

## Gender and Age Differences in Basic ADL Ability on the Elderly: Comparison between the Independent and the Dependent Elderly

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**Abstract** The purpose of this study was to investigate the ADL ability characteristics of the elderly by comparing the characteristics to achieve basic activities between the independent and institutionalized dependent elderly from the viewpoints of gender and age differences. The subjects were 697 Japanese dependent elderly living at welfare institutions for the aged, and 482 independent elderly living at home. Seventy-four activities were selected from nine ADL domains. The survey for the independent elderly was conducted in health or culture education classes, and for the elderly without these classes, a general delivery survey was conducted. The independent elderly provided their own data. The survey for the dependent elderly was conducted in welfare institutions and the staff working at the subjects' institutions responded. In two-way ANOVA of rates of items, significant gender differences were found in some changing and holding posture activities in the independent elderly group, and in activities using upper extremities in the dependent elderly group. ADL ability in the independent elderly group significantly decreases with aging, but this trend is unclear in the dependent elderly group. In the independent elderly group, indications of a decrease appear in activities with lower limbs from the 70s, and appear in the most of basic activities from the 80s. Furthermore, differences in achievement levels of each activity with aging were found in both elderly groups. These findings may suggest that there are remarkable individual differences in ADL ability of the elderly with aging. *J Physiol Anthropol* 22 (1): 19-27, 2003 <http://www.jstage.jst.go.jp/en/>

**Keywords:** ADL, aging, independent and dependent elderly

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### Introduction

The change in activities of daily living (ADL) ability with aging is an important indicator of advancing disability in the elderly. Although in general, ADL ability of the elderly decreases with aging (Sato et al., 1999a; Bowling and Grundy, 1997; Dunlop et al., 1997), there are various decreasing patterns, such as slight, gradual and rapid, according to the type of activity. In addition, if the gender and functional levels are different, the decreasing pattern is also considered to be different.

In general, instrumental ADL (IADL) or functional ADL (FADL) is used to assess ADL ability of the independent elderly in addition to basic ADL (Lawton and Brody, 1970; Keith et al., 1987; Kempen et al., 1995). This is because the functional level of the independent elderly is higher than the dependent elderly, and the independent elderly can achieve most of the basic ADL. Furthermore, it is expected that they can maintain an ADL ability level required in daily life until a much older age. However, even in the independent elderly, physical function also decreases with age, and the difficulty in achieving these basic activities gradually increases. In addition, individual differences in ADL ability tend to increase with aging, and the decreasing pattern of ADL ability also differs with functional level. Therefore, determining the decreasing pattern in ADL ability with aging to achieve basic activities for the independent elderly is useful in recognizing that ADL ability is beginning to decrease. Comparing the achievement characteristics of many basic life activities between elderly groups with different functional levels can provide useful suggestions as to how ADL ability characteristics decrease with aging in the elderly population.

We studied the ADL ability characteristics of the elderly by comparing the characteristics to achieve basic activities between independent and institutionalized dependent elderly from the viewpoints of gender and age differences.

## Methods

### Subjects

Subjects of this study were 697 Japanese dependent elderly living at welfare institutions for the aged, such as special homes for the aged and health facilities (173 males, mean age  $\pm$ SD:  $80.0 \pm 7.4$  years; 524 females,  $81.9 \pm 7.5$  years) and 482 independent elderly living at home (213 males,  $72.5 \pm 6.8$  years; 269 females,  $73.2 \pm 7.6$  years). Subjects of this study were living in Ishikawa, Fukui, Akita and Gifu prefectures. Informed consent from the subjects was obtained via institutional staff in the dependent elderly group, and obtained from the subjects themselves in the independent elderly group. The mean age and sample size for male and female age groups (60s, 70s, and 80s) of each elderly group are shown in Table 1. Due to the small number of 60s subjects in the dependent elderly group, this group was classified into two aged groups of 79 years old or less (under 80 years group) and 80 years old or more groups (over 80 years group).

The dependent elderly group ranged from rank A (house-bound: needing partial assistance only in outdoor activities) to rank C (bed-bound: dependent for most daily activities) of the standard for the degree of independence for disabled elderly approved by the Japan Ministry of Health and Welfare in 1991. In investigating assistance devices for movement, 27.8% of the dependent elderly were without assistance, 22.4% used a stick, 27.5% used a wheelchair and 20.1% were immobile.

The independent elderly group consisted of those who ranked J (independent in daily life activities) in the above standards. About 80% of the independent subjects were recruited from health or culture education classes for the elderly offered by each municipality, and the others were community-dwelling elderly without these classes. About half of the subjects from these municipal classes participated in health education classes which provided healthy exercise programs and recreational sports, and the other half participated in culture education classes which included traditional culture programs such as flower arrangement, calligraphy, "go" games and "haiku" poems. In investigating assistance devices for movement, 72.4% of the independent subjects were without assistance, 18.5% used some assisting devices, and 9.1% had no response. Of the total, 8.1% used a stick, 1.5% used a walker, 1.2% used a wheelchair and 2.9% used other. The proportions of subjects using assisting devices for each age group were 5.1% in the 60s, 18.2% in the 70s, and 44.8% in the 80s for males, and 3.8% in the 60s, 24.1% in the 70s, and 57.4% in the 80s for females.

### ADL index

In this study, 74 basic ADL items were selected from the following nine ADL domains; 1) movement, 2) going up and down stairs, 3) changing and holding the posture, 4) bathing, 5) using the toilet, 6) dressing, 7) grooming, 8) eating, and 9) manual activities. These ADL domains and items were referenced to in previous studies (Mahoney and Barthel, 1965;

**Table 1** Sample size and mean ages of each elderly group

		60s group			70s group			80s group		
		n	mean	SD	n	mean	SD	n	mean	SD
Independent elderly	Males	83	65.6	2.5	96	74.6	2.8	34	83.1	3.3
	Females	112	66.0	2.6	97	74.3	3.0	60	84.8	3.6
Dependent elderly	Males	18	65.7	2.1	60	75.9	2.7	95	85.3	4.1
	Females	34	66.0	2.6	146	75.6	2.9	344	86.1	4.6

Significant differences in mean age were found in both of independent and dependent elderly groups. For analyses in this study, dependent elderly group was classified into two aged groups of 80 years old or more and 80 years old or less groups, due to the sample size of 60s.

Shoening and Iversen, 1968; Granger, 1979; Klein and Bell, 1982; Spector, 1987; Kempen et al., 1995; Sato et al, 1999b). This study used a dichotomous rating scale of "possible" or "impossible" (Tables 2-1 and 2-4).

### Data collection

The survey for the dependent elderly group was conducted in welfare institutions such as homes for the aged and health facilities. The survey duration at each institution ranged between four to six weeks. Subjects were selected at random by the staff, such as occupational therapists, physical therapists and nurses, working at the subjects' institutions and the staff responded to the ADL index survey.

The survey for the independent elderly group was conducted in health or culture education classes setting. For the elderly without these classes, a general delivery survey was conducted. The subjects provided their own information, but in accordance with a subject's request, the survey staff interviewed them. The survey duration of delivery survey ranged between four to six weeks.

### Statistic analyses

The rates of items (%item) were calculated for 74 ADL items in each elderly group. Gender and age differences in %item were investigated by two-way ANOVA, after each %item was transformed into the angle by the arcsine transformation method (Mosteller and Youts, 1961; Cochran, 1943). 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. To investigate the change with aging in achievement levels among each ADL domain, the range of % items among each ADL domain was calculated using the differences between the highest %item and the lowest %item for each age group.

## Results

Tables 2-1 to 2-4 show the results of two-way ANOVA for each %item for the dependent and independent elderly groups. In the dependent elderly group, the %items extend from 12.6%

Table 2-1 Rate of "possible" response (%item) in each item and results of two-way (gender x age) ANOVA

domain	item	%items of DEP				%items of INDEP				Two-way ANOVA			
		total	80-	80+	post hoc	Total	60s	70s	80s	A	B	C	Post hoc
Movement	Going down a slope	17.0	M 20.3	F 17.6		89.8	M 97.6	F 92.5	71.0	**			60>70>80
	Going up a slope	17.5	M 20.3	F 17.6		89.9	M 97.6	F 90.5	74.2	**			60>70>80
	Crossing the doorstall	21.1	M 26.7	F 25.5		94.7	M 98.8	F 95.7	83.9	**			60>70>80
	Walking to an adjoining room	27.4	M 29.7	F 32.6		96.0	M 98.8	F 95.7	90.3	**			60,70>80
	Walking in the room	29.3	M 31.5	F 33.7		95.8	M 98.8	F 95.8	90.3	**			60,70>80
	Crawling	31.7	M 33.3	F 29.9		95.3	M 98.8	F 96.8	80.6	**			60,70>80
			F 31.4	M 31.8			F 99.1	M 97.9	84.5				
Going up and down stairs	Going up the stairs	12.7	M 19.4	F 9.7		88.1	M 97.6	F 91.5	74.2	**			60>70>80
	Going down the stairs	12.8	M 19.4	F 9.7		87.9	M 97.6	F 92.6	70.0	**			60>70>80
	Getting on and off an automobile	19.5	M 26.0	F 17.4		89.6	M 96.4	F 92.6	77.4	**			60,70>80
Changing and holding posture	Standing up from the squatting posture	14.1	M 17.6	F 10.5	**	88.1	M 96.4	F 89.5	71.0	**			60,70>80
	Squatting down from the standing posture	14.2	M 18.9	F 10.8	**	87.9	M 96.3	F 90.6	80.0	**			60,70>80
	Sitting upright from the standing posture	15.6	M 21.4	F 12.5	*	83.7	M 95.2	F 89.5	74.2	**			M>F 60>70>80
	Maintaining the knee-standing posture	16.2	M 16.7	F 11.6		83.3	M 95.1	F 90.2	71.9	**			M>F 60,70>80
	Sitting cross legged from the standing posture	17.2	M 24.7	F 19.8		86.6	M 96.4	F 91.6	80.0		*		80:M>F M,F:60>70>80
	Keeping the standing posture	18.5	M 20.0	F 18.9		90.5	M 96.3	F 92.5	81.2	**			60,70>80
	Walking on the knee	19.4	M 20.0	F 16.7		83.1	M 95.1	F 86.0	75.0	*			M>F 60,70>80
	Standing up from the sitting posture	23.0	M 26.7	F 20.7		88.2	M 96.4	F 88.5	80.6	**			60,70>80
	Sitting on a chair from the standing posture	35.2	M 34.7	F 37.2		95.0	M 97.6	F 92.6	93.7		*		80:M>F F:60>70>80
	Maintaining the sitting posture	38.9	M 44.7	F 40.2		91.2	M 95.1	F 95.7	84.4	**			60,70>80
Getting up on the bed	39.9	M 36.0	F 44.7		96.4	M 97.6	F 96.9	90.6	**			60,70>80	
		F 40.7	M 38.4			F 100.0	M 99.0	86.2					

Table 2-2 Rate of "possible" response (%item) in each item and results of two-way (gender x age) ANOVA

domain	item	%items of DEP					%items of INDEP					Two-way ANOVA				
		total	80-	80+	A	B	C	post hoc	Total	60s	70s	80s	A	B	C	Post hoc
Changing and holding posture	Getting off the bed	40.1	M 33.3	F 43.0					M 97.6	F 96.8	M 90.6		**			60,70>80
	Sitting up from the lying posture	40.9	M 43.4	F 40.4				93.9	M 98.8	F 97.9	M 83.9		**			60,70>80
	Moving the face of the body towards a different direction in the sitting posture	42.6	M 47.3	F 44.1				95.0	M 97.6	F 95.8	M 93.7		*			60>80
	Shifting the body while lying on one's back	43.0	M 41.6	F 44.7				96.4	M 98.8	F 96.8	M 90.3		**			60,70>80
	Tossing about in bed	55.0	M 51.4	F 56.5				97.9	M 97.6	F 98.9	M 90.6	*	**			M>F 60,70>80
Bathing	Entering the bathtub	18.1	M 20.0	F 18.1				91.8	M 97.6	F 89.6	M 84.4		*			M:60,70>80 F:60>70>80
	Washing the back in the bath	19.2	M 20.5	F 14.7				91.1	M 97.6	F 90.6	M 81.2		**			60>70>80
	Washing the hair in the bath	23.5	M 21.1	F 24.6				93.0	M 97.6	F 89.6	M 90.6		**			80:M>F F:60>70>80
	Getting out of the bathtub	23.9	M 22.7	F 23.4				91.8	M 97.6	F 89.6	M 84.4		*			M:60,70>80 F:60>70>80
	Washing the extremities in the bath	23.9	M 15.8	F 16.0			F>M	94.3	M 98.8	F 92.7	M 90.6		**			60>70>80
	Scooping water in the bathtub	28.6	M 21.6	F 27.2				94.7	M 98.8	F 93.7	M 90.6		**			60>70>80
	Squeezing a wet towel	30.0	M 26.7	F 24.5				94.1	M 97.6	F 93.5	M 87.5		**			60>80
	Drying the body with a towel after bathing	30.3	M 23.6	F 28.7				93.9	M 97.6	F 91.5	M 87.5		**			60>70>80
	Rinsing the body in the shower	32.6	M 26.4	F 31.2				93.0	M 97.6	F 91.6	M 90.6		**			80:M>F F:60>70>80
			F 31.6	M 33.5					F 100.0	M 94.8	F 74.1					
Using the toilet	Using a Japanese-style lavatory	15.6	M 19.4	F 11.0				85.4	M 95.2	F 88.2	M 71.9		**			60>70>80
	Pulling up and down the underwear during excretion	35.6	M 34.7	F 28.4				95.6	M 98.8	F 93.6	M 93.7		*			80:M>F F:60>70>80
	Using a Western-style lavatory	37.2	M 32.4	F 36.3				95.6	M 98.8	F 93.5	M 90.6		**			60>70>80
	Wiping off and flushing after excretion	39.2	M 29.3	F 35.1			F>M	95.4	M 98.8	F 91.6	M 90.6		**			60,70>80
	Controlling urination	47.6	M 47.3	F 46.8				95.5	M 98.8	F 94.6	M 90.3		**			60>70>80
Controlling defecation	Controlling defecation	53.5	M 44.7	F 53.2				97.2	M 97.6	F 97.8	M 93.5		**			60,70>80
			F 51.4	M 56.6					F 100.0	M 97.9	F 91.2					

Table 2-3 Rate of "possible" response (%item) in each item and results of two-way (gender x age) ANOVA

domain	item	%items of DEP					Two-way ANOVA					%items of INDEP					Two-way ANOVA											
		total	80-	80+	A	B	C	post hoc	Total	60s	70s	80s	A	B	C	Post hoc	Total	60s	70s	80s	A	B	C	Post hoc				
Grooming	Cutting the nails	19.9	M	14.9	20.0				88.9	M	97.5	88.5	73.3	**		60>70>80												
			F	18.4	20.5					F	99.1	91.6	62.1															
	Wiping the body with a towel	36.7	M	28.9	35.6				95.1	M	98.8	92.7	90.3	**		60>70>80												
			F	38.6	37.4					F	100.0	97.9	82.8															
	Taking care of dentures. (Brushing the teeth)	38.4	M	25.7	31.2	**		F>M	95.5	M	97.6	96.8	87.1	*		70:M>F										M,F:60,70>80		
			F	43.1	40.1					F	100.0	100.0	79.3	**		60,70>80												
Manual activity	Washing the face	41.0	M	32.9	42.4				99.1	M	100.0	100.0	93.3	**		60,70>80												
	Shaving (males) Combing (females)	41.2	M	21.1	26.1	**		F>M	94.8	M	97.5	91.6	87.1	**		60>70>80												
			F	39.5	43.7					F	100.0	100.0	96.6															
	Washing hands	58.4	M	42.1	59.3	**		80+>80-	97.7	M	98.8	97.9	86.2	*		M>F											60,70>80	
		F	54.2	63.7					F	100.0	100.0	93.1	**															
Dressing	Writing characters	21.5	M	19.7	24.7				95.5	M	98.8	93.7	87.1	**		60>70>80												
			F	20.2	20.9					F	100.0	97.9	86.0															
	Cutting paper with scissors	27.7	M	23.0	24.4				94.5	M	98.8	89.6	90.3	**		60,70>80												
			F	25.9	29.7					F	100.0	96.9	84.5															
	Undoing a package wrapped in cloth	31.4	M	23.3	27.0				95.1	M	97.6	94.8	87.1	**		60,70>80												
			F	29.9	34.3					F	100.0	94.7	87.9															
	Tying a string	34.9	M	23.3	29.3	*		F>M	95.1	M	97.6	92.6	83.9	**		60,70>80												
			F	33.7	39.0					F	99.1	97.9	89.7	**														
Dressing	Opening and closing a sliding door	44.4	M	44.5	43.1				97.2	M	100.0	100.0	90.3	**		60,70>80												
			F	45.8	46.2					F	100.0	99.0	84.5	**														
	Opening and closing a drawer	55.5	M	54.8	57.1				96.4	M	100.0	96.9	90.3	**		60>70>80												
			F	57.4	54.1					F	100.0	99.0	82.8	**														
	Putting on socks or stockings in the standing posture	10.9	M	11.0	8.7				78.6	M	96.3	81.1	54.8	**		60>70>80												
			F	15.4	8.6					F	91.6	74.5	43.6	**														
	Pulling a zipper closed	11.5	M	12.0	7.5				94.4	M	97.5	93.6	90.3	**		60,70>80												
			F	13.1	12.0					F	99.1	97.9	78.9	**														
	Putting on pants or a skirt in the standing posture	13.6	M	13.3	9.8				85.3	M	97.5	85.4	61.3	**		60>70>80												
			F	17.6	12.1					F	98.1	84.2	57.9	**														
	Clasping buttons	18.0	M	11.7	7.5	*		F>M	94.7	M	97.6	93.7	83.9	**		60,70>80												
			F	18.0	21.0					F	100.0	97.9	82.8	**														
Putting on socks or stockings in the sitting posture	22.6	M	21.3	21.3				92.3	M	96.3	92.6	83.3	**		60,70>80													
		F	24.4	22.6					F	99.1	95.8	72.4	**															
Putting on pants or a skirt in the sitting posture	23.7	M	21.3	21.7				92.3	M	98.7	92.6	83.9	**		60>70>80													
		F	24.3	24.9					F	99.1	95.7	69.0	**															
Putting on wooden clogs	31.6	M	35.2	30.0				91.4	M	96.3	89.5	83.9	**		60,70>80													
		F	31.2	31.4					F	97.2	93.6	77.2	**															
Putting on a long-sleeved shirt with buttons	34.5	M	25.3	33.0				95.1	M	97.6	92.6	93.5	*		F:60>70>80													
		F	35.4	36.2					F	100.0	97.9	82.8	**															
Putting on shoes	34.7	M	36.0	35.9				94.2	M	97.6	93.7	90.3	*		F:60>70>80													
		F	35.6	32.9					F	100.0	95.8	78.9	**															

Table 2-4 Rate of "possible" response (%/item) in each item and results of two-way (gender x age) ANOVA

domain	item	%items of DEP					%items of INDEP					Two-way ANOVA				
		total	80-	80+	A	B	C	post hoc	Total	60s	70s	80s	A	B	C	Post hoc
Dressing	Putting on shoes without strings	M	39.2	36.7				94.7	M	98.8	94.7	90.3	**			60>70>80
		F	33.2	31.1				95.3	F	100.0	95.8	79.3			*	F:60>70>80
	Putting on a short-sleeved shirt with buttons	M	25.3	34.7				94.9	M	97.6	92.6	93.5	**			60>70>80
		F	36.5	36.7				94.4	F	100.0	97.9	84.5				
		M	30.7	36.6	*		F>M		F	100.0	97.9	90.3	**			60>70>80
Tucking the hem of the jacket into pants or a skirt	M	40.4	44.6				94.7	M	100.0	97.9	82.8	**			60>70>80	
	F	41.3	44.1				94.4	F	98.8	92.6	86.7	**			60>70>80	
Putting on mules	M	41.0	41.8				91.7	M	96.3	87.2	80.6	**			60>70>80	
	F	10.1	17.4	**		F>M		F	100.0	95.8	75.9	**			60,70>80	
Eating	Cutting or peeling fruits and vegetables with a knife	M	28.4	27.9				98.1	M	100.0	99.0	93.5	**			60,70>80
		F	24.7	21.6				97.4	F	100.0	99.0	91.4	**			60>70>80
	Opening and closing the faucet	M	20.5	21.6				100.0	M	100.0	96.8	91.4	**			60>70>80
		F	29.9	25.2				97.0	F	97.6	97.9	93.5	**			60,70>80
	Peeling a mandarin orange	M	46.7	37.5				93.0	M	99.1	98.9	89.5	**			60>70>80
		F	50.3	42.7	*		F>M		F	99.1	96.8	73.7	**			60,70>80
	Biting food	M	37.3	40.9				94.9	M	96.3	94.8	83.9	**			60,70>80
		F	44.9	54.0				97.6	F	99.1	96.8	87.7	**			60,70>80
	Eating with chopsticks	M	42.1	52.2				97.6	M	98.8	91.7	83.9	**			60>70>80
		F	56.9	53.6				94.9	F	99.1	96.8	73.7	**			60,70>80
	Pouring hot water from a kettle into another vessel	M	44.2	53.3	*		80+>80-	97.6	M	100.0	98.9	93.5	**			60,70>80
		F	49.7	58.5				96.2	F	99.1	100.0	87.9	**			60,70>80
	Eating while holding the tableware up towards the mouth	M	52.7	55.3				96.2	M	95.1	97.9	87.1	**			60,70>80
		F	54.0	62.3				96.2	F	100.0	97.9	89.5	**			60,70>80
	Eating with a spoon or a fork	M	50.7	60.2	*		80+>80-	96.2	M	95.1	97.9	87.1	**			60,70>80
F		53.7	64.5				96.2	F	100.0	97.9	89.5	**			60,70>80	
Eating while holding the tableware on the table	M	50.7	60.2	*		80+>80-	96.2	M	95.1	97.9	87.1	**			60,70>80	
	F	53.7	64.5				96.2	F	100.0	97.9	89.5	**			60,70>80	

DEP: the dependent elderly group, INDEP: the independent elderly group, 80-: under 80 years old group, 80+: 80 years old and over group, 60, 70 and 80: 60s, 70s and 80s, M: males, F: females, \*: P<0.05, \*\*: P<0.01 A: gender effect, B: age effect, C: interaction effect.

(pulling a zipper closed) to 56.3% (opening and closing a drawer) in the under 80 years group, from 9.0% (putting on socks or stockings in the standing posture) to 63.8% (eating while holding the tableware on the table) in the over 80 years group. Two-way ANOVA for the dependent elderly group indicated no significant interaction. Significant gender differences were found in nine of 74 items, such as one item in bathing, one in using the toilet, two in dressing, three in grooming, two in eating and one in manual activity. Resulting multiple comparisons according to these nine items indicate that the %items for females were higher than those for males in these nine items. Significant age differences were only found in six items, and included two items in changing the posture, one in grooming and two in eating. The %items of three items of "washing hands," "eating while holding the tableware up towards the mouth" "and "eating while holding the tableware on the table" were higher in the over 80 years group than in the under 80 years group.

In the independent elderly group, the %items of "biting food" were 100% in all ages. The %items, excepting for "biting food", ranged from 91.6% (maintaining a knee-standing posture) to 100% (washing the face) in the 60s group, 77.8% (putting on socks or stockings in a standing posture) to 100% (washing the face) in the 70s group, and 47.7% (putting on socks or stockings in a standing posture) to 95.5% (washing the face) in the 80s group. Two-way ANOVA indicated that the interaction effects were significant in eleven items; two items in changing and holding posture, four in bathing, one in using the toilet, three in dressing and one in grooming, and that a decreasing trend with aging in these 11 items was different between gender groups. Significant gender effects were found in five items; four in changing and holding the posture and one in grooming, and %items for males were higher than females for all five items. There were significant age effects for all items excepting "biting food," and the values decreased with aging.

In the range of %items among each ADL domain, the highest %item minus the lowest %item was calculated for each age group, and its change with aging was examined (Table 3). In the independent elderly group, the ranges of %items extended with aging except for manual activity. Particularly, there are immediate sharp extensions of the ranges in the 80s. In the dependent elderly group, the range of %items for each ADL domain, excepting for "going up stairs" and "manual activity," extended with aging.

## Discussion

It has been reported that trends in gender differences in ADL ability are influenced by cultural and environmental factors in the independent community elderly (Sonn and Asberg, 1991; Lamb, 1997). Ranberg et al. (1999) reported that although females have lower mortality, they are more disabled than males, and this difference is more marked with aging. Dunlop et al. (1997) also reported similar results for the

**Table 3** The changes with aging in the ranges of %items of each ADL domain

			Dependent group		Independent group		
			80under	80over	60s	70s	80s
I	Movement	males	13.0	16.1	1.2	6.3	19.3
		females	11.5	17.2	0.9	7.3	18.4
II	Going up and down stairs	males	6.6	7.7	1.2	1.1	7.4
		females	8.1	6.3	1.8	3.2	3.5
III	Changing and holding posture	males	34.7	46.0	3.7	12.9	22.7
		females	35.5	46.1	11.1	18.9	42.2
IV	Bathing	males	10.9	16.5	1.2	4.1	9.4
		females	13.5	18.5	0.9	2.2	17.3
V	Using the toilet	males	27.9	42.2	3.6	9.6	21.8
		females	36.4	40.8	5.5	15.6	29.1
VI	Dressing	males	30.3	36.6	2.5	13.6	38.7
		females	27.9	36.0	8.4	23.4	40.9
VII	Grooming	males	27.2	39.3	2.5	11.5	20.0
		females	35.8	43.2	0.9	8.4	34.5
VIII	Eating	males	42.6	42.8	4.9	12.8	19.4
		females	32.2	42.9	0.9	4.2	26.3
IX	Manual activity	males	35.1	32.7	2.4	10.4	6.4
		females	37.2	33.2	0.9	4.3	6.9

Note. The above ranges were calculated by the highest %item minus the lowest %items in each ADL domain and age group.

independent elderly based on six years of longitudinal data, and that females spend more time in a disabled state. In this study, significant gender differences in the independent elderly group were found in some changing and holding posture activities, such as "sitting upright from a standing posture," "maintaining a knee-standing posture," "walking on the knees," "sitting on a chair from a standing posture," and "sitting cross legged from a standing posture." These activities required more muscular function in the lower extremities. Ranberg et al. (1999) also indicated that an explanation of the gender differences in ADL ability of independent elderly was caused by the differences in muscle mass between males and females.

In the dependent elderly group, significant gender differences were mainly found in activities using upper extremities. These activities were little influenced by the differences in muscle mass. In contrast, Demura et al. (1999) and Sato et al. (2001) reported no significant gender differences in the dependent elderly. These inconsistencies of findings of gender differences in the dependent elderly may be caused by the influences of their characteristics and seriousness of diseases. Further investigations are needed to fully explain the gender differences in ADL ability in the dependent elderly.

With aging and ADL ability, in the independent elderly group, it was expected that they could achieve most of the basic ADL, such as used in this study, when they were over 80 years old, and their functional decreases would also be slight. However, all ADL items excepting for "biting food" significantly decreased. Half of them significantly decreased from the 70s group and another half significantly decreased

from the 80s group. Since the subjects in this study did not have a serious disease, the results in this study reflected the general aging process. That is to say, even independent elderly gradually find it difficult to achieve most daily activities, and a significant decrease of ADL ability appears in over 80 years old group.

The decreases of %items from the 60s to 80s were large in dressing and changing posture activities requiring a balancing ability with a standing posture and movement activities such as "crossing the doorsill," "going up and down a slope" and "going up and down the stairs". Significant age differences appeared from the 70s. We considered that independent elderly find difficulty in achieving dressing and changing posture activities with a standing posture and movement activity from the 70s, and find it difficult to achieve most of the basic activities such as manual activity, changing posture in a lying posture from the 80s. Previous studies (Sato et al., 1999a; Winograd et al., 1994) reported that a decrease in lower limb function induced a decrease in movement ability, so that an active area of daily life was narrowed. Considering these reports and the findings in this study, in an ADL assessment of independent elderly, we must assess lower limb activity more carefully from 60 to 80 years old.

On the other hand, in the dependent elderly group, although ADL ability was also expected to decrease with aging, significant age differences were shown for only three items. ADL ability level of the dependent elderly group was lower than the independent elderly group, but it decreased slightly less than the independent elderly group. Sato et al. (1999a) examined the ADL ability characteristics of institutionalized elderly, excepting bedridden elderly. While a significant age difference in ADL ability was shown in the elderly with a high functional level who could walk without an assisting device, this trend was not shown in the elderly with a low functional level, who could not move. Demura et al. (1999) also reported similar findings by comparing the ADL ability characteristics of institutionalized disabled elderly among different ambulatory activity levels. We inferred that the change of ADL ability of the dependent elderly is more influenced by the characteristics and seriousness of disease than the factor of aging. In this study, there are some items where the %items of the over 80 years group are higher than those of the under 80 years group. One of the reasons for this result may be that this study used cross-sectional data. Therefore, further study using longitudinal data is needed to give a detailed examination of the change in ADL ability with aging.

The change with aging in the ranges of %items among each ADL domain extended with aging in many ADL domains in both elderly groups. Particularly, there are immediate sharp extensions of the ranges in the 80s of the independently elderly group. Since most of the independent elderly in the 60s can achieve most activities in daily life, the range becomes small. It was thought, however, that the functional decrease with aging raises the difficulty of achieving various activities, and the range in the achievement levels also extends. These

decreases in achievement level with aging are considered to lead to the extension of achievement levels in the 80s. Similar trends were found in the dependent elderly group limited in their performance by various diseases. These findings may suggest that individual differences in ADL ability for the elderly may remarkably extend with aging.

In summary, significant gender differences were found in some changing and holding posture activities in the independent elderly group, and were found in activities using upper extremities in the dependent elderly group. ADL ability in the independent elderly significantly decreased with aging, but this trend is not clear in the dependent elderly. In the independent elderly group, it is considered that indications of disability appear in activities using lower limbs, such as dressing, movement activity and changing posture, from the 70s, and appear in most basic activities, such as manual activity and changing posture with a lying posture, from the 80s or later. Extensions of achievement levels in ADL ability with aging were found in both elderly groups. Individual differences in ADL ability for the elderly may remarkably extend with aging.

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