Assessment and evaluation of the nutritional status of the elderly using 2 different instruments

Ozge Kucukerdonmez, MSc, Eda Koksal, PhD, Neslisah Rakicioglu, PhD, Gulden Pekcan, PhD.

ABSTRACT

Objectives: The elderly population continues to increase in most countries and inadequate nutrition is a common problem affecting their functional and physical status. Therefore, we should periodically assess the nutritional status of the elderly using practical methods. Our study objectives are to assess the nutritional status of the elderly using 2 different methods: Mini Nutritional Assessment (MNA) and Nutritional Screening Initiative Checklist (NSIC), and to evaluate the consistency of the methods.

Methods: We carried out a cross-sectional study between February 2003 and March 2004. We included a total of 1,564 elderly volunteers living in Ankara, Turkey, with median (± inter quartile range [IQR]) age of 70 ± 8 (Male: 71 ± 9; Female: 70 ± 9) years. We utilized 2 frequently used instruments; MNA and NSIC in this study.

Results: The MNA results (<17 points) indicated that 6.5% of the male and 8.8% of the female participants had inadequate nutrition. According to NSIC, 34.3% of males and 36.9% of females were classified as having a high risk of nutritional deficiency. We observed a decrease in MNA and an increase in NSIC scores with the increase of age (p<0.01). We determined a negative correlation of MNA and positive correlation of NSIC with body weight, body mass index (BMI), mid-upper arm circumference (MUAC), and calf circumference (CC) (p<0.01). We did not find correlations between MNA and NSIC score to be statistically significant (r:-0.318; p>0.05). We analyzed agreements between MNA and NSIC score by Kappa statistical method (kappa: 0.13, p: 0.285) and determined that neither of these 2 methods can be used in lieu of the other.

Conclusion: For the assessment of the nutritional status of the elderly, we could use both MNA and NSIC instruments but depending on the facilities and preferences, we cannot use one to replace the other. The MNA includes both anthropometric measurements and various nutritional parameters, and is a practical and most valid method.

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Aging is a process experienced by all living creatures as they approach the end of their predestined life spans.[1] The global demographic transition to an older population affects both the developing as well as developed countries. By 2050, the world population over 60 years of age is expected to reach 2 billion.[2] A variety of physiological, psychological, economic, and social changes that may compromise nutritional status accompany aging. These changes do not adversely affect all individuals, as many older people remain in excellent health until very old age. As a group, however, older persons tend to have a high prevalence of chronic disease and heavy medication use, while they are also relatively sedentary and may have unhealthy eating habits. Many of the seemingly inevitable consequences of aging may actually be accelerated by these factors.[3] Inadequate nutrition is

From the Department of Nutrition and Dietetics, Hacettepe University, Samanparazari, Ankara, *Turkey*.

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Address correspondence and reprint request to: Ozge Kucukerdonmez, Department of Nutrition and Dietetics, Hacettepe University, Samanparazari 06100, Ankara, *Turkey.* Tel. +90 (312) 3119649. Fax. +90 (312) 3091310. E-mail: ozgek@hacettepe.edu.tr.

a major problem for elderly people. Despite the prevalence and significance of the problem, there is little information on the nutritional status of the elderly population and its impact on their quality of life.[4] Nutritional assessment is a challenge as there are a lot of factors affecting malnutrition that are difficult to define. In a review of the literature, Klein et al,[5] concluded that no gold standard exists for determining nutritional status. Therefore, a combination of indicators from several categories such as anthropometry, biochemical parameters, food intake, and the presence of risk factors are recommended, and have been used clinically to classify nutritional status.[6] In the last 15 years, nutritional screening tools have been developed, tested, and implemented.[7-11] Most were designed to screen elderly people in the community or in long-term care settings,[7-9] or focused on general surgical patients and not specifically on elderly patients.[10,11] The Mini Nutritional Assessment (MNA),[9] with 18 weighted questions and a score for each question, was designed to be administered by a trained health care practitioner. As it can be used as an assessment tool as well as a screening tool, the total MNA score rates elderly patients as either well nourished or at risk for malnutrition, instead of ranking by risk. The Nutrition Screening Initiative Checklist (NSIC) is a similar screening tool designed for self-administration or administration by interview and takes 5-10 minutes to complete.[8] Weighted scoring is compared with a rating system to determine low, moderate, or high risk for malnutrition. Our objectives were to determine the nutritional status of the elderly using the 2 different instruments and evaluate the consistency of the methods.

Methods. The survey was given to 1,564 elderly volunteers living in Ankara, Turkey between February 2003 and March 2004. Median (± inter quartile range [IQR]) age of the volunteers was 70 ± 8 (Male: 71 ± 9 Female: 70 ± 9) years. Two frequently used tools; the MNA and the NSIC were used in this study. The MNA is composed of 18 items, including anthropometrical measurements (body weight, height, and weight loss), a global assessment (6 questions related to lifestyle, medication, and mobility), a dietary questionnaire (8 questions related to the number of meals, food, and fluid intake), and subjective assessment (self-perception of health and nutrition). The maximum score is 30 points, the risk for malnutrition increasing with lower scores. The MNA score is used to classify patients as well nourished (a score of 24-30 points), at risk for malnutrition (a score of 17-23.5 points) or malnourished (a score of <17 points).[9] The "Determine Your Nutritional Health Checklist-NSIC" was developed within the context of the US Nutrition Screening Initiative (NSI), and was designed to increase public awareness of malnutrition in the elderly and to help identify individuals at risk for nutrition problems. The checklist includes 10 yes/no items that are given different weights associated with the nutritional well being of older people. The cumulative score can range between 0 and 21. Subjects with a score ≥6 are considered at high nutritional risk. Scores from 3-5 indicate moderate nutritional risk, whereas a 0-2 score is classified as having good nutrition.[12] The body weight of elderly wearing minimal clothing was measured to the nearest 0.5 kg with a portable scale (KRUPS). Height to the nearest 0.1 cm was measured with a fiber-glass tape. Body mass index (BMI) was calculated as weight (kg)/height (m^2). Mid-upper arm circumference (MUAC), and the calf circumference (CC) were measured in standing position, using a fiber–glass tape and recorded to the nearest 0.1 cm. All measurements were obtained as described by Lohman et al.[13] Cumulative scores were calculated for both checklists. Based on the pre-set cutoff values, subjects were classified in nutritional risk categories according to either score. All values are reported as the median ± IQR. Statistical evaluations of the results were performed with the SPSS 10.0 computer program. The Kolmogorov-Smirnov test was used to determine whether outcome variables were normally distributed, and then the differences were assessed using Mann-Whitney U-test. In addition, Spearman rank correlation coefficients were used to assess the associations between the 2 assessment methods and for other variables. Agreement between MNA and NSIC points were analyzed by Kappa statistical method. The level of significance was set at a probability of less than 5% ($p<0.05$) or 1% ($p<0.01$).

Results. The study was conducted on 1,564 randomly selected elderly volunteers (M: 689; F: 875). The median (± IQR) age of males was 71 ± 9 years and females was 70 ± 9 years, **(Table 1)**. The results showed that 49.4% of the subjects were married, 65.3% were living with their families, and 32.3% of the elderly had only a primary school education. Age and anthropometric measurements of the elderly are shown in **Table 2.** As it can be seen, all the anthropometric measurements represent statistically considerable differences between men and women, except age and MUAC values. As expected, body weight and height measurements of the men were higher than those of the women, while BMI and MUAC values were higher than in the women ($p<0.05$). As shown in **Table 2**, the prevalence of overweight and obesity was 46.9% and 10.9% in males and 47.3% and 22.5% in females. **Table 3** shows the nutritional status of the subjects according to the MNA and NSIC. Using

MNA, 16.2% (n=253) of the elderly were classified as well nourished, while 25.4% (n=397) of the elderly were on a good nutrition level according to NSIC. Furthermore, MNA classified 76% at risk of under-nutrition and 7.8% malnourished. According to NSIC, 38.9% of the elderly were at moderate risk and 35.7% at high nutritional risk. Elderly were classified according to MNA as at risk/malnourished and well nourished, while according to the NSIC as having high and moderate nutritional risk and at good nutritional status. Anthropometric measurements of the subjects have been assessed in accordance with MNA and NSIC, and the results of the evaluations are shown in **Table 4**. According to MNA, all the anthropometric measurements of well nourished and at risk/malnourished subjects were different from each other, while in well-nourished subjects, all results except age were high ($p<0.01$). When the results were compared with the evaluation of the NSIC only MUAC and CC measurements were found to be higher in the high-risk group ($p<0.05$) compared to moderate/good group ($p<0.01$). The correlations between the MNA and NSIC, anthropometric measurements, and age of the subjects are given in **Table 5**. As age increases, the point scored in MNA decreases and conversely increases on the NSIC. In addition, anthropometric measurements showed a negative correlation with the NSIC and a positive correlation with MNA ($p<0.01$). The consistency of these 2 methods that were used in the evaluation of the nutritional status of the elderly had been tested with Kappa statistics and was not found to be consistent and, therefore, one instrument cannot be used to replace the other (kappa: 0.13, *p*: 0.285).

Discussion. An important objective is to identify elderly with protein-energy malnutrition (PEM) or as being at risk of PEM. The MNA and NSIC are 2 widely used methods in evaluating the nutritional status of the elderly. In this study, we evaluated the nutritional status of the elderly based on these 2 measurement tools. According to the NSIC 35.7% of subjects were at high nutritional risk, while based on the MNA, 7.8% were classified as malnourished. Similarly, in the SENECA (Survey in Europe of Nutrition in the Elderly, a Concerted Action)[14] study, according to the NSIC and MNA 48% of the subjects and 1% of the subjects have been found to be malnourished. In addition to this study, numerous others have reported a higher prevalence (range=48-98%) of being at risk for poor nutritional status according to the NSIC.[15-17] These studies however, do not allow a control group comparison as they included different population segments, such as meals on wheels applicants and participants,[15] as well as inner-city-dwelling black Americans.[16] Moreover, it is not certain whether the NSIC scoring system is applicable to European populations. The checklist items and their scores have been adopted based on the analysis of a representative sample of non-institutionalized persons aged 70 years and older in New England.[17]

On the other hand, the low prevalence of malnutrition revealed with MNA is not surprising as it is specifically intended for the elderly.[18] However, based on a cross-validation study in 347 healthy older persons in New Mexico, the use of the MNA was recommended for uncovering the risk of malnutrition, instead of malnutrition, in community-dwelling or healthy elderly people.[9] When we compare the age and anthropometric measurements of the elderly in accordance with the classification of the MNA and NSIC, there were no differences on the basis of age, while in accordance with MNA, all anthropometric results have been found to be significantly high in well-nourished subjects ($p<0.01$). We can consider this result confirmation of the evaluation's dependability. Body mass index is a frequently used method for the evaluation of

Table 1 - Age and anthropometric measurements of the elderly.

Measurements	Males (n=689)			Females (n=875)			
	Median	IQR	Range	Median	IQR	Range	*p*-value
Age (year)	71	9	65 - 110	70	9	65 - 102	0.077
Body weight (kg)	72	15	40 - 113	65	15	30 - 97	0.000*
Height (cm)	170	8	143 - 185	155	11	133 - 174	0.000*
BMI (kg/m^2)	25.7	4.53	16.3 - 33.9	27	5.16	14.7 - 33.8	0.000*
MUAC (cm)	29	5	19 - 44	29.5	5	14.5 - 44	0.104
CC (cm)	35	5	24 - 47	35	6	16.5 - 46	0.031*

*$p<0.05$ indicate differences between males and females by Mann-Whitney U-test, BMI - body mass index, MUAC - mid-upper arm circumference, CC - calf circumference, IQR - inter quartile range

Table 2 - Body mass index distribution according to gender.

Classification	BMI (kg/m^2)	Males (n = 689) n (%)	Females (n = 875) n (%)	Total (n = 1,564) n (%)
Severe/Moderate PEM	(<16.9)	1 (0.1)	5 (0.5)	6 (0.4)
Mild PEM	(17 - 18.4)	8 (1.2)	18 (2.1)	26 (1.7)
Normal	(18.5 - 24.9)	282 (40.9)	241 (27.6)	523 (33.4)
Overweight	(25 - 29.9)	323 (46.9)	414 (47.3)	737 (47.1)
Obese I	(30 - 34.9)	75 (10.9)	197 (22.5)	272 (17.4)

PEM - protein energy malnutrition, BMI - body mass index

Table 3 - Evaluation of the elderly according to MNA and NSIC.

Score	(Points)	Males (n = 689) n (%)	Females (n = 875) n (%)	Total (n = 1,564) n (%)
MNA				
Malnourished	(<17)	45 (6.5)	77 (8.8)	122 (7.8)
Risk of under-nutrition	(17 - 23.5)	490 (71.1)	699 (79.9)	1189 (76)
Well-nourished	(≥24)	154 (22.4)	99 (11.3)	253 (16.2)
NSIC				
High nutritional risk	(≥ 6)	236 (34.3)	323 (36.9)	559 (35.7)
Moderate nutritional risk	(3 - 5)	236 (34.3)	372 (42.5)	608 (38.9)
Good	(0 - 2)	217 (31.4)	180 (20.6)	397 (25.4)

MNA - mini nutritional assessment, NSIC - nutritional screening initiative checklist

Table 4 - Age and anthropometric measurement of the elderly according to MNA and NSIC classification.

Measurements	MNA					NSIC				
	At risk / malnourished (n=1,311)		Well nourished (n=253)			High risk (n=559)		Moderate / good (n = 1,005)		
	Median	IQR	Median	IQR	*P*	Median	IQR	Median	IQR	*P*
Age (year)	70	9	70	8	0.118	71	10	70	8	0.110
Body weight (kg)	67	15	75	12.5	0.000*	66	12.5	70	15	0.120
Height (cm)	160	14	165	12	0.000*	161	17	162	14	0.481
BMI (kg/m^2)	25.9	5.86	27.1	3.87	0.000*	25.5	6.74	26.3	5.22	0.228
MUAC (cm)	29	6	31	5	0.000*	29	7	29.5	5	0.025**
CC (cm)	34.5	5	37	5.5	0.000*	32.5	5.25	35	6	0.001*

*p<0.01,**p< 0.05 by Mann Whitney U test , MUAC - mid-upper arm circumference, CC - calf circumference, BMI - body mass index , MNA - mini nutritional assessment, NSIC - nutritional screening initiative checklist, IQR - inter quartile range

Table 5 - Spearman rank correlation coefficients for MNA and NSIC according to gender (r).

Measurements	Males (n=689)		Females (n=875)	
	MNA	NSIC	MNA	NSIC
Age (year)	-0.203*	0.006*	-0.106*	0.109*
Body weight (kg)	0.423*	-0.126*	0.287*	-0.112*
BMI (kg/m^2)	0.381*	-0.114*	0.274*	-0.095*
MUAC (cm)	0.320*	-0.109*	0.293*	-0.104*
CC (cm)	0.296*	-0.101*	0.310*	-0.113*

*p<0.01 indicate correlation between MNA and NSIC with Spearman rank correlation coefficient, MUAC - mid-upper arm circumference, CC - calf circumference, MNA - mini nutritional assessment, NSIC - nutritional screening initiative checklist

nutritional status in the elderly. The BMI has also been shown to be a good estimate of body fat.[19] High and low values of BMI are associated with increased risks of disease, and the relation of BMI with all causes of mortality is U- shaped. The cutoff points for centiles as markers for obesity or under-nutrition are not clearly established.[20] However, some studies show that elderly individuals with a BMI of greater than 27 or less than 24 kg/m^2 may be at an increased risk for poor nutritional status.[19] Taking into consideration the above-mentioned information, in our study, the median BMI values in men was found to be at normal level (25.7 ± 4.53 kg/m^2) while in women the normal level was 27 ± 5.16 kg/m^2. Of the total study population, 22.5% of the women and 10.9% of men had a BMI higher than 30 kg/m^2. Even without an intervention or disease, the composition of the body changes naturally with age.[21] Loss of muscle mass starts in the middle of adulthood and continues through old age. In the elderly, decreased weight and height have been reported along with decreased nutrient intake and lower energy expenditure.[22,23] The primary reason for decreased height in the elderly appears to be the shortening of the spinal column. Other factors contributing to altered height in the elderly include an actual bone loss of 12% in men and 25% in women, leading to osteoporosis and kyphosis.[24] Body weight tends to increase until the early 40s in men and the early 50s in women, to hold relatively steady for the next 15-20 years, and to decrease thereafter.[19] The MUAC and CC provides estimates of skeletal muscle and the change of lean muscle mass together with decrease of activity.[24] In this study, we took into account all of these measurements, and evaluated the anthropometric measurements of the subjects according to their age and gender. We found the differences between all the anthropometric measurements of both men and women, except age and MUAC, to have a statistically significant correlation with body weight and height of the men. In addition, BMI, MUAC, and CC measurements were higher in women than men. Other studies reported the correlation of age and anthropometric measurements with MNA.[25,26] In these studies, a positive correlation, particularly, was shown, while in the studies made by NSIC, the examination of the same correlation is limited.[27] In this study, we made the correlation of age and anthropometric measurements by both methods and the confirmed expected correlation in both methods. From a dependability point of view these, we can consider the results as important. We tested the consistency of both methods by using Kappa statistics and found a similar inconsistency, as reported by Groot et al[14] and Beck et al.[28]

In conclusion, we can use both the MNA and NSIC methods in the elderly, depending on the facilities and preferences to assessment and evaluation of the nutritional status. However, we cannot replace one method with the other. Since MNA includes both anthropometric measurements and other important variables, it should be considered as the most reliable and valid method.

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