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Relationship between mortality and Council of Nutrition Appetite Questionnaire scores in Japanese nursing home residents

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ABSTRACT

Objective: This 1-y cohort study examined whether Council of Nutrition Appetite Questionnaire (CNAQ) scores predicted mortality in 316 elderly Japanese residents of five nursing homes (60 men, 256 women; mean age: 84.9 ± 8.3 y).
Methods: The baseline survey included participant characteristics (e.g., age, sex, height, weight, and medical history), and Barthel Index (BI), Clinical Dementia Rating (CDR), Mini Nutritional Assessment-Short Form (MNA®-SF), CNAQ, Simplified Nutritional Appetite Questionnaire (SNAQ; simplified CNAQ), and SNAQ for the Japanese elderly (SNAQ-JE) scores.
Results: Following the baseline survey, mortality data were collected for 1 y; during this time, 62 participants (19.6%) died. The deceased group's CNAQ scores (25.1 ± 4.8) were significantly lower than those of the survival group (28 ± 3.6; $P < 0.001$). After adjusting for age, sex, medical history, BI, CDR, and MNA®-SF scores in Cox proportional regression, CNAQ (hazard ratio [HR], 0.91; 95% confidence interval [CI], 0.85–0.97; $P = 0.004$), SNAQ (HR, 0.84; 95% CI, 0.75–0.93; $P = 0.001$), and SNAQ-JE (HR, 0.84; 95% CI, 0.76–0.92; $P < 0.001$) scores were related to mortality.
Conclusions: This study showed that CNAQ scores were inversely associated with 1-y mortality. Furthermore, appetite assessment using the CNAQ predicted the death of Japanese nursing home residents. Similarly, the SNAQ and SNAQ-JE scores were inversely associated with 1-y mortality.

Introduction

Individuals ages ≥65 y comprise >25% of the Japanese population, and Japan is poised to become the world's first "super-aged" society. Consequently, the number of elderly people who require care is also expected to increase. Additionally, numerous elderly people in urgent need of care are recipients of caregiving services at nursing homes and other residential type facilities [1].

Moreover, undernutrition is a major cause of reduced quality of life (QoL) in elderly people [2]. Additionally, some reports state that undernutrition is related to infections, hospitalization, and mortality in this population [3,4]. Therefore, the treatment and prevention of undernutrition in elderly people is an important issue.

Hospitals currently use blood tests to evaluate individuals' nutritional status [5]. However, this is infeasible for nursing home residents because of the cost and invasive nature of blood tests. Previous studies evaluating nutritional status have focused on weight loss [6–8] and reduced dietary intake [6]. However, this approach requires actual measurements, which constitute a substantial burden for both dependent elderly people and evaluators, and it is likely to be inappropriate as a screening reference to predict unfavorable outcomes such as death.

Appetite maintenance and increase are essential, as poor appetite could be a factor in undernutrition. However, poor appetite in

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elderly individuals occurs because of various factors such as illness and disease, medication use, physical and mental health conditions, lifestyle and living environments, and the physiological changes that accompany aging [9]. Previous studies involving nursing home residents [10] and hospitalized elderly individuals [11] evaluated appetite using questions pertaining to the presence or absence of reduced dietary intake, and the results showed that poor appetite was a predictive factor for death. However, they evaluated only one aspect of poor appetite, namely dietary intake reduction, and did not consider the variety of factors that influence poor appetite.

Wilson et al. created the Council on Nutrition Appetite Questionnaire (CNAQ) to assess appetite and reported that it was a valid appetite-assessment tool for use in predicting weight loss in community-dwelling adults and nursing home residents [12]. However, to our knowledge, few other studies have used the CNAQ to examine appetite in nursing home residents. Additionally, Tokudome et al. created the Japanese version of the CNAQ, which demonstrated validity and reliability as a weight loss index for dependent elderly people and elderly people with cognitive disorders [13]. Wilson et al. also created the Simplified Nutritional Appetite Questionnaire (SNAQ)—a simplified version of the CNAQ—that has demonstrated equal reliability [12]. Furthermore, a study involving community-dwelling older Japanese adults demonstrated the validity of the SNAQ [14], and Tokudome et al. recommend the SNAQ for use with the Japanese Elderly (SNAQ-JE) in elderly-care facilities [13].

Considering the abovementioned issues, we conducted a 1-y cohort study to determine whether CNAQ scores predicted mortality for nursing home residents in Japan. We also examined whether the SNAQ and SNAQ-JE scores would predict mortality. Ethical approval for the study was granted by the Ethics and Conflict of Interest Committee at the Japan National Center for Geriatrics and Gerontology.

Methods

Participants and study design

An explanation regarding the survey was provided for residents at five nursing homes managed by a single social welfare service corporation in Prefecture "A" in Japan. In all, 359 elderly individuals provided informed written consent to participate in the study and completed a baseline survey in January 2014, and their mortality information was collected 1 y thereafter. We excluded individuals who were unable to perform oral ingestion, those for whom a date of death was not provided, and those for whom data regarding age, sex, medical history, or Barthel Index (BI), Clinical Dementia Rating (CDR), Mini Nutritional Assessment-Short Form (MNA®-SF), or CNAQ scores were missing. Data for 316 participants (60 men, 256 women; mean age: 84.9 ± 8.3 y) were ultimately included in the analysis.

Survey items

To ensure the uniformity of assessment criteria in the baseline survey, training was provided to nurses, care workers, and dietitians in charge of the residents who participated in the survey. Upon completion of this training, questionnaires were distributed to responsible professionals, basic data (sex, age, height, weight, and medical history) were collected, and the following tools were administered: the BI to assess physical function, the CDR to assess cognitive function, the MNA®-SF to assess nutritional status [15–17], and the CNAQ to assess appetite [12].

BI

The BI [18] is used to evaluate physical function and consists of 10 items describing daily activities (i.e., feeding, transfer from a chair to bed and back, grooming, toilet use, bathing, mobility on level surfaces, using stairs, dressing, bowel control, and bladder control). Evaluation is based on the extent of assistance required to perform each activity [19]. Total scores range from 0 to 100, with higher scores indicating greater ability to perform ordinary daily activities.

CDR

The CDR was administered following the evaluation method used by Morris et al. [20]. The CDR includes five grades (i.e., 0, 0.5, 1, 2, and 3) and six items: memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care. Higher grades indicate dementia of greater severity. The final decision regarding the CDR grade is made by a medical specialist such as the clinician or attending physician.

CNAQ

The CNAQ [12] is used to assess appetite in elderly individuals in the community and nursing homes. It consists of eight items used to predict clinically significant weight loss: appetite, feeling full, feeling hungry, food flavors, changes in food flavors, number of daily meals, feeling sick or nauseated when eating, and usual mood. Responses are provided using a 5-point scale ranging from 1 to 5, and total scores range from 8 to 40. Scores between 29 and 40 indicate good appetite; those between 8 and 28 indicate poor appetite [12].

The SNAQ consists of four of the CNAQ eight items: appetite, feeling full, food flavors, and number of daily meals. Responses are provided using a 5-point scale ranging from 1 to 5. Total scores range from 4 to 20, and lower scores indicate a lack of appetite [12]. However, considering that most elderly-care facilities in Japan stipulate that residents should be provided with three meals per day, Tokudome et al. recommended use of the SNAQ-JE, in which the "usual mood" item is used in replacement of "number of meals" [13].

Statistical analyses

Numbers and percentages were calculated for categorical variables, whereas means and SDs were calculated for continuous variables. To avoid multicollinearity, the correlation between variables was examined using Pearson's correlation coefficient, and we selected the MNA®-SF (including body mass index [BMI]) in subsequent analyses. To identify factors related to mortality, Cox proportional regression analysis was performed, with the period from the first day of observation to the date of death included as an outcome variable, and age, sex, previous medical history, respiratory disease (including aspiration pneumonitis), cerebrovascular disorder, cardiovascular disorder, neoplastic disease, Parkinson's disease, neurologic disorder, BI, CDR, MNA®-SF, and CNAQ as explanatory variables (model 1). Additionally, a similar analysis was performed using the SNAQ or SNAQ-JE as an explanatory variable instead of the CNAQ. Furthermore, the sample was divided into a poor appetite (CNAQ ≤28) and a good appetite (CNAQ >28) group based on CNAQ scores [12]. The cumulative survival rate was examined using the Kaplan–Meier method to clarify differences between the two groups, and the log-rank test was performed. C statistics and net reclassification improvement were evaluated to determine which of three appetite assessment tools improved discrimination and risk stratification for mortality. The significance level was set at $P < 0.05$. Statistical analyses were performed using SPSS Statistics version 23 (IBM, Armonk, NY, USA) and SAS version 9.4 (SAS, Cary, NC, USA).

Results

Table 1 shows the participants' characteristics. Of the 316 participants, 62 (19.6%) died during the study period. Table 1 also presents the results of a comparison between the survival and deceased groups. Relative to those in the survival group, the participants in the deceased group were older, and their BMI was significantly lower. Additionally, the deceased group's BI, MNA®-SF, and CNAQ were significantly lower relative to those observed in the survival group. Moreover, the survival and deceased groups' CDR grades differed significantly, with grade of 3 being higher in the deceased group.

Figure 1 shows the survival curve obtained using the Kaplan–Meier method. Log-rank test results showed significant differences ($P < 0.001$) in survival time between participants with poor (CNAQ ≤28) and good (CNAQ >28) appetites. With sex; age; medical history; and BI, CDR, MNA®-SF, and CNAQ scores adjusted for, the results of the Cox proportional regression analysis showed that CNAQ scores were significantly inversely associated with the mortality rate 1 y after the baseline survey (hazard ratio [HR], 0.91; 95% confidence interval [CI], 0.8 –0.97; $P = 0.004$; Table 2).

The results of the analysis of the SNAQ and SNAQ-JE scores were as follows: mean baseline SNAQ and SNAQ-JE scores were 14 ± 2.3 (survival group: 14.3 ± 2, deceased group: 12.7 ± 2.8; $P < 0.001$) and 13.4 ± 2.6 (survival group: 13.8 ± 2.4, deceased group: 11.8 ± 3; $P < 0.001$), respectively. Additionally, comparisons of the survival and deceased groups during the observation period showed that the deceased group's SNAQ and SNAQ-JE scores were significantly lower than those observed in the survivor group.

Table 1
Baseline characteristics and comparison between the survival and deceased groups

	Total (N = 316) Mean ± SD/n (%)	Survival (n = 254) Mean ± SD/n (%)	Deceased (n = 62) Mean ± SD/n (%)	*P*-value
Age (y)	84.9 ± 8.3	83.6 ± 8.1	90.0 ± 6.7	<**0.001**
Female	256 (81)	203 (79.9)	53 (85.5)	0.370
Observation period (d)	323.4 ±95.1	365 ± 0	153.1 ± 100.3	<**0.001**
Height (cm)	147.1 ± 11.2	147.5 ± 11.6	145.5 ± 9.1	0.127
Weight (kg)	45.9 ± 9.3	47 ± 9.4	41.4 ± 7.8	<**0.001**
BMI (kg/m^2)	21 ± 3.5	21.4 ± 3.5	19.5 ± 3.2	<**0.001**
Medical history				
Respiratory disease	48 (15.2)	29 (11.4)	19 (30.6)	**0.001**
Cerebrovascular disorder	111 (35.1)	91 (35.8)	20 (32.3)	0.658
Cardiovascular disorder	117 (37)	91 (35.8)	26 (41.9)	0.382
Neoplastic disease	20 (6.3)	16 (6.3)	4 (6.5)	1.000
Parkinson's disease	14 (4.4)	12 (4.7)	2 (3.2)	1.000
Neurologic disorder	24 (7.6)	22 (8.7)	2 (3.2)	0.187
BI (score)	39.9 ± 28.5	43.4 ± 27.7	25.2 ± 26.8	<**0.001**
CDR				
0	6 (1.9)	5 (2)	1 (1.6)	**0.004**
0.5	33 (10.4)	30 (11.8)	3 (4.8)	
1	85 (26.9)	68 (26.8)	17 (27.4)	
2	102 (32.3)	90 (35.4)	12 (19.4)	
3	90 (28.5)	61 (24.0)	29 (46.8)	
MNA®-SF (score)	8.6 ± 2.3	9.0 ± 2.2	7.3 ± 2.4	<**0.001**
CNAQ (score)	27.4 ± 4	28.0 ± 3.6	25.1 ± 4.8	<**0.001**

BI, Barthel Index; BMI, body mass index; CNAQ, Council on Nutrition Appetite Questionnaire; CDR, Clinical Dementia Rating; MNA®-SF, Mini Nutritional Assessment-Short Form
Number of participants = survival/deceased; height = 248/59; weight = 234/59; BMI = 228/56
p value (bold) show a significant difference

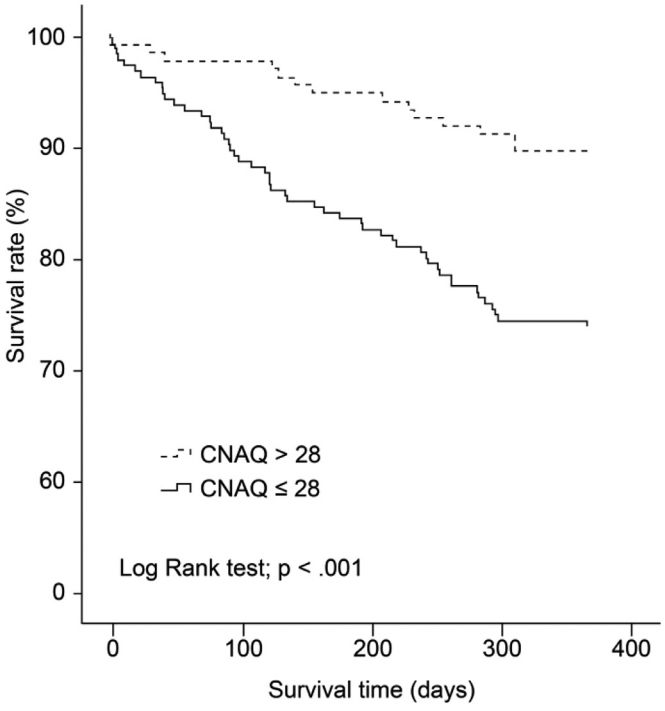

Fig. 1. Survival curve of the Council of Nutrition Appetite Questionnaire category with mortality. CNAQ, Council on Nutrition Appetite Questionnaire.

Furthermore, adjusted for similar factors with the CNAQ, the results of the Cox proportional regression analysis showed that the SNAQ (HR, 0.83; 95% CI, 0.74–0.92; $P = 0.001$) and SNAQ-JE (HR, 0.84; 95% CI, 0.76–0.92; $P < 0.001$) scores were both significantly inversely associated with the mortality rate 1 y after the baseline survey.

Last, the three appetite assessment tools significantly improved discrimination and reclassification for mortality (Table 3). As compared with the CNAQ, the SNAQ and SNAQ-JE showed higher net reclassification improvement; however, there were no significant differences in the C statistics between the three appetite assessment tools.

Discussion

This study sought to determine whether appetite assessment using the CNAQ was effective in predicting mortality in dependent elderly Japanese nursing home residents. The results showed that,

Table 2
Multivariate HRs and 95% CIs from Cox proportional regression analysis for the relationship with mortality rate 1 y after the baseline survey

	Crude HR (95% CI)		*P*-value	Model 1 HR (95% CI)		*P*-value
Age	1.11	(1.07–1.15)	<**0.001**	1.11	(1.06–1.15)	<**0.001**
Female	1.43	(0.70–2.89)	0.325	0.57	(0.26–1.23)	0.151
Medical history						
Respiratory disease	2.75	(1.60–4.73)	<**0.001**	1.70	(0.93–3.11)	0.083
Cerebrovascular disorder	0.87	(0.51–1.49)	0.622	0.95	(0.55–1.66)	0.867
Cardiovascular disorder	1.29	(0.78–2.14)	0.322	1.44	(0.83–2.49)	0.193
Neoplastic disease	0.97	(0.35–2.68)	0.960	0.69	(0.23–2.06)	0.509
Parkinson's disease	0.70	(0.17–2.85)	0.615	1.49	(0.34–6.57)	0.603
Neurologic disorder	0.39	(0.09–1.58)	0.186	0.49	(0.11–2.28)	0.364
BI	0.98	(0.97–0.99)	<**0.001**	0.98	(0.97–1.00)	**0.037**
CDR						
0		Reference			Reference	
0.5	0.49	(0.05–4.69)	0.535	0.42	(0.04–4.66)	0.480
1	1.13	(0.15–8.49)	0.906	0.47	(0.05–4.15)	0.494
2	0.64	(0.08–4.89)	0.663	0.19	(0.02–1.74)	0.141
3	2.03	(0.28–14.87)	0.488	0.23	(0.03–2.10)	0.193
MNA®-SF	0.75	(0.68–0.82)	<**0.001**	0.84	(0.74–0.95)	**0.004**
CNAQ	0.87	(0.83–0.92)	<**0.001**	0.91	(0.86–0.97)	**0.004**

BI, Barthel Index; CDR, Clinical Dementia Rating; CNAQ, Council on Nutrition Appetite Questionnaire; MNA®-SF, Mini Nutritional Assessment®-Short Form
p value (bold) show a significant difference

Table 3
C statistics and NRI of 3 appetite assessment tools

	C statistic	Category-free NRI, %
CNAQ + covariates in model 1*	0.834	Reference
SNAQ + covariates in model 1	0.833	0.9
SNAQ-JE + covariates in model 1	0.838	21.5

CNAQ, Council on Nutrition Appetite Questionnaire; NRI, net reclassification improvement; SNAQ, Simplified Nutritional Appetite Questionnaire; SNAQ-JE, Simplified Nutritional Appetite Questionnaire for Japanese elderly
CNAQ vs SNAQ, $P = 0.793$; CNAQ vs SNAQ-JE. $P = 0.520$
*Model 1 includes age, sex, medical histories, Barthel Index, Clinical Dementia Rating, Mini-Nutritional Assessment-Short Form.

with factors reported to affect prognoses in elderly people [4,21] including age; sex; medical history; and BI, CDR, and MNA®-SF, adjusted for, CNAQ scores were significantly related to mortality.

In an 8-y cohort study involving 1856 community-dwelling elderly individuals in Taiwan, appetite was evaluated via responses of "good," "normal," and "bad" to the question, "How is your current appetite?" In the Taiwanese study's appetite assessment, a response of "bad" represented poor appetite, which was related to death [22]. Similarly, a French study [11] used the MNA® item "reduced food intake" as an index of appetite. The results showed that, after adjusting for items that immediately resulted in or caused poor appetite (i.e., age; sex; Geriatric Depression Scale, Mini-Mental State Examination, BI, and MNA® scores; digestive disease; disease burden; weight loss of ≥3 kg in 3 mo; serum albumin levels; and transferrin levels), poor appetite was an independent predictive factor, and the risk for death observed for those with poor appetites was three times higher than that observed for those with good appetites. Furthermore, a previous study involving nursing home residents [10] used reduced food intake as an index of poor appetite, and the mortality rate in participants with poor appetites was 2.26 times higher than that observed in those with good appetites (95% CI, 2.14–2.38). In this study, the assessment of appetite was simple (e.g., the presence or absence of appetite or reduction of food intake); however, the CNAQ uses multiple items and is scored per item. Therefore, an assessment tool such as the CNAQ facilitates clarification of intervention points and effects. For example, if the "usual mood" item received a low score, we would try to do things to help the residents feel happy (e.g., talking or engaging in a hobby). Furthermore, to our knowledge, very few studies have examined whether appetite affects prognoses in dependent elderly people [10]; therefore, the results of the present study provide essential information related to nutrition management in this population.

The CNAQ is noninvasive and uses a simple questionnaire that can be completed within a brief period. Additionally, it has demonstrated adequate reliability and validity as a tool to predict weight loss, even when dependent elderly people exhibited reduced cognitive ability, and their responses were recorded by responsible nurses or care workers [13]. Previous research has shown a relationship between weight loss and mortality rates and demonstrated the importance of periodically checking for changes in body weight [23,24]. Considering the results of this study, the mutual associations of weight loss, mortality rate, and the CNAQ were clarified. Weight loss requires actual measurements, which constitutes a substantial burden for both dependent elderly people and evaluators; however; the evaluation of appetite using the CNAQ is less burdensome and might well predict prognosis.

In the present study, the proportion of participants with poor appetites (CNAQ scores ≤28) at baseline was 59.8% (n = 189). Of these, 25.9% (n = 49) died during the year following the baseline survey. The proportion of participants with poor appetite in the present study was somewhat lower relative to those reported in previous research. For example, previous studies reported proportions of 78.4% and 64.2% for hospitalized patients [25] and community-dwelling elderly people [26] with poor appetites, which was defined via CNAQ scores of ≤28, respectively. This discrepancy could have occurred because of differences between the current sample and those of the previous studies, as they targeted outpatients and hospitalized and community-dwelling elderly people. Additionally, outpatients and hospitalized elderly people could have illnesses with symptoms that affect appetite [27]. Furthermore, lifestyle factors, such as economic problems, living alone, and being confined to one's residence, in community-dwelling elderly people could have affected appetite assessment [22]. However, nursing home residents are provided with food in amounts and at times that suit individuals' tastes and feeding and swallowing abilities. In most cases, appropriate measures, such as

hospitalization, are taken when serious illness or symptoms appear. Therefore, the present study included a lower proportion of participants with poor appetites than did previous studies, although they were older and exhibited lower BMI values.

Recent studies using the SNAQ [25,28–32] have shown a significant relationship between SNAQ scores and mortality rates. The present study examined the SNAQ and SNAQ-JE and found that questionnaire scores were significantly associated with death; that is, the results showed that the use of any of the measurement tools (i.e., the CNAQ, SNAQ, or SNAQ-JE) could be effective in using appetite to predict mortality in dependent elderly people. The SNAQ and SNAQ-JE each consist of four items used to assess appetite and can be completed within a shorter time relative to that required to complete the CNAQ. Nevertheless, as three meals are provided to nursing home residents daily, the SNAQ-JE is considered an appropriate tool for use in assessing appetite in nursing home residents. The results of this study indicate that it is possible to assess appetite using the SNAQ and SNAQ-JE; however, the eight-item CNAQ is appropriate for the examination of specific intervention points and effects.

Poor appetite often occurs when there is a reduction in independence with respect to eating. Edahiro et al. identified difficulty in focusing on eating as a factor that hindered independence with respect to eating in patients with Alzheimer's disease [33]. Therefore, it could be possible to maintain and improve appetite by observing patients during meals and providing support and encouragement using discussion, guidance, and assistance when necessary.

In intervention studies for elderly people with poor appetite, it is reported that energy and dietary intake increased when various foods and flavor enhancers were added to meals [34,35]. Additionally, a number of studies [9,36–39] have shown that poor appetite in dependent elderly people resulted from a variety of strongly related factors such as illness or disease, prescribed medication, dementia, depression, reduced physical function, reduced oral function, sleep disorder, living environment, and economic status. However, very few intervention studies have included appetite improvement as the desired outcome.

The causative factors for poor appetite must be identified to allow for the development of interventions to improve appetite. We intend to use the CNAQ to conduct further intervention studies, in which nutritional interventions will be implemented in consideration of several factors related to poor appetite to improve appetite and prognoses in dependent elderly people.

Limitations

The results of this study might not be generalizable to elderly people in nursing homes in other regions, because the 1-y observation period was short, and only five institutions from a limited geographic area were selected for survey participation. Additionally, if participants struggled to provide direct responses because they were dependent elderly people, we asked the in-charge life-care provider to do so (e.g., nurses, care workers, and dietitians), which could have led to evaluation errors, although we provided them with sufficient explanation. Furthermore, biological markers (e.g., albumin concentration [40]) associated with the death of nursing home residents and diseases (e.g., digestive diseases [41]) related to appetite were not investigated in this study. Therefore, future research should examine biological markers and disease related to appetite.

Conclusions

This study demonstrated that the CNAQ scores were inversely associated with 1-y mortality, and appetite assessment using the CNAQ predicted the death of Japanese nursing home residents. Similarly, both the SNAQ and SNAQ-JE scores were inversely associated with 1-y mortality.

Using the CNAQ to assess appetite might improve the nutritional status, morbidity of infections and other illnesses, and rehospitalization rates of dependent elderly people. Additionally, it is possible that maintaining and improving QoL in dependent elderly people could improve their mortality prognoses.

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