this study was provided to eligible older adults and written informed consent was obtained. The study was conducted with the approval of the Research Ethics Committee of Osaka Prefecture University (2019–119), initiated after registration with the Research Ethics Committee of University Hospital Medical Information Network Center (registration number: UMIN000023191).

We assessed body height, weight, MMSE, and Geriatric Depression Scale 5 as basic characteristics. In addition, we recorded the age, the frequency per week attending the day-care center, marital status, and cohabiting family. Body mass index (BMI) was defined as body mass (kg)/height^2 (m^2). In addition, we measured IADL and number of daily steps as a primary outcome, basic activities of daily living (BADL), the grip strength and the Short Physical Performance Battery (SPPB) as secondary outcomes.

IADL was assessed using the Fillenbaum's IADL (FIADL) screener[12]. This questionnaire consists of five items: 1) Can you get to places out of walking distance? 2) Can you go shopping (groceries/clothing)? 3) Can you prepare your own meals? 4) Can you do your housework? and 5) Can you handle your own money? Participants receive 1 point when they can perform the task without assistance. When some kind of assistance is needed, they receive 0 point. More than 4 points reflect high independence in IADL[13].

For the objective measurement of the number of steps, we used a wrist-worn three-axis accelerometer (UP2, Jawbone Inc., San Francisco, CA, USA) and measured the number of steps in 24 hours for eight days. This device can check the number of steps by Bluetooth synchronizing the device with the smartphone on which the UP2-dedicated application is installed. Reliability and validity of this device had been reported in many previous studies[14–16]. Accurate measurements at the optimum speed has also been confirmed in older adults[17]. The mean number of steps was calculated from the accelerometer data of six days excluding the first and last days.

BADL measured the Functional Independence Measure (FIM)[18]. FIM score range is 18–126, with higher scores indicating higher activity levels. Grip strength was measured twice on each hand using a Smedley-type grip gauge in a sedentary sitting position, and the maximum value was taken as representative[19]. SPPB is an indicator of overall physical performance by examining the balance function, walking speed, and sitting-to-standing time. Specifically, it measures standing time on both feet, semi-tandem and tandem positions, maximum walking speed of a distance of 4 m, and standing/sitting time five times. This assessment has been used by international working groups and has reported to be highly reliable and valid as an indicator of the physical performance of frail older adults[20, 21].

Descriptive statistics were calculated for all variables and normality was evaluated using the Shapiro-Wilk test. For the relationship between FIADL and steps count, the Spearman rank correlation coefficient was used. Further, age-adjusted partial correlation analyses were performed. In addition, as a secondary analysis, a two-group comparison of each outcomes with FIADL's results (independence=1, dependence=0) was performed using Student's t test. ALL statistical analyses were performed with SPSS version 25 for Windows (IBM Corporation, Armonk, USA). The level of significance was set at 0.05.

RESULTS

Table 1 shows basic characteristics and outcome measures for participants in this study. The participants were older people over the age of 80 and took by very few numbers of daily steps. FIADL and the number of steps showed a significant moderate correlation ($r=0.432$, $p=0.024$). Furthermore, even if partial correlation adjusted by age was performed, FIADL and step count showed a significant association ($r=0.454$, $p=0.020$). The results of the comparison of the FIADL subscale are shown in Table 2. Participants who were able to prepare meals and do housework were significantly higher in daily steps count than the dependent group ($p=0.030$, $p=0.005$, respectively). The independent group had a significantly higher FIM scores than the dependent group except for the item "Going shopping". Participants who can get to places out of walking distance, can prepare for meals, and can do housework were significantly higher in grip strength. SPPB was significantly related to being able to get to places out of walking distance and meal preparation.

DISCUSSION

This cross-sectional study revealed that there was a moderate correlation between FIADL and the number of steps of frail older females attending the day-care centers. In addition, frail older females who cannot prepare meals and cannot do housework by themselves had taken significantly lower steps than those who are independent. The strength of this study was to reveal that the higher IADL increased the number of daily steps even in frail older females.

Table 1. Characteristics and outcmes of study participants (n=27)

Age (years)		84.4 ± 6.5
Height (cm)		146.0 ± 6.1
Weight (kg)		48.4 ± 10.5
Body mass index (kg/m^2)		22.7 ± 4.7
Mini-Mental State Examination (scores)		26.9 ± 1.8
Geriatric Depression Scale 5 (scores)		2.0 (1.0–2.0)
Frequency per week attending day-care center (times/week)		2.0 (1.0–3.0)
Married, n (%)		24 (88.9)
Cohabiting family, n (%)		19 (70.4)
FIADL (score), median		3.0 (1.0–4.0)
Can you get to places out of walking distance?	independence, n (%)	12 (44.4)
Can you go shopping (groceries/clothing)?	independence, n (%)	9 (33.3)
Can you prepare your own meals?	independence, n (%)	16 (59.2)
Can you do your housework?	independence, n (%)	22 (81.4)
Can you handle your own money?	independence, n (%)	14 (51.9)
Number of steps (steps/day)		1,571.4 ± 860.6
Functional Independence Measure (scores)		115.3 ± 6.8
Grip strength (kg)		14.9 ± 3.6
Short Physical Performance Battery (scores)		7.3 ± 2.7

Data are presented in mean ± SD or median (IQR) or frequency (percentage).
IQR: Interquartile range; FIADL: Fillenbaum's instrumental activities of daily living.

The low FIADL scores (3.0 scores at the median) suggested that most of the participants in this study were dependent in IADL, while daily life activities were performed with a little assistance in ADL presented by an average of 115.3 FIM scores. Moreover, the average number of steps was less than 2,000 steps per day. In previous studies, individuals taking less than 2,000 steps have been reported to be at risk for bedridden[22, 23]. From the above reason, the sphere of their daily activities was limited to their home, and we suggested that most of their steps were achieved by the indoor activities.

IADL shows higher life functions than BADL. Loss of muscle strength, muscle mass, SPPB and cognitive function cause impairment of IADL[6, 24–26]. Excessive social participation has also been reported to lead to IADL disability[27]. However, there is no report on IADL and the number of steps per day, which is an objective indicator of the activity. In our study, IADL was moderately correlated with the number of steps adjusted by age. This indicates that IADL is related not only to the body function and the participation but also to objective activities. It is suggested that maintenance and increase of the number of steps are necessary for IADL independence of the frail adults.

Among FIADL's subscales, participants who were independent of meals preparation and housework had significantly higher number of steps than those who were dependent. Previous research has shown that housework and shopping disabilities are most likely to occur in the individuals older than 60 years of age[28]. With regard to meals preparation, this activity may include not only planning the cooking menu and cooking but also going out to shop for groceries. As for the household, the participants live mainly indoors. Thus, we considered that independence of meal preparation and housework made them increase the number of daily steps.

This study was limited by the small sample size, which may limit generalizability of our findings. Our cross-sectional design does not allow us to determine whether the dependence of the FIADL directly leads to a decrease in the number of steps. The number of daily steps may have been affected by seasonal fluctuations. Further studies should investigate the causality of IADL disorders with large sample sizes.

In conclusion, IADL dependent frail older females significantly negatively affected the number of daily steps compared to those who were independent in IADL.

Conflict of interest

None.

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Table 2. Comparison of FIADL subscale (yes or no)

	Independent group	Dependent group	p-value
Can you get to places out of walking distance?	n=12	n=15	
Age (years)	84.8 ± 6.0	84.1 ± 7.1	0.812
Number of steps (steps/day)	1,900.8 ± 821.9	1,307.9 ± 822.9	0.075
Functional Independence Measure (scores)	118.9 ± 4.1	112.4 ± 7.3	0.011
Grip strength (kg)	16.6 ± 3.9	13.5 ± 2.6	0.021
Short Physical Performance Battery (scores)	8.6 ± 1.7	6.3 ± 2.9	0.026
Can you go shopping (groceries/clothing)?	n=9	n=18	
Age (years)	84.0 ± 4.6	84.6 ± 7.4	0.795
Number of steps (steps/day)	1,849.2 ± 1150.5	1,432.5 ± 669.7	0.337
Functional Independence Measure (scores)	117.3 ± 4.2	114.3 ± 7.6	0.281
Grip strength (kg)	15.7 ± 2.1	14.5 ± 3.3	0.412
Short Physical Performance Battery (scores)	8.4 ± 4.5	6.8 ± 2.8	0.127
Can you prepare your own meals?	n=16	n=11	
Age (years)	82.3 ± 6.3	87.5 ± 5.6	0.035
Number of steps (steps/day)	1,841.8 ± 949.7	1,178.3 ± 534.4	0.030
Functional Independence Measure (scores)	118.9 ± 3.4	110.1 ± 7.3	<0.001
Grip strength (kg)	16.5 ± 3.3	12.6 ± 2.6	0.004
Short Physical Performance Battery (scores)	8.2 ± 2.0	6.1 ± 3.0	0.042
Can you do your housework?	n=22	n=5	
Age (years)	83.9 ± 6.3	86.6 ± 7.6	0.414
Number of steps (steps/day)	1,690.9 ± 911.4	1,045.8 ± 170.9	0.005
Functional Independence Measure (scores)	116.6 ± 6.6	109.4 ± 4.8	0.029
Grip strength (kg)	15.6 ± 3.4	11.7 ± 2.1	0.021
Short Physical Performance Battery (scores)	7.5 ± 2.8	6.4 ± 1.8	0.395
Can you handle your own money?	n=14	n=13	
Age (years)	84.3 ± 6.5	84.5 ± 6.8	0.922
Number of steps (steps/day)	1,823.9 ± 929.8	1,299.5 ± 716.6	0.115
Functional Independence Measure (scores)	117.8 ± 4.2	112.6 ± 8.2	0.047
Grip strength (kg)	16.1 ± 3.9	13.6 ± 2.7	0.059
Short Physical Performance Battery (scores)	7.6 ± 2.3	7.0 ± 3.1	0.541

Data are presented in mean ± SD. FIADL: Fillenbaum's instrumental activities of daily living.

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