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Relationship between the lifestyle and cognitive functions in elderly individuals

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Abstract

We investigated the relationship between lifestyle and cognitive function in elderly subjects who had their checkups at a memory clinic. The 136 elderly study subjects included 51 with Alzheimer's disease, 22 with vascular dementia, 23 with frontotemporal dementia, 25 with mild cognitive impairment, and 15 healthy control. The patients' lifestyles were assessed using the Frenchay activities index (FAI), and their cognitive functions were assessed by neuropsychological tests, such as the mini-mental status examination and the frontal assessment battery (FAB). The FAI score was lower in the demented patients than in the control subjects. Strong correlations were observed between the FAI scores and the scores in the neuropsychological tests. The FAI scores did not correlate with the educational level or the duration of disease. The findings from the stepwise regression analysis indicated that the FAB score, the number of family members, gender, and age were factors independently affecting the FAI score. The results indicated that the lifestyles of the elderly people might be affected by not only their age and family organization but also their cognitive function. We concluded that cognitive function could play a role in the lifestyle of elderly people.

INTRODUCTION

In 1995, 15% of Japanese families had an elderly member, and it is estimated that by 2020, this same percentage will increase to 35%. This aging of the society will have a major impact on the practice of medicine. In Japan, 27.3% of the people who are 85 years old or older have dementia. In this context, an important aspect of medical care in an aging society is to promote the concept of active aging.[1-4] Aging results in decrease in the performance of physical and mental function. The opportunities for interaction outside the home become limited, and isolation becomes a problem. A prevalent concern of the elderly is the loss of memory. The maintenance of cognitive functions, which decline with age, is very closely related and critical to maintaining the motor functions and improvements in the quality of life of the elderly. However, there have been only few reports on the relationship between lifestyle and dementia. Our memory clinic was therefore established in 1998 to provide medical care to senior citizens experiencing dementia. The psychiatrists in this clinic perform neurological, neuropsychological, and neuroradiological examinations on patients who complain of amnesia. The early detection and the accurate diagnosis of dementia are the basis for improving the daily life of patients with dementia. This study examined the lifestyles of elderly people confined to the home and also evaluated how these were affected by their characteristics and cognitive functions.

METHODS

Patients

This outpatient study included 136 elderly people confined to their homes, of whom 51 were men and 85 were women. Their ages ranged from 65 to 91 (76.0 ± 6.1) years. Each member of the group had received a mean of 10.8 ± 2.6 years (range, 3–16 years) of formal education.

The patients were diagnosed with probable Alzheimer's disease or vascular dementia on the basis of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*)[5]

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and the criteria established by the National Institute for Neurological and Communicative Disorders and Stroke and Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA).[6] Frontotemporal dementia was diagnosed according to the Lund-Manchester research criteria.[7] Mild cognitive impairment was diagnosed according to Petersen's criteria.[8]

Alzheimer's disease was diagnosed in 51 patients. Twenty-three patients had frontotemporal dementia; 22, vascular dementia; and 25, mild cognitive impairment. The healthy control in this study were 15 elderly persons with no abnormality in the neurological and neuropsychological tests and the magnetic resonance imaging scans. All the subjects were aware of the purpose of this study and were cooperative. Informed consent was obtained from each subject.

Procedure

The patients' lifestyles were assessed using the Frenchay activities index (FAI).[9] The FAI consists of 15 common activities, such as preparing and eating meals, washing clothes, local shopping, social outings and hobbies, and driving cars/ travelling on buses, during the last 3 to 6 months. The Japanese version of the test gives a score between 0 (no activities) and 45 (full activities).[10,11]

Neuropsychological testing was conducted using the mini-mental status examination (MMSE)[12], the kana-hiroi test[13], the word fluency test (WFT)[14], the auditory-verbal learning test (AVLT)[15], the Raven's coloured progressive matrices (RCPM) test[16], the frontal assessment battery (FAB)[17], and the self-rating depression scale (SDS).[18] In the kana-hiroi test, the subjects were asked to identify 5 kana letters (*A*, *I*, *U*, *E*, and *O*, Japanese vowels) while reading a story written in kana. The total number of kana letters was 406, with 61 of them being vowels. The number of letters correctly recognized in 2 min was used as the score, which decreased with age; the mean score previously recorded in the sixth decade of life is was 25.[13] For the WFT, both category WFT (CWFT-C) and initial letter WFT (WFT-L) were conducted according to the method of Saito *et al*.[14] The testing time was 1 min for each test, and it involved determining the total number of words starting with *shi*, *I*, and *re* (in Japanese pronunciation) that the subject recalled (WFT-L). In the AVLT test, the subjects repeated words immediately (immediate recall; AVLT-IR) or 30 min (delayed recall) after the verbal presentation of 15 words. In the AVLT-IR, words were to be repeated 5 times, and then the total number of repeated words was determined.[15] RCPM were used to test and evaluate the visual perception. The maximum score in this test was 36 points.[16] The FAB consisted of 6 subtests—conceptualization, mental flexibility, motor programming, sensitivity to interference, inhibitory control, and environmental autonomy. The maximum total score was 18.[17] The SDS test was completed by all the patients.[18]

All the statistical procedures were performed using a commercially available software program (Statview 4.11 for Macintosh, California). All the values are presented as the mean ± SD. The analysis of variance (ANOVA) test was used to assess the significance of any differences between the groups in regarding to the types of dementia. The differences between the groups involving categorical data were tested by chi-squared analysis. The Spearman's rank correlation coefficients were calculated to determine the relationships between the neuropsychological test scores and the ages, the duration of dementia, the years of education, and the FAI scores. A *P* value less than 0.05 was considered to indicate statistical significance.

RESULTS

Table 1 shows the differing types of dementia presented by the test candidates in addition to the results of their neuropsychological tests. The data from the MMSE, the WFT, and the AVLT of the patients experiencing any form of dementia indicate that they performed poorly in comparison with the control subjects and those with mild cognitive impairment. However, no significant difference was observed in the performance between the control subjects and those with frontotemporal dementia on the basis of the RCPM test data. The patients with Alzheimer's disease were observed to have a fewer number of years of education than the patients with mild cognitive impairment and the control subjects. There was no significant difference in the age, duration of amnesia, number of family members, and the SDS scores among the patients with different types of dementia.

A comparison of the patients with dementia and the control subjects showed that the patients with dementia scored lower in the FAI test. The men also had lower FAI scores than the women among the control subjects, those with mild cognitive impairment, and patients with dementia (Figure 1).

Table 1: Neuropsychological test and types of dementia

	CS	MCI	AD	FTD	VD	DF	F	P value
Age (years)	75.3 (5.9)	76.8 (5.5)	76.7 (6.6)	74.1 (5.1)	75.6 (6.4)	4	0.95	NS
Education (years)	12.4 (2.2)	11.1 (2.9)	9.8 (2.4)*#	10.9 (2.6)	11.3 (2.2)	4	3.95	<.005
Duration (mo)	27.0 (32.6)	31.4 (28.2)	24.4 (21.6)	19.5 (20.3)	20.2 (16.2)	4	0.95	NS
MMS (/30)	27.8 (1.8)	25.9 (2.4)	19.1 (5.2)*#	19.8 (5.1)*#	21.0 (4.5)*#	4	14.98	<.0001
Kana-hiroi test (/2 min)	26.8 (11.6)	15.6 (8.2)*	6.7 (6.7)*#	12.2 (11.6)*#	8.9 (8.2)*#	4	13.59	<.0001
WFT-C (/3 min)	27.5 (6.2)	23.2 (6.1)	18.8 (8.3)*#	17.9 (7.1)*#	19.2 (6.7)*#	4	5.02	<.005
WFT-L (/3 min)	17.1 (6.3)	11.8 (5.2)*	8.6 (6.2)*#	7.8 (5.4)*#	7.6 (6.0)*#	4	7.19	<.0001
AVLT-IR (/75)	40.4 (7.8)	23.6 (5.5)*	16.5 (8.6)*#	18.5 (8.2)*#	21.0 (5.3)*#	4	25.97	<.0001
AVLT-DR (/15)	8.3 (3.0)	1.6 (2.7)*	0.8 (2.1)*	0.5 (1.1)*	0.8 (1.9)*	4	34.34	<.0001
AVLT-RC (/15)	13.2 (1.5)	9.5 (3.3)*	7.3 (4.0)*#	9.3 (4.2)*	8.4 (4.2)*#	4	6.33	<.0001
RCPM (/36)	28.5 (2.9)	27.1 (3.1)	17.5 (6.5)*#	26.3 (2.8)	18.4 (6.7)*#	4	22.80	<.0001
FAB (/18)	13.5 (2.2)	11.8 (2.7)	8.4 (4.0)*#	9.1 (3.9)*#	8.4 (4.2)*#	4	6.90	<.0001
SDS (/80)	41.2 (11.2)	40.4 (8.0)	43.2 (8.7)	38.6 (6.3)	40.1 (8.1)	4	1.15	NS

Values are the mean (SD)
CS, control subjects; MCI, mild cognitive impairment; AD, Alzheimer's disease; FTD, frontotemporal dementia; VD, vascular dementia; MMS, Mini-mental state; WFT-C, word fluency test (category); word fluency test (initial letter); AVLT-IR, auditory verbal learning test (immediate recall); AVLT-DR, auditory verbal learning test (delayed recall); auditory verbal learning test (recognition); RCPM, Raven's colored progressive matrices; FAB, frontal assessment battery; SDS, self-rating depression scale
ANOVA test
Fisher's PLSD
*p<0.005 Significant different from Healthy
#p<0.05 Sigificant different from MCI

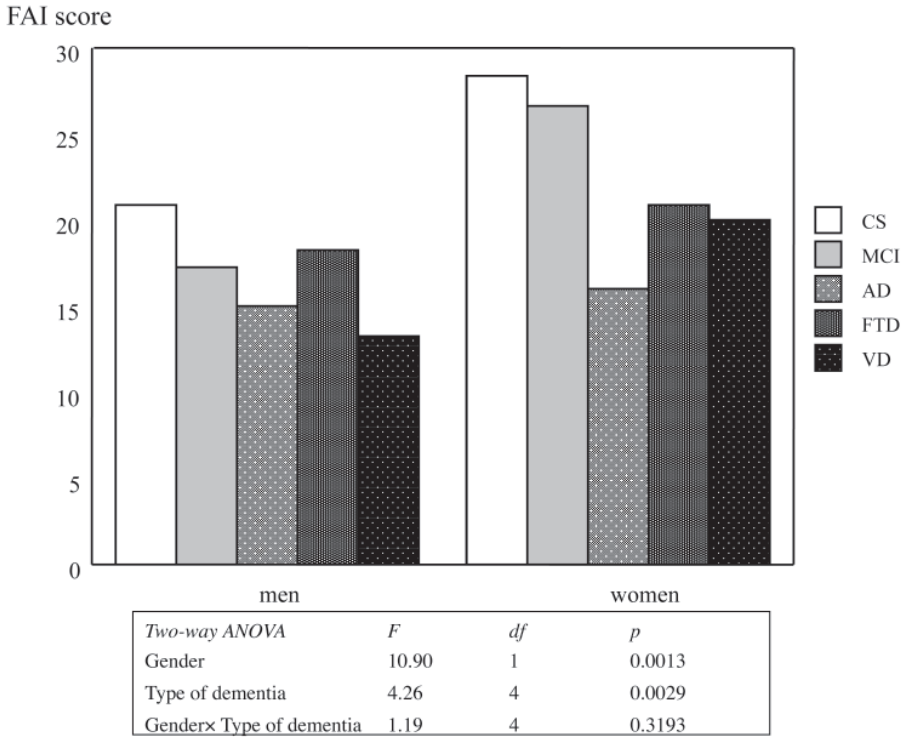
Strong correlations were observed between the FAI scores and the number of family members and between the FAI scores and the SDS score (Table 2). FAI scores was not correlated with the age, the number of years of education, and the duration of dementia. There were high correlations between the FAI scores and the neuropsychological test results, including those from the MMSE, the WFT, the AVLT, the RCPM test, and the FAB (Table 2).

Table 3 summarizes these data item by item, with comparisons made on a group basis. There were recognizable differences in the performance of reading books, outing/car rides, and household/car maintenance (Figure 2). For example, in the case of the outing/car rides, all the subjects with dementia performed poorly in comparison with the control subjects and those with mild cognitive impairment. In reading books, subjects with Alzheimer's disease or vascular dementia tended to perform poorly, whereas those with frontotemporal dementia did relatively well.

The stepwise regression analysis was used to evaluate the determinant factors of the FAI score. The results revealed that the FAB score, the number of family members, sex, and age affect the FAI scores and are determinant factors of the FAI scores (Table 4).

DISCUSSION

Recently, studies have shown the relationship between lifestyle and cognitive and physical functions in the elderly. Attempting to perform leisure activities, such as travelling, sewing, and gardening[19], and other specific activities, such as watching movies[20], help individuals to maintain their cognitive function, and there are reports that these decrease the morbidity of patients experiencing dementia. Participation in cognitively stimulating leisure activities has also been associated with reduced rates of dementia.[21,22] Bussuk *et al*.[23] reported that elderly people who maintain many social contacts showed better cognitive functions than those who live a life of solitude. In addition, Hall *et al*.[24] found that aerobic exercise prevents the decline of cognitive function with increasing age.



Two-way ANOVA	*F*	*df*	*p*
Gender	10.90	1	0.0013
Type of dementia	4.26	4	0.0029
Gender× Type of dementia	1.19	4	0.3193

Figure 1. Frenchay activities index: sex and types of dementia
A comparison of the patients with dementia with the healthy subjects demonstrated that the patients with dementia scored lower in the FAI test. The men also had lower FAI scores than the women among the healthy subjects, those with mild cognitive impairment, and the patients with dementia. ANOVA, analysis of variance.

Table 2: Correlations between neuropsychological tests and the Frenchay Activities Index scores

	R	P value
Age	–0.15	NS
Education	0.13	NS
Duration	–0.15	NS
Number of family members	–0.25	<0.005
MMS	0.41	<0.0001
Kana-hiroi test	0.46	<0.0001
WFT-C	0.38	<0.0001
WFT-L	0.34	<0.0001
AVLT-IR	0.43	<0.0001
AVLT-DR	0.23	<0.001
AVLT-RC	0.41	<0.0001
RCPM	0.38	<0.0001
FAB	0.50	<0.0001
SDS	–0.23	<0.01

Pearson's correlation

MMS, Mini-mental status; WFT-C, word fluency test (category); word fluency test (initial letter); AVLT-IR, auditory verbal learning test (immediate recall); AVLT-DR, auditory verbal learning test (delayed recall); auditory verbal learning test (recognition); RCPM, Raven's colored progressive matrices; FAB, frontal lobe assessment battery; SDS, self-rating depression scale

Table 3: Frenchay Activities Index items and the types of dementia

	CS	MCI	AD	FTD	VD	DF	F	P value
Main meals	1.8 (1.5)	1.9 (1.5)	1.4 (1.5)	1.5 (1.5)	1.4 (1.5)	4	0.43	NS
Washing up	1.8 (1.5)	1.9 (1.5)	1.8 (1.4)	1.9 (1.4)	1.6 (1.5)	4	0.21	NS
Washing clothes	2.0 (1.4)	1.8 (1.4)	1.8 (1.4)	1.6 (1.4)	1.3 (1.5)	4	0.57	NS
Light housework	2.4 (1.0)	1.8 (1.3)	1.6 (1.3)	1.5 (1.1)	1.3 (1.4)	4	1.45	NS
Heavy housework	0.9 (1.3)	0.9 (1.3)	0.5 (1.0)	0.7 (1.1)	0.7 (1.1)	4	0.48	NS
Local shopping	2.2 (1.0)	1.8 (1.2)	1.3 (1.1)	1.3 (1.1)	1.3 (1.3)	4	1.91	NS
Social outing	2.5 (0.7)	1.9 (1.2)	2.2 (0.8)	1.7 (1.3)	2.4 (0.9)	4	1.59	NS
Walking outside >15 m	2.7 (0.9)	2.7 (0.8)	1.9 (1.3)	2.2 (1.2)	2.4 (1.1)	4	1.93	NS
Hobby	1.7 (1.2)	1.2 (1.4)	0.9 (1.2)	0.8 (1.1)	0.6 (1.2)	4	1.83	NS
Drive car/travel on bus	1.5 (1.4)	1.1 (1.4)	0.7 (1.1)	1.1 (1.2)	0.6 (1.1)	4	1.45	NS
Outing/car rides	0.6 (0.7)	0.6 (0.6)	0.2 (0.6)*#	0.1 (0.4)*#	0.1 (0.2)*#	4	3.95	<.01
Gardening	1.1 (1.2)	1.6 (1.4)	1.3 (1.1)	1.5 (1.3)	1.2 (1.2)	4	0.52	NS
Household/car maintenance	1.2 (1.2)	1.3 (1.3)	0.5 (0.9)*#	1.5 (1.3)	0.8 (1.2)	4	2.72	<0.5
Read book	2.4 (1.1)	1.9 (1.3)	0.7 (1.2)*#	1.3 (1.4)	0.5 (1.0)*#	4	7.38	<.0001
Paid work	0.8 (1.3)	0.7 (1.1)	0.4 (0.9)	0.7 (1.1)	0.5 (0.8)	4	0.57	NS

Values are the mean (SD)
CS, control subjects; MCI, mild cognitive impairment; AD, Alzheimer's disease; FTD, frontotemporal dementia; VD, vascular dementia;
ANOVA test
Fisher's PLSD
*p<0.005 Significant different from Healthy
#p<0.05 Sigificant different from MCI

This study examined the lifestyles of elderly people confined to the home, and the relationship between the different types of dementia on the lifestyle. We found that the items "household/car maintenance" and "reading books" tended to score lower in patients with Alzheimer's disease and those with vascular dementia. Alzheimer's disease and vascular dementia cause visual and perceptual problems, as well as memory impairment. The dysfunction of these complicated cognitive dysfunctions may thus have effect on the household/car maintenance chore and reading. These could also be the effect of socio-cultural factors. As even those elderly not having dementia residing in the study area, most would prefer not to drive. In addition, public transport such as bus or train is not well developed in this rural area. This may be the reason for the lack of difference in the scores on the items "driving a car/travelling on a bus" among the people with different types of dementia.

On the other hand, in patients with dementia,

Table 4: Multivariate (stepwise regression) analysis for factors determining the Frenchay Activities Index score

Variable	Coefficient	Std. Error	Std. Coefficient	F to remove
Intercept	20.245	7.478	20.245	7.329
FAB	1.194	0.183	0.492	42.599
Number of family members	–0.825	0.386	–0.162	4.561
Gender	4.447	1.485	0.229	8.968
Age	–0.227	0.093	–0.187	5.996

R=0.613, df=4, F=16.747, p<0.0001

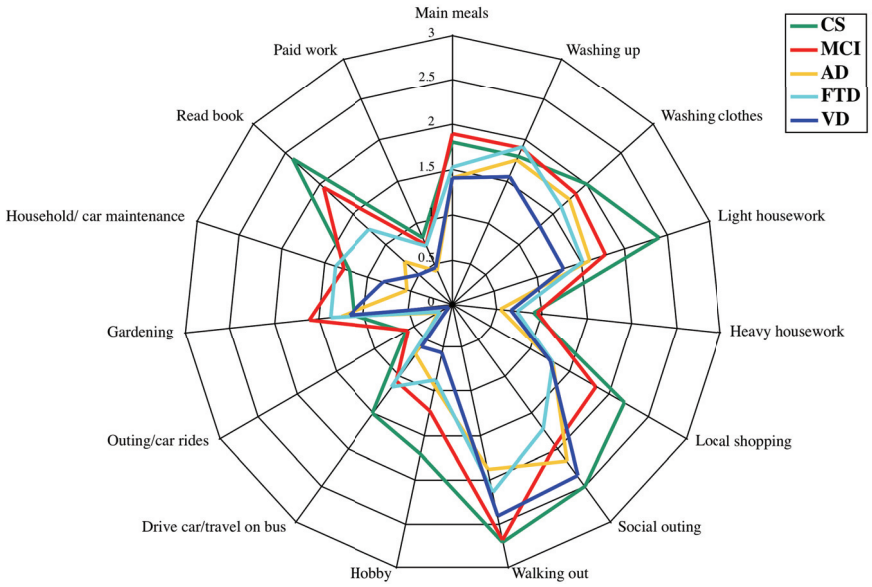


Figure 2. Frenchay activities index: items and the types of dementia
There were recognizable differences in the performance with respect to reading books, outing/car rides, and household/car maintenance. For example, in the case of outing/car rides, all the test candidates experiencing some form of dementia performed poorly in comparison with the control subjects and those with mild cognitive impairment.

while the score on "outing/car rides" in the FAI test decreased, while the score on "social outing" was relatively maintained. The difference may be due to "outing/car rides" being difficult for those with dementia because it puts extra burdens on the family. Whereas the score on "social outing" was high in this study. This may be because the nursing care insurance system in Japan covers dementia and allows them opportunities to go out for day care services. The stepwise regression analysis indicated that the FAB score, the number of family members, sex, and age were factors independently affecting the FAI score. These results indicate that the higher the number of family members who live with an elderly individual and the higher the SDS score, the lower the FAI score. In a large number of families, younger family members who live with elderly persons tend to leave for work; thus, the elderly patients do not have an opportunity to go out of the house. In addition, because housemates do most of the housework, there are a significant number of patients who do not cook or clean and thus spend the entire day not doing anything. It may be necessary to instruct families who live together with elderly persons to encourage lifestyle and daily activities that may be cognitively stimulating to the elderly.

In conclusion, this study showed a relationship between lifestyle and cognitive function among the patients who came to our hospital. The extent where the lifestyles of the patients has an effect on their cognitive function or, conversely, the variations that exist in their lifestyles are caused by a decline in cognitive functions is uncertain. It is thus necessary to have a prospective and follow-up study to clarify this important relationship.

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DISCLOSURE

There are no conflicts of interest.

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