Short Communication

Evaluation of weight loss in the community-dwelling elderly with dementia as assessed by eating behavior and mental status

Keiko Miyamoto MS[1], Sadanori Higashino PhD[2], Kazuki Mochizuki PhD[1], Toshinao Goda PhD[1], Hideo Koyama PhD[3]

[1]Graduate School of Nutritional and Environmental Sciences, University of Shizuoka, Shizuoka, Japan
[2]School of Administration and Informatics, University of Shizuoka, Shizuoka, Japan
[3]University of Hyogo, Hyogo, Japan

Involuntary weight loss is a symptom of protein energy malnutrition often reported among elderly people, especially those with dementia. In this study, we examined whether dementia-related eating difficulties increase the probability of weight loss in the elderly. This cross-sectional observation study was conducted in 60 community-dwelling elderly people with dementia (84.1±6.7 yr of age). Over 6 months, 26.7% of the subjects lost at least 5% of body weight. Impaired mental status and eating difficulties were closely associated with weight loss as determined by Spearman's rank correlation coefficient. Assessment of eating difficulties combined with mental states in the subjects by discriminant analysis enabled us to differentiate subjects with ≥5% weight loss from those with less than 5% weight loss at a probability of 76.4%. This result suggests that eating difficulties and impaired mental status among elderly people with dementia are closely associated with weight loss.

Key Words: eating difficulties, elderly, dementia, nutritional assessment, weight loss

INTRODUCTION

Involuntary weight loss is a symptom of protein energy malnutrition (PEM). Several studies have reported that involuntary weight loss often occurs in people with Alzheimer's disease.[1-3] A longitudinal cohort study, which was conducted over four years in a long-term care institution, showed that residents with dementia had significantly lower body weight throughout their stay than those without dementia.[1] A later study demonstrated that total energy expenditure of patients with Alzheimer's disease was 14% lower than that of healthy elderly subjects.[2] These results indicate that weight loss among people with Alzheimer's disease may not be directly attributable to physiological factors.

A prospective cohort study conducted over two years reported that a decline in nutritional and functional scores in patients with Alzheimer's disease could be assessed by the Mini-Mental Status Examination (MMSE) score, which is a regular test for assessing dementia.[4] Further, a previous observational study demonstrated that institutionalized patients with Alzheimer's disease have a greater weight loss when they also have symptoms of agitation or aggression and depression, as assessed by behavioral and psychological symptoms of dementia.[5] These results suggest that dementia in elderly people is closely associated with functional ability and nutritional status. Indeed, several studies have shown that elderly dementia patients frequently have difficulty feeding themselves such as not opening their mouth, refusing to eat, and gathering food in their mouth, along with severe communication problems with their caregivers.[6] Interestingly, it has been reported that patients with Alzheimer's disease with a low score on the Eating Behavior Scale (EBS), which was developed to assess functional ability during meals and has been applied to patients with Alzheimer's disease, not only required more time to finish a meal, but they also had a lower MMSE score.[7] These studies suggest that decreased functional ability and mental status in elderly people with dementia are closely associated with weight loss accompanied by eating and feeding difficulties.

In Japan, day-care services are frequently used by community-dwelling elderly with dementia.[8] Assessing dementia-related eating difficulties among the elderly attending day-care services may be helpful to prevent weight loss in these patients.

In the present study, we examined whether eating difficulties and decreased mental status were associated with weight loss among elderly patients with dementia who attended a day-care centre.

Corresponding Author: Keiko Miyamoto, Laboratory of Food Management, Graduate School of Nutritional and Environmental Sciences, University of Shizuoka, 52-1 Yada, Suruga-ku, Shizuoka 422-8526, Japan.
Tel: +81-54-264-5512; Fax: +81-54-264-5512
Email: mymtkiko@gmail.com

MATERIALS AND METHODS

This was a cross-sectional observation study conducted from August to September 2006. Subjects were 60 community-dwelling elderly people (mean age, 84.1±6.7 years; 13 men and 47 women) diagnosed with dementia and registered as users of dementia day-care services at a day-care centre in Tokyo.

Since a weight loss of 5% (5% WL) or greater over 3-6 months is regarded as a moderate risk of PEM,[9] we used this criteria to define those at risk of PEM. Weight records of the subjects were collected from health records from January to August 2006.

Functional status was evaluated through the Barthel Index (BI) scoring system.[10] This instrument contains 10 self-care independence items in Activities of Daily Living (ADL). In the present study, 8 items were selected, giving a maximum score of 75 points. The score decreases with decreasing ability to perform ADL.

In this study, we chose "Nishimura's geriatric rating scale for mental status" (the NM scale) to assess mental status, because the NM scale is closely correlated with the Revised Hasegawa Dementia Scale,[11,12] which evaluates cognitive function in a question-answering system and is widely used in Japan to screen for dementia.[13] The NM scale evaluates mental status through observation of behavior and is classified according to 5 aspects, including "housework; proper arrangement of personal belongings",

"interest and volition; social relations", "conversation", "memory", and "orientation". The total possible number of evaluation points for the 5 aspects is 50. The score decreases with decreasing mental status.

The EBS was employed to assess the ability to execute normal eating behaviors.[7] The EBS includes 6 items, including "initiate eating", "maintain attention to the meal", "locate food", "use utensils", "bite, chew and swallow without choking", and "terminate meal", with a total possible score of 18 points (3 points, able to eat independently; 2 points, needs verbal prompts; 1 point, needs physical assistance; 0 points, dependent on others to eat).

All analyses were conducted with SPSS statistical software (Version 12.0 for Windows). The significance level was set at $p<0.05$.

RESULTS

Among all subjects, 26.7% ($n=16$) lost ≥5% body weight (WL), including 21.4% ($n=6$) with ≥10% WL over 3-6 months. No data on weight change were available for three subjects (Table 1). There were no significant differences in sex, age, or availability of family members between the subjects with at least 5% WL and those with less than 5% WL. No subject had a medical diagnosis (e.g., cancer) that may have explained the 5% weight loss, and no subjects had acute illness.

Subjects with at least 5% WL had significantly lower

Table 1. Subject characteristics

	Overall (n=57)	<5% weight loss (n=41)	≥5% weight loss (n=16)	p-value
Age (years) (mean ± SD)	84.1±6.7	83.7±6.9	83.5±6.4	0.426[†]
Sex (n, %)				
Male	12 (21.2)	8 (19.5)	4 (25.0)	0.723[‡]
Female	45 (78.9)	33 (80.5)	12 (75.0)	
Family member (n, %)				
Live-alone	5 (8.8)	4 (9.8)	1 (6.3)	
Spouse /partner	8 (14.0)	7 (17.0)	1 (6.3)	0.714[‡]
Grown-up child and someone else	44 (77.2)	30 (73.2)	14 (87.5)	
Body mass index (BMI , kg/m^2) (mean ± SD)[¶]	20.3±3.2	21.1±3.3	19.2±1.9	0.041[†]
BMI classification (n, %)				
<18.5	13 (22.8)	9 (21.9)	4 (25.0)	
18.5-25.0	39 (68.4)	27 (65.9)	12 (75.0)	0.461[‡]
≥25.0	5 (8.8)	5 (12.2)	0 (0)	
BI score[††]	45.0 (20.0-63.8)	45.0 (27.5-65.0)	30.0 (10.0-48.8)	0.056[§]
NM-Scale score[††]	24.0 (11.3-32.5)	25.0 (15.0-33.0)	15.0 (9.0-26.0)	0.027[§]
EBS score[††]	16.0 (7.3-18.0)	17.0 (12.0-18.0)	10.0 (3.5-14.8)	0.009[§]
Diagnosis of dementia (n, %)				
Alzheimer's disease	16 (28.1)	11 (26.8)	5 (31.3)	
Vascular dementia	11 (19.3)	8 (19.5)	3 (18.8)	0.319[‡]
Unspecified dementia	16 (28.1)	13 (31.7)	3 (18.8)	
Cognitive impairment	14 (24.6)	9 (22.0)	5 (31.3)	
Complications (n, %)				
Heart disease	12 (21.1)	8 (19.5)	4 (25.0)	0.723[‡]
Cerebrovascular disease	20 (35.1)	13 (31.7)	7 (43.8)	0.538[‡]
Mental disease (except for dementia)	8 (14.0)	5 (12.2)	3 (18.8)	0.712[‡]
Disease of muscles and bones	9 (15.8)	4 (9.8)	5 (31.3)	0.099[‡]
Diabetes	12 (21.1)	9 (22.0)	3 (18.8)	1.000[‡]
Hypertension	21 (36.8)	16 (39.0)	5 (31.3)	1.000[‡]

Comparisons between the ≥5% weight loss and <5% weight loss groups were performed by [†]: Student t-test, [‡]: chi-square test, and [§]: Mann-Whitney U test.
[¶]: BMI after weight loss. [††]: Values are median (25th-75th percentile).
BI: Barthel Index, NM-scale: Nishimura's geriatric rating scale for mental states, EBS: Eating Behavior Scale.

Table 2. Spearman rank correlations for age, BMI, weight loss (%), BI score, NM-scale score and EBS score

		Age (n = 60)	BMI[§] (n = 60)	Weight loss (%) (n = 55)[†]	BI score (n = 60)	NM scale score (n = 60)	EBS score (n = 60)
NM-scale score	r$_s$[‡]	-0.135	0.253	0.284	0.886		0.812
	p-Value	0.306	0.051	0.036	p <0.001		p <0.001
EBS score	r$_s$[‡]	-0.063	0.291	0.348	0.838	0.812	
	p-Value	0.628	0.024	0.009	p <0.001	p <0.001	

BMI: Body mass index, BI: Barthel Index, NM-scale: Nishimura's geriatric rating scale for mental states, EBS: Eating Behavior Scale.
[†]: No data on weight change were available for three subjects and two subjects with ≥10% weight gain were excluded.
[§]: BMI after weight loss.
[‡]: r$_s$-value is Spearman rank correlation coefficient.

Table 3. Sensitivity, specificity and discriminant probability of the EBS score with or without the NM-scale score in predicting PEM risk

		Model 1 BMI <18.5	Model 2 ≥5% weight loss	Model 3 ≥10% weight loss
EBS score	Sensitivity (%)	50.0	56.3	61.5
	Specificity (%)	70.5	76.9	81.0
	Correct discriminant probability (%)	65.0	70.9	76.4[†]
EBS score +NM score	Sensitivity (%)	50.0	68.8	61.5
	Specificity (%)	68.2	79.5	78.6
	Correct discriminant probability (%)	63.3	76.4[‡]	74.5

PEM: protein energy malnutrition, BMI: Body mass index, BI: Barthel Index, NM-scale: Nishimura's geriatric rating scale for mental states, EBS: Eating Behavior Scale.
Discriminant analysis was performed using a forced entry method.
[†]: Discriminant of model 4: Y1 = -2.299 + 0.176 X1; X1 = EBS score.
[‡]: Discriminant of model 3: Y2 = -2.250 + 0.213X1 - 0.023 X2; X1 = EBS score, X2 = NM-scale score.

NM scale scores (p=0.027) and EBS scores (p=0.009) than those with less than 5% WL (Table 1), according to the Mann-Whitney U test. The NM scale score was significantly correlated with the magnitude of weight loss (r$_s$=0.284, p=0.036), the BI score (r$_s$=0.886, p<0.001) and the EBS score (r$_s$=0.812, p<0.001; Table 2). The EBS score was significantly correlated with body mass index (BMI, kg/m^2) after 5% WL (r$_s$=0.291, p=0.024), magnitude of weight loss (r$_s$=0.348, p=0.009), BI score (r$_s$=0.838, p<0.001) and NM scale score (r$_s$=0.812, p<0.001; Table 2). The r-values are Spearman's rank correlations.

There were significant differences in the scores for 6 items of the EBS between subjects with at least 5% WL versus those with less than 5% WL, according to the Mann-Whitney U test. Those with at least 5% WL had greater scores for "initiate eating" (p=0.01), "maintain attention to the meal" (p=0.013), and "terminate meal" (p=0.003) than those with less than 5% WL. Scores for "locate food", "use utensils", and "bite, chew and swallow without choking" did not differ significantly between ≥5% WL and <5% WL (data not shown).

Forced-entry discriminant analysis was performed to examine whether PEM risk could be predicted from the EBS and NM scale scores (Table 3). Three models of dependent variables were used. In each model, subjects were classified into two groups according to the levels of variable cut-off points as follows: model 1: BMI<18.5 and ≥18.5, model 2: ≥5% WL and <5% WL, and model 3: ≥10% WL and <10% WL. In model 3, using the EBS score only was associated with a 76.4% probability of correctly classifying the PEM risk (using a cut-off of 10% WL). The specificity was 81.0 %. The combined use of EBS and NM scale scores was associated with a probabil-

ity of 76.4 % for predicting PEM risk with a cut-off of 5% WL. The specificity was 79.5 % (Table 3).

DISCUSSION

In this study, we found a positive correlation between weight loss and the NM scale score or EBS score in community-dwelling elderly subjects with dementia. It has been reported that symptoms caused by decreased mental status, such as apraxia, affect feeding behavior.[3,14] In this study, we have demonstrated, for the first time, that mental status and eating difficulties associated with dementia in elderly people are closely related to weight loss. Furthermore, we showed that assessing eating difficulties combined with mental status by discriminant analysis was more effective for differentiating patients with at least 5% weight loss over 3-6 months than only assessing eating difficulties. These results indicate that assessing both eating difficulties and mental status is helpful for assessing the risk of weight loss in patients with dementia.

Several scales have been developed for the observational evaluation of eating behaviors in dementia patients, including those assessing the necessity of nursing intervention and the evaluation of aversive feeding behaviors.[15,16] In addition, further assessment of chewing and swallowing function has been recommended when specific symptoms are observed; for example, when the patient makes gurgling sounds or chokes on water.[17] Among the available scales, we used the EBS as an index for eating behavior ability in this study because it is a brief but comprehensive screening tool for eating difficulties. There are few reports regarding the relevance of the EBS in elderly people with dementia, but the method is simple and quick (can be completed within mealtimes), and is

low cost. Our results suggest that the EBS as well as the NM scale is useful for assessing weight loss in elderly people with dementia. To confirm our results, the relevance of the EBS and association between the EBS and weight loss in elderly people with dementia need to be further assessed in a large population. In addition, information obtained by EBS depends on the skills of the clinician performing the observation. Therefore, a standardized method of assessing eating behaviors in subjects with dementia must be developed to minimize inter-observer variability. Research based on a standardized method will foster a shared awareness of eating behavior difficulties.

Prevention of weight loss is a health issue of major importance among the elderly with dementia. However, nutritional assessment including dietary intake, hydration and feeding and eating difficulties are often neglected in elderly people. In particular, many elderly people live alone or with their families and only periodically use a day-care service. The service provides an important opportunity to conduct nutritional assessments among the elderly. Our results suggest that regular measurement of eating difficulties using the EBS could help prevent weight loss among the elderly who use day-care services.

ACKNOWLEDGMENTS

AUTHOR DISCLOSURES

REFERENCES

1. Wang SY, Fukagawa N, Hossain M, Ooi WL. Longitudinal weight changes, length of survival, and energy requirements of long-term care residents with dementia. J Am Geriatr Soc. 1997;45:1189-95.
2. Poehlman ET, Dvorak RV. Energy expenditure, energy intake, and weight loss in Alzheimer disease. Am J Clin Nutr. 2000;71:650S-5S.
3. Gillette Guyonnet S, Abellan Van Kan G, Andrieu S, Belmin J, Berrut G, Bonnefoy M et al. International Academy on Nutrition and Aging Expert Group. IANA (International Academy on Nutrition and Aging) Expert Group: weight loss and Alzheimer's disease. J Nutr Health Aging. 2007;11: 38-48.
4. Cortes F, Nourhashémi F, Guérin O, Cantet C, Gillette-Guyonnet S, Andrieu S, Ousset PJ, Vellas B, REAL-FR Group. Prognosis of Alzheimer's disease today: A two-year prospective study in 686 patients from the REAL-FR Study. Alzheimers Dement. 2008;4:22-9.
5. White HK, McConnell ES, Bales CW, Kuchibhatla M. A 6-month observational study of the relationship between weight loss and behavioral symptoms in institutionalized Alzheimer's disease subjects. J Am Med Dir Assoc. 2004;5: 89-97.
6. Athlin E, Norberg A, Asplund K, Jansson L. Feeding problems in severely demented patients seen from task and relationship aspects. Scand J Caring Sci. 1989;3:113-21.
7. Tully MW, Matrakas KL, Muir J, Musallam K. The Eating Behavior Scale. A simple method of assessing functional ability in patients with Alzheimer's disease. J Gerontol Nurs. 1997;23:9-15.
8. Kuzuya M, Masuda Y, Hirakawa Y, Iwata M, Enoki H, Hasegawa J, Iguchi A. Day care service use is associated with lower mortality in community-dwelling frail older people. J Am Geriatr Soc. 2006;54:1364-71.
9. Omran ML, Morley JE. Assessment of protein energy malnutrition in older persons, part I: History, examination, body composition, and screening tools. Nutrition. 2000;16:50-63.
10. Mahoney FI, Barthel DW. Functional evaluation: The barthel index. Md State Med J. 1965;14:61-5.
11. Nishimura T, Kobayashi T, Hariguchi S, Takeda M, Fukunaga T, Inoue O, Kondo H, Niigawa H, Tanaka S, Yamashita M. Scales for mental state and daily living activities for the elderly: clinical behavioral scales for assessing demented patients. Int Psychogeriatr. 1993;5:117-34.
12. Sadamori S, Hayashi S, Hamada T. The relationships between oral status, physical and mental health, nutritional status and diet type in elderly Japanese women with dementia. Gerodontology. 2008;25:205-9.
13. Kim KW, Lee DY, Jhoo JH, Youn JC, Suh YJ, Jun YH, Seo EH, Woo JI. Diagnostic accuracy of mini-mental status examination and revised hasegawa dementia scale for Alzheimer's disease. Dement Geriatr Cogn Disord. 2005;19: 324-30.
14. LeClerc CM, Wells DL. Use of a content methodology process to enhance feeding abilities threatened by ideational apraxia in people with Alzheimer's-type dementia. Geriatr Nurs. 1998;19:261-7.
15. Watson R. The Mokken scaling procedure (MSP) applied to the measurement of feeding difficulty in elderly people with dementia. Int J Nurs Stud. 1996;33:385-93.
16. Rivière S, Gillette-Guyonnet S, Andrieu S, Nourhashemi F, Lauque S, Cantet C, Salva A, Frisoni G, Vellas B. Cognitive function and caregiver burden: predictive factors for eating behaviour disorders in Alzheimer's disease. Int J Geriatr Psychiatry. 2002;17:950-5.
17. Easterling CS, Robbins E. Dementia and dysphagia. Geriatr Nurs. 2008;29:275-85.

Short Communication

Evaluation of weight loss in the community-dwelling elderly with dementia as assessed by eating behavior and mental status

Keiko Miyamoto MS[1], Sadanori Higashino PhD[2], Kazuki Mochizuki PhD[1], Toshinao Goda PhD[1], Hideo Koyama PhD[3]

[1]Graduate School of Nutritional and Environmental Sciences, University of Shizuoka, Shizuoka, Japan
[2]School of Administration and Informatics, University of Shizuoka, Shizuoka, Japan
[3]University of Hyogo, Hyogo, Japan

以飲食行為及智力狀態評估患失智症之社區老人體重下降的可能性

非蓄意性體重減輕是蛋白質能量營養不良的症狀，常發生在患有失智症的老人身上。本研究檢視與失智相關的進食困難，是否會增加老人體重下降的可能性。以橫斷性研究，調查 60 位失智的社區老人，他們平均年齡為 84±6.7 歲。有 26.7%的研究對象在六個月當中，流失至少 5%的體重。由 Spearman 等級相關係數顯示，受損的智力狀態及進食困難與體重減輕有密切相關。利用區別分析，以進食困難及智力狀態合併評估，有 76.4%的概率可區分體重減輕≥5%與體重減輕<5%的老人。由結果推論，患有失智症之老人，進食困難及受損的智力狀態與體重下降有密切相關。

關鍵字：進食困難、老年人、失智症、營養評估、體重下降