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Original Article

ADL Ability Characteristics of Partially Dependent Older People: Gender and Age Differences in ADL Ability

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Abstract

Age and gender differences in ADL ability were investigated using 568 Japanese partially dependent older people (PD, Mean age=82.2±7.76 years) living in welfare institutions. The subjects were asked about 17 ADL items representing 7 ADL domains by the professional staff working at subjects' institutions. Each item was assessed by a dichotomous scale of "possible" or "impossible". Item proportions of "possible" response were calculated for gender and age groups (60s, 70s, 80s and 90s). Two-way analysis of variance (ANOVA) using the arcsine transformation method indicated no gender differences. Significant decreases in ADL ability with aging were found in 13 of the 17 items. The dependency of ADL in the PD significantly increases with aging, and there is no significant difference in this trend between men and women. The dependency of more difficult activities using lower limb increase from the 70s, and independency of low-difficult activities such as manual activities, feeding and changing posture while lying is maintained until the 80s and over.

Key words: Japanese partially dependent older people, changing with age, difficulty of ADL

Introduction

In Japan in the year 2020, approximately one-fourth of the total population will be 65 years of age or older. In this aging society, the importance of assessing functional ability of older people by using ADL will increase. Furthermore, it is desirable to assess not only the present state but also the possibility of preventing older people from being bedridden or to recognize an independent level. Older people can be conceptually classified into the following three groups based on their functional level: the bedridden (BED), the partially dependent (PD) and the independent living (IL). The PD has specific functional characteristics, because if their functional level declines, they will become bedridden, and if their functional level improves, they will become independent. Investigating the process of disability in the PD is, therefore, important in clarifying the patterns of dependency in daily life of older people. That is, the PD is an important target in ADL assessment of older people. We previously developed an ADL index for the PD[1)], and reliability and validity of this index was examined in our previous studies, but, little is known about the ADL ability characteristics of the PD.

In general, it has been reported that the physical fitness level of the elderly declines with aging and that a gender difference is recognized. ADL ability level has also been reported to decline with aging[2–5)]. In addition, women generally have higher rates of disability than men, and this gender difference is marked with advancing age[6)]. However, there are various difficulties with activities of daily living and the patterns of dependency differ by the type of activity[7)]. It is thought that the dependency of more difficult activities marked with advancing age reflect the aging process in the physical fitness level, while the independency of basic activities performed repeatedly in daily life is maintained until an older age. Therefore, examining the relationship between type of activity and pattern of disability is associated with clarifying aging process of ADL ability.

The purpose of this study was to investigate the characteristics of gender and age differences in ADL ability, considering ADL difficulty.

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Materials and Methods

1. Subjects

The subjects in this study were 568 partially dependent older people (PD: mean age=82.2±7.66 years). PD was defined as institutionalized older people who belong to rank A or B according to the standard for the degree of independence for dependent older people approved by the Japan Ministry of Health and Welfare in 1991. Rank A indicates house-bound: needing partial assistance only in outdoor activities, and rank B indicates chair-bound: needing partial assistance in indoor and outdoor activities. Professional staff (e.g., nurses, physical therapists, and occupational therapists) working at the subjects' institutions were asked to rank the subjects based on this standard. The sample size and mean ages of each gender and age group (60s, 70s, 80s and 90s groups) are shown in Table 1. The subjects who replied that they did not have any diseases was lower than 10 percent, indicating most of the PD suffered from some type of disease. The morbidities of the following diseases were high: cardiac disease (20.5%), cerebrovascular disorders (44.2%), articular impairments (16.8%), and skeletal impairments (16.5%).

2. ADL items

This study used the ADL index for partially dependent older people (Demura et al. 1999; Table 2). A feature of this index is that 17 ADL items of the index are placed on a unidimensional scale of difficulty order based on proportions of "possible" responses for each item. Seventeen ADL items were selected from the following seven ADL domains: (1) changing and holding posture, (2) dressing, (3) using the toilet, (4) walking, (5) bathing, (6) manual activity, and (7) movement and carrying. These domains and items were referenced to the following major ADL indices: basic ADL indices[8–10], instrument ADL (IADL) indices[11–13], unified indices of ADL-IADL[14,15], and disability scales[16]. Each item was assessed by a dichotomous scale, "possible" or "impossible". The reliability (intra-tester reliability: r=0.996, inter-tester reliability: r=0.940, α coefficient=0.926), the unidimensionality (Guttman's coefficient of reproducibility=0.939, coefficient of scalability=0.691) and the validity were examined in our previous study[1].

3. Data collection

The ADL index survey for PD was conducted in institutions such as homes for the aged, health facilities in the prefectures of

Table 1 Sample size and mean age of each gender and age groups

	60s			70s			80s			90s		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Male	13	66.5	2.79	56	75.4	2.72	71	85.3	2.17	30	92.8	1.50
Female	24	67.5	2.05	109	76.0	3.06	217	85.1	2.89	48	93.3	2.98
Total	37	67.1	5.83	165	75.8	8.84	288	85.1	7.53	78	93.2	6.78

Note: Sample size was 568.

Table 2 ADL items selected in the present study

ADL domains	No.	ADL items	Contents of each ADL item
I Changing and holding the posture	1	Tossing about in bed	Can toss about in bed without assistance.
	2	Sitting up from the lying posture	Can change the posture from lying to sitting.
	3	Standing up from the sitting posture	Can change the posture from sitting to standing without hanging on to something.
	4	Holding standing posture	Can hold standing posture without assistance for about one minute*.
II Dressing	5	Putting on a shirt over the head	Can put on a shirt over the head within about thirty seconds*.
	6	Putting on slacks	Can put on slacks while standing.
	7	Putting on trousers (buttons, belt)	Can put on trousers including button, belt, and within about one to two minutes*.
III Going to toilet	8	Using the toilet (Western style)	Can use a Western-style toilet without assistance.
	9	Going to the toilet	Can go to and use a Western-style toilet without assistance.
IV Bathing	10	Washing the whole body	Can wash your whole body without assistance.
	11	Entering the bathtub	Can straddle the bathtub and go inside without assistance.
V Manual activities	12	Eating	Can eat something small such as a bean using chopsticks.
	13	Writing	Can write by hand in normal size.
VI Walking	14	Walking	Can walk without a self-help device.
	15	Going up the stairs	Can go up and down the stairs one step at a time without hanging on to a handrail.
VII Movement and carrying	16	Carrying object	Can carry relatively light things such as a piece of clothing, a garden plant, or a pan.
	17	Range of activity	Can go for a walk in the neighborhood.

Note: The subject being tested responded "possible" or "impossible" to the above-stated questions.
*: The times were determined based on the results of survey for occupational therapists.

Ishikawa, Nagano, Fukui, Akita and Tottori in Japan. The duration of the survey period at each institution ranged between four and six weeks. The therapists working at the subjects' institutions responded to the ADL index survey. The agreement rates for each ADL item were 93.3% or higher in the intra-tester reliability, and 80.0% or higher in the inter-tester reliability.

4. Statistical analyses

The item proportions of "possible" response were calculated for each gender and age group. Item difficulty was based on the ordering of the item proportions. Two-way (gender×age group) ANOVA using the arcsine transformation method was applied to each ADL item proportion to examine the gender and age differences in ADL ability. If the main effects were significant, Tukey's HSD test was applied for multiple comparisons. In addition, if the interaction was significant, the simple main effects of each level in a factor were examined, and then multiple comparisons were carried out. The level of statistical significance was set at P-value less than 0.05.

Results

Gender and age differences in proportions of "possible" response in each ADL item (Table 3, Fig. 1)

The item with the highest proportion of "possible" responses was "eating" (64.1%), and that with the lowest proportion was "going up stairs" (9.2%). The proportion values tended to be low in "going up stairs", "putting on slacks" and "putting on trousers",

Table 3 "Possible" proportions of each gender and age groups and results of two-way ANOVA

				Item proportions				Two-way ANOVA		
No.	Item	Total		60s	70s	80s	90s	Fa	Fb	Fc
15	Going up the stairs	9.2	male	33.3	4.9	7.1	0.0		**	
			female	26.1	17.8	5.0	2.4			
6	Putting on slacks	13.7	male	33.3	19.5	8.9	4.4		**	
			female	43.5	16.7	9.5	9.5			
7	Putting on trousers (buttons, belt)	19.2	male	41.7	17.1	8.9	4.4		**	
			female	47.8	20.0	16.2	11.9			
3	Standing up from the sitting posture	20.1	male	33.3	26.8	16.1	4.4		**	
			female	47.8	26.7	16.2	9.5			
10	Washing the whole body	20.3	male	41.7	26.8	17.9	4.4		**	
			female	47.8	27.8	19.6	11.9			
17	Range of activity	26.9	male	50.0	26.8	17.9	17.4		**	
			female	52.2	30.0	19.0	14.3			
16	Carrying a object	28.2	male	33.3	34.2	19.6	13.0		**	
			female	56.5	36.7	24.0	16.7			
14	Walking	29.6	male	41.7	29.3	21.4	13.0		**	
			female	56.5	36.7	29.1	16.7			
11	Entering the bathtub	31.3	male	41.7	36.6	28.6	8.7		**	
			female	47.8	41.1	35.2	16.7			
5	Putting on a shirt over the head	33.6	male	50.0	36.6	37.5	21.7		**	
			female	47.8	40.0	34.1	14.3			
8	Using the toilet (Western style)	40.9	male	58.3	36.6	48.2	30.4		**	
			female	52.2	52.2	40.2	26.2			
4	Maintaining the standing posture	41.9	male	50.0	43.9	35.7	26.1			
			female	52.2	46.7	39.1	35.7			
13	Writing	46.5	male	66.7	43.9	42.9	26.1		**	
			female	56.5	52.2	45.3	42.9			
2	Sitting up from the lying posture	49.8	male	66.7	36.6	50.0	26.1			
			female	56.5	56.7	54.8	45.2			
1	Tossing about in bed	53.5	male	66.7	41.5	53.6	43.5			
			female	60.9	60.0	54.8	54.8			
9	Going to the toilet	60.0	male	83.3	61.0	57.1	34.8		**	
			female	78.3	70.0	59.8	57.1			
12	Eating	64.1	male	66.7	61.0	53.6	52.2			
			female	65.2	66.7	71.0	69.1			

Note. Fa: gender effect, Fb: age effect, Fc: interaction effect, **: P<0.01.
Items ordering was based on item difficulty.

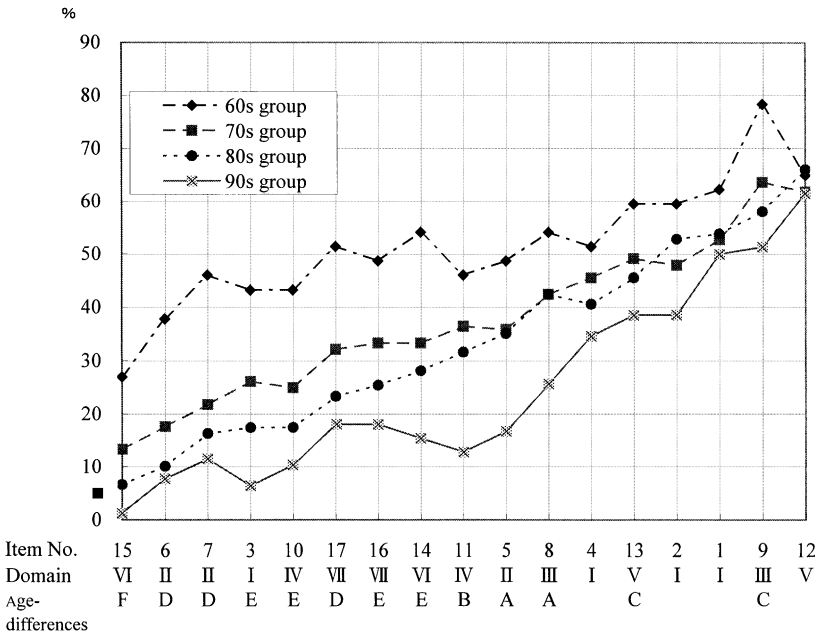

Fig. 1 Proportions of "possible" response of each age group.
Results of multiple comparisons for age differences: A: 60s,70s,80s>90s; B: 60s,70s>90s; C: 60s>90s; D: 60s>70s,80s,90s; E: 60s>80s,90s/70s>90s; F: 60s>70s,80s,90s/70s>90s. Seventeen items are indicated based on difficulty ordering (item proportion ordering). Since no significant gender difference was found, the proportions were calculated after pooling the data of both genders.

while they tended to be high in "eating", "sitting up from a lying posture" and "tossing about in bed".

The results of two-way (gender×age group) ANOVA indicated that there were no significant interactions and gender differences for any item. There were significant age differences in 13 of the 17 items: i.e. items 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 16 and 17. Figure 1 shows item proportions for each age group. Since no significant gender difference was found, the proportions in Figure 1 were calculated after pooling the data of both genders. Further, to examine the relation between age differences and item difficulty based on item proportion, these proportions were tabulated based on the difficulty-ordering. The differences of proportions among age groups tended to become small with decreasing item difficulty.

Discussion

In respect to gender differences in ADL ability, it has been reported that trends in gender differences in ADL are influenced by cultural and environmental factors in the case of non-disabled community older people[2,17]. Ranberg et al.[6] examined gender difference in ADL ability for community-dwelling older people living in Denmark. They reported that although women have lower mortality, they are more disabled than men, and this difference is more marked with advancing age. Dunlop et al.[7] also reported similar results for community-dwelling older people based on six years of longitudinal data, and women spend more time in a disabled state. Ranberg et al.[6] indicated these inconsistencies have not yet been fully explained.

In contrast, no significant gender difference was found in the present study. In addition, item proportions of "possible" responses for women in the 90s group tended to be greater than those of men except for three items of "range of activity", "putting on a shirt over the head" and "using the toilet". Ranberg et al. indicated that an explanation of the gender difference could be the differences in muscle mass between men and women. In this study, however, no gender difference was found even in activities requiring more muscle, such as "going up the stairs", "putting on slacks or trousers" and "standing up from the sitting posture".

The reasons why the results in this study differ from those of previous studies are suggested as follows: First, ADL items selected in this index consider if the activity is generally performed in daily life in both men and women, and that the pattern of activity is not different by gender. Further, most of subjects in this study had some form of disease. It is, therefore, considered that the characteristics of the disease were more influential on ADL performance than the factor of gender.

It has been reported that ADL ability decreases with age, reflecting the increase of physical functional problems associated with aging[18]. In this study, significant age differences were found as shown in Figure 1. In three items from the top of the difficulty ordering, "going up the stairs", "putting on slacks" and "putting on trousers", the proportions significantly declined from the 70s. In the fourth to eighth items of difficulty ordering, "standing up from the sitting posture", "washing the whole body", "range of activity", "carrying a object" and "walking", significant decreases were found in the 80s or 90s. Further, in the next three items of "entering the bathtub", "putting on a shirt over the head" and "using the toilet", significant decreases were found in 90s. For the remaining items, marked declines were not found. These results suggest that the characteristic of declining ADL ability with age for the PD varies among activities, this is related to the difficulty of ADL, and that the difference in the proportions among age groups becomes small with declining difficulty of ADL. The ability level regarding low-difficulty ADL performed repeatedly in daily life, such as eating, using the toilet and changing posture while lying, is maintained even at 80 years and older. However, the higher the difficulty of ADL, such as movement, dressing while standing and changing posture while standing, the earlier the disability appeared and the larger the difference of ability level among age

groups. It has been reported that the ability level of movement activity decreases with age, and that it significantly relates to comprehensive ADL ability level[19–21]. Lower limb activities representing movement activity are considered to be important assessment tools even in healthy older people. Dunlop et al.[7], based on longitudinal data, reported that pattern of disability was in the following order: walking, bathing, transferring, dressing, using a toilet and eating, and that probability of having an eating disability was greater when preceded by a decrease in other disabilities in six activities of daily living. Mahoney et al.[21] indicated that lower extremity disability was significantly associated with functional decline, and that it is an important predictor of functional loss. This study, based on cross-sectional data, indicated that difficulty ordering of ADL items of dependent older people was similar to the pattern of disability of independent older people, and a significant decrease of ability level in lower limb activities was shown from the 70s group, which was an earlier stage than in other upper limb activities or changing lying posture activities. Considering these previous reports and the results of the present study, it is inferred that also in the PD group, disability in lower limb activities appears at an early stage of the aging process, and that assessing these activities is important in recognizing functional disability of older people. Further examination of the aging process of ADL ability will be expected by using longitudinal data of the PD.

In conclusion, dependency of basic ADL performed repeatedly in daily life of the PD significantly increases with advancing age, and there is no significant difference in this trend between men and women. Although independency of low difficult activities such as manual activities, feeding and changing lying posture activities are maintained until 80 years and over, the dependency of more difficult activities such as going up stairs, dressing while standing and walking appear in the earlier stages of the aging process. The characteristics of dependency of basic ADL in the PD are influenced by the effects of the aging process in physical fitness and disease characteristics.

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