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ASSESSING THE PREVALENCE OF MALNUTRITION WITH THE MINI NUTRITIONAL ASSESSMENT (MNA) IN A NATIONALLY REPRESENTATIVE SAMPLE OF ELDERLY TAIWANESE

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Abstract: *Objective:* The study was to determine whether the Mini Nutritional Assessment (MNA) could be used as a tool to effectively identify malnourished elderly in a non-Caucasian population. *Design:* The study was a part of a population-based multistage random sample survey. *Setting:* In-home face-to-face interviews. *Participants:* Randomly selected 1583 men and 1307 women, 65 years or older, in Taiwan. *Measurements:* Assessing nutritional risk status of participants with the Mini Nutritional Assessment. *Results:* The prevalence of malnutrition is 1.7% in elderly men and 2.4% in elderly women, 65 years or older. The proportion at risk of malnutrition is 13.1%. *Conclusion:* To the best of our knowledge, this is the first study to apply the MNA to estimate the prevalence of malnutrition in the elderly in a nationally representative sample. Results suggest that the MNA can identify malnourished elderly in a non-Caucasian population. However, it appears that the functionality of the instrument can be improved by adapting population-specific anthropometric cutoff standards.

Key words: Mini Nutritional Assessment, elderly, malnutrition, nutritional risk, Taiwan.

Introduction

Nutritional status can influence one's aging and immunity, and it also plays a significant role in the development and progression of many chronic diseases. The elderly, the fastest growing population of most industrialized countries, is more vulnerable to malnutrition owing to increased risk of poor economic status, social isolation and inappropriate or inadequate food intake. A practical approach to preventing the occurrence of malnutrition in the elderly is to have them periodically screened for risk of malnutrition followed with appropriate interventions. A simple method that has been widely used is the Mini Nutritional Assessment (MNA) (1).

The MNA, a simple and quick nutritional risk-screening instrument, uses data that can be obtained through non-invasive means. Most of the needed information can be obtained from the brief physical examination and an interview with the elderly or someone knowledgeable about the condition and dietary intake patterns of the elderly. Simple anthropometric measurements including weight, height (for calculating BMI), and mid-arm and calf circumferences, are also needed. The instrument was developed and validated by researchers based on studies conducted in Europe and the US (Toulouse University Hospital, Toulouse, France, the Nestle Research Center in Lausanne, Switzerland, and the University of New Mexico, Albuquerque, New Mexico, USA). The MNA is composed of 18 questions, each assigned a weighted score ranging from 1 to 3 points and has a total score of 30 points.

The instrument is simple and convenient to use and it has been successfully used in assessing the nutritional status in free-living elderly (2, 3), frail older persons, patients with Alzheimer's disease (4), and patients living in nursing homes, long-term care facilities (5, 6) or hospital wards (7, 8) in many Western countries. It was also tested in frail elderly Japanese and was found to be useful as well. However, it was suggested that the instrument could be modulated to improve the result (9). The instrument theoretically could be an ideal screening tool for identifying elderly who are in need of nutritional intervention or treatment in a general elderly population (10). In this study our objective was to employee the MNA to assess the prevalence of malnutrition in elderly men and women in a national survey in Taiwan.

Methods

The study was a part of "The Survey of Health and Living Status of the Elderly in Taiwan (SHLSET)" conducted in 1999 by the former Taiwan Provincial Institute of Family Planning (TPIFP), now a component of the Bureau of Health Promotion of the Department of Health of Taiwan (11). The SHLSET is a longitudinal cohort study initiated in 1989 with an objective of monitoring the health and living status of older people in Taiwan. The project conducted periodic interview surveys on a cohort of nationally representative older men and women (11). The study design consisted of a multistage equal probability sampling process which was applied twice, the first time in 1989 to select a total of 4049 subjects, 60 years or older, and the second time in 1996 to select a total of 2462 subjects, 50-66 years old. The remaining pool (4915) constituted the sampling size of the 1999 survey. Among them, 4440 subjects successfully completed the 1999 survey. The major reason for the non-completions was "unable to reach subject". Detailed

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methods and procedure of the survey have been described elsewhere (12, 13).

The project originally had a strong emphasis on socioeconomic, demographic and living status. In the 1999 survey, the questionnaire was expanded to include participants' health and nutritional status and the MNA. To incorporate the MNA into the questionnaire, it was first translated into Chinese, repeatedly tested in the field, evaluated and carefully revised by a study team composed of nutrition experts, survey researchers and field interviewers. Special care was taken to preserve the original meaning of the MNA questions. Trained interviewers conducted individual, face-to-face, interviews. The pretests did reveal certain difficulties on questions K (intake of marker proteins) and L (intake of fruit and vegetable), and therefore these questions were modified. The revised questions asked for consumption frequencies instead of the number of servings consumed. Additionally, Question I on pressure sore/skin ulcers and Question M on fluid intake were not administered in the survey because of the difficulty in getting accurate answers. Proxy respondents, usually the caregiver or close relatives, were interviewed if a participant was unable to provide meaningful answers due to cognitive or other problems.

Measurements of mid-arm circumference (MAC) and calf-circumference (CC) were carried out according to reference procedures using a flexible but non-stretchable measuring tape during the visit (14). Self-reported height and body weight were also elicited from each participant. The BMI value (kg/m^2) of each participant was calculated from weight and corrected height using regression equations developed by Kuczmarski et al. (15). The MNA score of each participant was calculated based on cutoff values specified in the original MNA screen. Individuals having a total MNA score <17 were considered malnourished, 17-23.5 were at risk of malnutrition and 24 or higher were normal. The Human-Subject Study Ethic Committee of the Institute (TPIFP) approved the protocol of this study.

Results of this study were statistically analyzed with SPSS (Statistical Package for the Social Sciences, SPSS Base 10.0 Application Guide, 1999 by SPSS Inc. Chicago, IL). Although the survey included the entire spectrum of older adults, 53 years and older, for purposes of comparison, only participants who were 65 years or older were included and analyzed in the current report. Pearson's Chi-square test was applied to determine the significance of differences in age and gender profiles of institutionalized elderly. Pearson's correlation analysis was performed to determine the significance of the relationship of the MNA score with each of the anthropometric, functional and health parameters. In order to avoid the situation where the variable being tested is a component of the dependent variable (the MNA score), the contributing scores of the respective variable were removed from the total MNA score of each participant when analyzing the specific correlations (Table 4). A 5% probability level was designated as the level of statistical significance but higher levels of significance were also reported.

Results

Of the 4915 subjects in the cohort, 4440 completed the interview, yielding a 90.34% completion rate. Approximately 2900 of these participants were 65 years or older and their data were statistically analyzed in this report. Detailed results of each MNA questions are shown in Table 1. Only questions that showed a total of more than 10% of subnormal status (receiving less than a full score) are listed in the table. Table 2 shows the prevalence of malnutrition and at risk of malnutrition. For men, the prevalence of malnutrition and at risk of malnutrition stayed fairly constant throughout all age stages. For women, the proportions became markedly higher after age 75. Table 3 shows the proportions of institutionalized elderly. The proportions increased with age but were not different between the two genders. When classified according to whether one had a total MNA score, those who had no MNA scores had a significantly greater probability of being institutionalized, especially in older elderly men. Table 4 shows the correlates of the MNA scores (without including the scores of the respective variables).

Table 1
Proportions (%) of elderly with subnormal status for each of the MNA parameters[1]

MNA questions (full score)	Score assigned	Men (N=1583)	Women (N=1307)
A. Declined food intake (2)			
Severely	(0)	4.8	6.1
Moderately	(1)	9.9	16.5
B. Lost > 3kg body weight (3)	(0)	17.3	13.7
C. Mobility (2)			
Bed or chair bound	(0)	4.0	6.2
Able to get out of bed but does not go out	(1)	3.2	4.5
D. Suffered psychological stress (2)	(0)	15.9	25.9
E. Had neuropsychological problems (2)			
Severe dementia/depression	(0)	3.3	5.8
Mild dementia	(1)	12.3	20.7
F. Body mass index (3)			
<19 kg/m2	(0)	10.6	11.7
19-21 kg/m2	(1)	17.6	16.6
21-23 kg/m2	(2)	24.9	24.0
H. Taking >3 prescribed medicine (1). If "yes"	(0)	10.2	13.0
K. Consumption of protein-rich foods (1)			
0 or 1 "yes"	(0)	7.3	10.0
2 "yes"	(0.5)	16.4	19.4
L. Fruit & vegetable intake (1). If < 2 servings/d	(0)	17.6	16.8
O. Self-rated nutritional status (2)			
Malnourished	(0)	8.0	10.4
Uncertain of status	(1)	7.2	12.1
P. Self-rated health status relative to peers (2)			
Not as good as others	(0)	7.5	10.3
Not sure	(0.5)	25.0	34.5
As good as others	(1)	56.1	48.7
Q. Mid-arm circumference (1)			
<21 cm	(0)	0.7	3.8
21-22 cm	(0.5)	1.0	1.4
R. Calf circumference (1)			
<31 cm	(0)	16.2	34.0

1. Some items (except MAC) were not shown because the subnormal values were less than 10%.

Table 2

The prevalence (%) of malnutrition and at risk of malnutrition of Taiwanese men and women, 65 years or older, according to the MNA

Age (y)	N	Malnutrition	At risk*
Men			
65-74	812	1.6	8.9
75-84	454	1.8	12.3
>85	59	1.7	10.2
All	1325	1.7	10.1
Women			
65-74	610	1.6	13.8
75-84	406	3.0	20.0
>85	59	6.8	27.1
All	1075	2.4	16.8
Total	2400	2.0	13.1

*The proportions at risk of malnutrition are significantly (P<0.001) different between the two genders on basis of Pearson's Chi-square test.

Table 3

Proportions (% & N of cases/N total) of elderly men and women residing in institutionalized facilities. Data are stratified by age, gender and availability of the MNA score

	65-74 y	75-84 y	>85 y	All ages
Men				
MNA yes	0.50% (4/793)	1.59% (7/440)	5.17% (3/58)	1.08% (14/1291)
MNA no	1.43% (2/139)	9.65% (11/114)***	20.6% (7/34)*	6.96% (20/287)*
All	0.64% (6/932)	3.25% (18/554)	10.9% (10/92)	2.15% (34/1578)
Women				
MNA yes	0.00% (0/604)	1.01% (4/396)	5.26% (3/57)	0.66% (7/1057)
MNA no	4.44% (4/90)***	6.14% (7/114)***	4.65% (2/43)	5.26% (13/247)*
All	0.58% (4/694)	2.16% (11/510)	5.00% (5/100)	1.53% (20/1304)

* Significantly (*P<0.05 or ***P<0.001) different from respective "MNA yes" (have MNA scores) groups on basis on Pearson's Chi-Square tests. Significant age effects were observed in both men and women.

Table 4

Pearson's correlation of the MNA scores[1] with age, MAC, CC, BMI, mobility, self-rated nutritional status, self-rated health status, number of unplanned hospital visit and hospital length of stay (N = 2429)

	r	P
Age	-0.119	<0.001
MAC	0.244	<0.001
CC	0.341	<0.001
BMI	0.190	<0.001
Mobility	0.281	<0.001
Self-rated nutritional status	0.413	<0.001
Self-rated health status	0.375	<0.001
Number of unplanned hospital visit	-0.213	<0.001
Hospital length of stay	-0.308	<0.001

1. The scores of BMI, MAC, CC, mobility, self-rated nutritional status and self-rated health status were not included in the total MNA scores when analyzing each of these correlations, respectively.

Discussion

Results of this study show that 2% of the elderly Taiwanese are malnourished and an additional 13.1% are at risk of malnutrition based on the MNA in a nationally representative sample. To the best of our knowledge, this is the first time that the MNA is used to assess the prevalence of malnutrition in a national random-sample survey. Although gold standard is not available, the 2.0% prevalence of malnutrition observed in the Taiwanese elderly in the present study appears reasonable. It is higher than the 1% prevalence in community healthy elderly in Caucasian populations observed by Guigoz et al. (2) but lower than the 3% prevalence in 75-94 y home-care patients in Finland observed by Soini et al. (6). The present study is a nationally representative sample, so it is expected to include not only the healthy but also some frail and ill elderly. Another reason is that the MNA was developed based on studies conducted in Caucasian populations who are known to have, in general, larger stature and body size. Thus, the anthropometric cutoff standards may not be totally appropriate for the Asian populations as already pointed out by Kuzuya et al. (9). Additionally, there are obvious differences in food pattern and lifestyle between the Caucasian and Taiwanese populations. These variations can affect the outcome of the estimate. It is of interest to note that the combined (malnourished and at risk of malnutrition) prevalence of 15.1% observed in the present study is surprisingly close to the composite prevalence of 14% observed by Margetts et al. (16) in a nationally representative cross-sectional sample of elderly, 65 years or older, in the United Kingdom using a non-MNA procedure based on a composite measure of low BMI and recently reported weight loss.

Results also suggest that there is a gender-associated difference in the prevalence of malnutrition in older elderly. The prevalence of malnutrition (1.6% to 1.8%) or at risk of malnutrition (8.9% to 12.3%) was fairly consistent throughout all three age-ranges in men but increases with age in women, from 1.6% to 6.8% for malnutrition and 13.8% to 27.1% for at risk of malnutrition (Table 2). The reason for this gender difference is not apparent but could be related to the relatively large proportions of missing data (the MNA scores) and samll number of observations in more advanced age groups. Older elderly men who are without MNA scores have increased probability of being institutionalized (Table 3). Since institutionalization is often associated with increased risk of malnutrition, it can impact the assessment results.

In the present study, the elderly Taiwanese scored poorly on the BMI question. The result showed that 10.6% of Taiwanese elderly men and 11.7% of elderly women were severely underweight, and an additional 42.5% of men and 40.6% of women were somewhat or moderately underweight. Only 47% of elderly men and 48% of elderly women received a full score of 3 points. These high rates of underweight may indicate that the BMI cutoff standards in the MNA are too high for the

Taiwanese population. Since the BMI question has a high weighted score (3 points), over-rating the proportion of underweight can substantially increase the false positive results. There are studies suggesting that the Asians are different from the Caucasians in their body mass index to body fat relationship. At a given BMI, the Asians have a higher percentage of body fat than that of the Caucasians (17, 18). In fact, the Department of Health of Taiwan has proposed a scale of BMI 24-27 as overweight and BMI >27 as obese for the Taiwanese. Similarly, the CC scale in the MNA might be also too high for the Taiwanese elderly. It placed 16.2% of elderly men and 34.0% of elderly women in the subnormal category. On the other hand, the cutoff standards for MAC could be too low for the Taiwanese elderly men. It placed only 0.7% in the malnourished category. In a population representative sample one would expect an ideal cutoff value to identify the subnormal individuals below the fifth percentile value of a general population. Application of population-specific anthropometric cutoff standards would minimize these shortcomings.

In addition to the anthropometric parameters, the study also experienced some other difficulties in some MNA questions. Getting accurate estimate on fluid intake is somewhat difficult to some participants because many foods are often prepared in soupy or juicy forms in Taiwanese culture. Figuring out fluid intake is difficult and time consuming to many of the participants. For those reasons, the question was not administered. Explaining pressure sore to the elderly is also difficult because it is often confused with joint and muscle pains that are prevalent in the elderly. Inadequate fluid intake and pressure sore occur more frequently in the oldest old or immobilized patients. Omitting these two questions will lead to slightly underestimating the prevalence of malnutrition. Counting servings of food consumed is also difficult because foods are not prepared or served in serving sizes in the Taiwanese culture. Thus, food consumption frequencies, instead of number of servings, were used. Using frequency rather than servings of consumption may tend to over represent intake status.

Results show that among the three anthropometric markers, CC is most closely correlated with the MNA scores (without including the scores of the respective variables). This observation echoes the finding of Bonnefoy et al. (19) that the CC is more sensitive than other anthropometric markers in predicting protein-calorie malnutrition in the elderly. The MNA score (without including the scores of the respective variables) also shows strong correlation with self-rated nutritional status, self-rated health status and mobility. These results suggest that the MNA has good predictive values as suggested by others (20-22). The high positive correlations of CC and MAC with the MNA score seem to be of special clinical interest because it is much easier to measure CC and MAC than body height and weight, especially in long-term care patients. MAC and CC both reflect general nutritional and lean body mass status. More importantly, MAC and CC also reflect one's mobility status and the ability to carry out his/her activity of daily living. It would be of great interest to explore whether a scale with only CC and/or MAC measurements without BMI could effectively predict nutritional risk status. An attempt to delete anthropometric measurements from the MNA for institutionalized elderly by Woo et al. (23) has resulted in a reduced ability of the tool to discriminate the levels of malnutrition.

It should be mentioned that the original weight and height data used in this study were self-reports. Over-reporting of height by older adults may occur due to time lapse since last height measurement and height decreases with age. Regression equations developed by Kuczmarski et al. (15) were used to correct self-reported weights to measured weights in computing individual BMI values but this application may have some shortcomings because the equations were not based on data from the target population.

The MNA has been reported to be an effective means of monitoring nutritional risk status among older populations of varied ethnic, age, income, and education. It has even been proposed to be an instrument for a national nutritional surveillance system (24). However, it has not been widely used in non-Caucasian populations. The present study suggests that the MNA can be used as a tool to estimate the prevalence of malnutrition in the elderly Taiwanese. The tool can also be used to identify the elderly individuals in need of nutritional intervention or treatment. However, the functionality of the instrument can benefit from adapting population-specific anthropometric cutoff standards.

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