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Inactive Time is Associated with Activities of Daily Living Ability in Sarcopenic Older Adults Requiring Care

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Abstract

Background: Older adults requiring care are more prone to sarcopenia (SP) and engage in limited physical activity. Further, reduced physical activity is known to affect the ability to perform activities of daily living (ADLs). Previous studies have described a significant association between inactive time and ADL ability in older adults requiring care, but little is known about this association in sarcopenic older adults. Therefore, this cross-sectional study aimed to explore the relationship between inactive time and ADL ability in sarcopenic older adults requiring care.

Methods: We included 46 older adults aged ≥65 years requiring care with SP and measured their inactive time and ADL ability using the International Physical Activity Questionnaire short version (Japanese version) and Barthel Index (BI), respectively. Based on BI scores, the subjects were into two groups (ADL independent group [BI = 100] and ADL dependent group [BI < 100]).

Results: Inactive time was significantly higher in the ADL dependent group than in the ADL independent group ($p < 0.05$). Multiple logistic regression analysis with two groups (BI = 100 and BI < 100 groups) as dependent variables revealed that this association was still significant even after adjusting for confounding factors like sex ($p < 0.05$).

Conclusion: Greater inactive time limits the ADL ability in sarcopenic older adults requiring long-term care; therefore, strategies aimed at reducing inactive time could help maintain or improve their ADL ability.

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Background

Sarcopenia (SP) is the primary symptom of age-related loss of muscle mass, which results in an increased risk of falls, fractures, and frailty [1]. It is also associated with a significant loss of independence in activities of daily living (ADLs) [2,3]. As the world population is aging, the aging rate has increased from 5.1% in 1950 to 9.3% in 2020, and it is expected to rise to 17.8% by 2060 [4]. Consequently, the number of elderly people with SP-related complications may also increase. In 2018, the number of elderly people requiring care in daily life and covered by long-term care insurance in Japan was reported to be 6,453,000, an increase of 1,756,000 cases since 2009 [5]. Furthermore, the prevalence of SP is reported as 7%–10% in community-dwelling older adults and 37.5% in older adults requiring care, with one report showing the merger with approximately 87% [6–9]. Therefore, it is particularly important to maintain or improve the ADL ability in sarcopenic older adults requiring care.

Physical activity is often related to the ADL ability in older adults [10]. The Japanese Ministry of Health, Labor, and Welfare issued official recommendations for older adults to not spend too much time engaged in sedentary behavior (sitting) in daily life [11]. Nevertheless, older adults requiring care in Japan are often in a state of advanced frailty that necessitates assistance [12] and are more likely to experience a decrease in physical activity. In a previous study, we reported a significant association between inactive time and ADL ability in older adults requiring care [13]. However, there is still a lack of clarity about the relationship between inactive time and ADL ability in sarcopenic older adults requiring care. Furthermore, in the aforementioned study, we used a questionnaire to measure inactive time but did not take into account the cognitive function of the subjects. Therefore, the present cross-sectional study aimed to clarify the relationship between inactive time and ADL ability in sarcopenic older adults requiring care. We believe exploring this association will help devise strategies to maintain or improve the ADL ability in this population.

Materials & Method

Participants

In this cross-sectional study, we recruited 151 elderly people aged ≥65 years who regularly visited one of the five adult day facilities using long-term care insurance in Japan between July 2022 and September 2024. The exclusion criteria were –1) unable to complete measurements; 2) having difficulty walking alone (except with supervision); 3) pacemaker users; 4) having a score of ≤20 on the Hasegawa's Dementia Scale –Revised (HDS-R). The HDS-R is a 9-item assessment scale that determines cognitive function and is scored on a 30-point scale; subjects with a score of ≤20 are suspected to have dementia [14, 15]. As the questionnaire was used to measure inactive time in this study, participants scoring ≤20 points (n = 73)

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were excluded. Additionally, two participants with incomplete data and 30 with no sarcopenia were excluded; finally, 46 participants were included in this study.

According to Japan's long-term care insurance system, there are seven levels of severity (support levels 1 and 2, and care need levels 1, 2, 3, 4, and 5) used to classify the type of care provided to older adults, with support level 1 being the mildest. The severity of long-term care is usually determined in terms of the time and effort required to provide care for each level; for example, support level 1 requires a care time of more than 25 min to less than 32 min, whereas care level 5 requires a care time of more than 110 min. In the present study, the distribution pattern for the severity of long-term care insurance of the participants was as follows; support level 1: n = 4, support level 2: n = 6, care level 1: n = 16, care level 2: n = 14, care level 3: n = 3, care level 4: n = 2, and care level 5: n = 1. The study was approved by the Ethics Committee of the Health Science University. All eligible participants read and signed an informed consent form.

Outcomes

Sarcopenia

The absence or presence of SP was determined using the Asian Working Group for Sarcopenia's 2019 criteria [16]. A combination of low skeletal muscle mass and low muscle strength or low physical function was defined as SP, and the presence of low skeletal muscle mass, low muscle strength, and low physical function was defined as severe SP. Appendicular muscle mass was measured using bioelectrical impedance analysis (BIA; TANITA, MC-780 AN, Tokyo, Japan). Using this value, the skeletal muscle mass index (SMI) was computed as appendicular muscle mass divided by height (in m^2); low skeletal muscle mass was defined as an SMI of <7.0 kg/m^2 in males and <5.7 kg/m^2 in females.

Muscle strength was determined in terms of handgrip strength (HS) measured using a digital hand dynamometer (Grip-D, Takei, Niigata, Japan). A total of four measurements were taken, two on each side at maximum effort in a sitting position, with the elbow joint extended and drooped along the side of the body; the highest value of the four trials was used in the analysis. Low muscle strength was determined as <28 kg in males and <18 kg in females.

Physical function was judged using the Short Physical Performance Battery (SPPB), five-repetition chair-stand time, and normal gait speed. The SPPB includes standing balance tests (standing with side-by-side, semitandem standing, and tandem standing), gait speed testing on a 4-m walkway (in m/s), and five-repetition chair-stand tests; the highest score for the SPPB is 12 points [17]. In this study, the 4-m normal gait speed and five-repetition chair-stand time were used to determine SP. The 4-m gait speed was measured twice and the faster value was used for analysis; participants were allowed to use their normal walking aids. Low physical function was determined if any of the three conditions were met: 1) SPPB score: ≤9 points, 2) five-repetition chair-stand time: ≥12s, and 3) normal gait speed: <1.0 m/s.

Activities of daily living (ADL) ability

We used the Barthel Index (BI) to measure ADL ability [18]. The BI scores a subject's ability to perform the following 10 ADLs –walking and moving from a wheelchair to a bed and back (0, 5, 10, or 15 points), eating, getting on and off the toilet, ascending and descending stairs, dressing, bowel control, and bladder control (0, 5, or 10 points), and grooming activity and bathing (0 or 5 points). The total score ranges between 0 and 100 (independent), with higher scores indicating that less assistance is required with ADLs.

Inactive time

We used a part of the International Physical Activity Questionnaire (IPAQ) Short Form (Japanese version) to measure the inactive time. The IPAQ is reported to be useful for evaluating physical activity in older adults [19]. We used the question "How much time do you spend sitting or lying down in bed in total on weekdays?"; the content of the question included all time spent at a desk, chatting with friends, reading, sitting, lying down, watching TV, etc., but not including the time spent sleeping.

Statistical analysis

The data were described as mean ± standard deviation. Based on the BI score, we divided the participants into two groups –ADL independent (BI = 100) and ADL dependent (BI < 100). The difference in inactive time was compared between the two groups using an unpaired t-test and between males and females using Fisher's exact test. Additionally, multiple logistic regression analysis was conducted to determine the impact of confounding factors on the association between BI and inactive time (dependent variable: two groups [BI = 100 and BI < 100]; explanatory variable: inactive time and significant differences in sex, age, and body mass index of the two groups). We used IBM SPSS Statistics (version 29.0 for Mac; IBM Corp., Tokyo, Japan) for the data analysis. A p-value of <0.05 was used to determine statistical significance.

Results

Table 1 summarizes the participant characteristics of each group. The two groups showed statistically significant differences in terms of the sex-based distribution and SPPB scores ($p < 0.05$, Table 1). Besides, the inactive time was significantly higher in the ADL dependent group than in the ADL independent group ($p < 0.05$; Table 1 and Figure 1). Further, the multiple logistic regression analysis revealed a significant association between inactive time and ADL independence even after adjusting for sex ($p < 0.05$, Table 2).

Discussion

We observed a significant association between the ADL ability and inactive time of sarcopenic older adults requiring long-term care. Moreover, inactive time was found to be an independent predictor of ADL ability after adjusting for sex, suggesting that decreasing inactive time could be beneficial in maintaining or even improving the ADL ability of this population.

SP is a known contributor to reduced ADL ability [2,3], with the complications of SP further deteriorating a person's ADL capacity. However, physical activity is also associated with ADL ability [10], and sedentary behaviors result in adverse outcomes for physical functions which further impact ADL ability [21]. Hence, a greater inactive time reduces the overall physical activity in older adults requiring care, particularly those with SP, and affects their ADL ability. We divided the subjects into two groups by BI scores and examined the relationship between inactive time and ADL ability in this study.

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Variables	All (n = 46)	ADL independent group (n =26)	ADL dependent group (n =20)	P value
Gender, n (male / female)	22 / 24	16/10	6/14	0.042
Age (year)	86.3 ± 6.8	86.4 ± 6.3	86.1 ± 7.6	0.876
Height (cm)	151.3 ± 11.0	153.9 ± 10.6	147.8 ± 10.8	0.062
Weight (kg)	47.5 ± 8.3	47.8 ± 7.9	47.2 ± 9.1	0.817
BMI (kg/m^2)	20.7 ± 3.4	20.1 ± 3.5	21.5 ± 3.3	0.165
HS (kg)	17.1 ± 6.0	18.3 ± 5.6	15.5 ± 6.4	0.117
Five-repetition chair-stand time (sec)	12.9 ± 7.7	13.7 ± 5.4	11.9 ± 10.0	0.430
Normal gait speed (m/sec)	0.69 ± 0.23	0.74 ± 0.22	0.62 ± 0.24	0.073
SPPB (score)	7.0 ± 2.8	7.9 ± 2.7	5.9 ± 2.6	0.012
Inactive time (min/day)	553.0 ± 253.6	461.5 ± 221.9	672.0 ± 247.3	0.004

Table 1: The characteristics of the participants in this study.

BMI body mass index, Handgrip strength HS, SPPB short physical performance battery

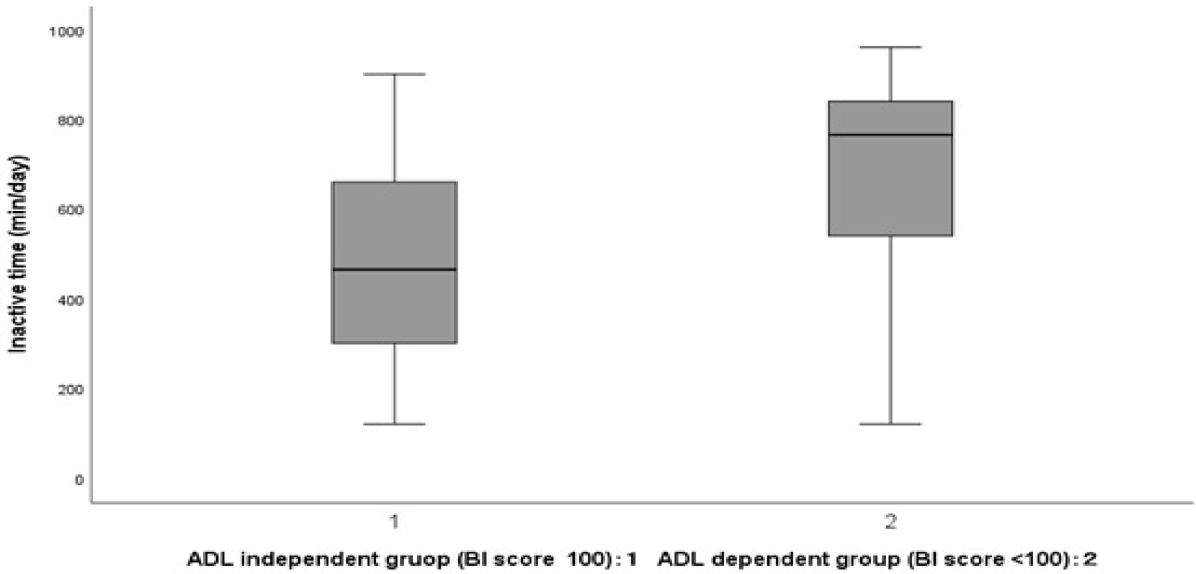

Figure 1: The difference of inactive time between ADL independent and ADL dependent groups.

Variables	OR	95% CI	P value
Gender	4.144	1.043 – 16.47	0.043
Inactive time	1.004	1.001 – 1.007	0.008

Table 2: Relationship between inactive time and the ability of ADL using multiple logistic regression analysis stair activities using multiple logistic regression analysis.

OR Odds ratio, 95 % CI 95 % Confidence interval

Inactive time was extracted as a significant independent predictor of ADL ability in this study. Previous study reported that the number of explanatory variables in logistic regression analysis is up to the number of samples in the smaller of the two groups divided by 10 [22], and gender and inactive time were the two explanatory variables in this study. On the other hand, low odds ratio was observed in this study. The sample size is small, so we should increase the sample size and re-examine the relationship between inactive time and ADL ability in future studies, including methods of analysis. Furthermore, subjects with sarcopenic obesity (SO) tend to be more disabled in ADLs than subjects with SP [23]. Future studies should explore the association between inactive time, ADL ability, and SO in older adults requiring care.

The average inactive time in our study participants was 553 minutes per day. Our previous study reported that the average daily inactive time in older adults receiving care was 275 minutes [13]. Another study reported a median sedentary time per day of 300 minutes in older adults [24]. In our study, we included older adults under long-term care who had SP; hence, the inactive time was even greater in our study participants. It is noteworthy that feeling safe, social connectedness, enjoyability, and accessibility (in terms of expenses and physical capacity) are crucial factors for improving physical activity in elderly people [25]. Therefore, we must aim to promote more physical activity for sarcopenic older adults requiring care, considering environmental and other factors. Future studies should also investigate the factors affecting the amount of physical activity possible in this population.

Our study has several limitations. First, the sample size was small and only included Japanese subjects, which limits the generalizability of our results. Second, the participants who scored ≤20 on the HDS-R were excluded from this study. According to Japan's Ministry of Health, Labour and Welfare, one of the diagnostic criteria for dementia is memory impairment [26]. Although cognitive decline may affect the reliability of the questionnaire, it is unclear whether participants scoring ≤20 on the HDS-R necessarily failed to answer the questions adequately. Therefore, it is necessary to conduct more detailed selection of participants by their cognitive function in the future studies. Third, we used BI to evaluate the ADL ability of our participants; other scales like the Functional Independence Measure consisting of 18 items, each rated on a 7-point scale [27] may allowdetailed assessment of the use of assistive devices and the amount of assistance.

Conclusions

Inactive time is significantly associated with ADL ability in sarcopenic older adults requiring long-term care in Japan. Moreover, inactive time was found to be an independent predictor of ADL ability even after adjusting for sex. These results suggest that reducing inactive time in older adults may help improve their physical function and independence in ADLs.

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Competing Interests

The authors declare that they have no competing interests.

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