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Evaluation of the Iranian Mini Nutritional Assessment Short-Form in Community-dwelling Elderly

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ABSTRACT

Background: This study was aimed to assess agreement and diagnostic accuracy of the Iranian version of Mini Nutritional Assessment short-form (MNA-SF) against the original MNA, as a gold standard in community-dwelling elderly.
Methods: The full MNA and 9-item MNA-SF comprising questions regarding clinical status, dietary assessment and self-perception of health status and nutrition together with mid-arm and calf circumference measurements without including the body mass index (BMI) were completed for 205 volunteers aged 65 or older recruited from all over Markazi Province (Iran). Correlation, diagnostic accuracy and agreement between the MNA-SF and full MNA were calculated.
Results: The MNA and the MNA-SF classified 45.4% and 64.4% of the subjects as malnourished or at risk of malnutrition, respectively. Substantial agreement between the MNA-SF and full MNA was observed (Kappa=0.633). The MNA-SF correlated strongly with the full MNA (r=0.868, *P*<0.001). The MNA-SF showed high sensitivity (96.77%) and negative predictive values (95.89%), relatively high specificity (62.5%) and positive predictive values (68.18%) and fair accuracy (Area under curve =0.796).
Conclusion: Iranian MNA-SF seems to be an applicable screening tool for quick detection of malnutrition or at risk of malnutrition in community-dwelling elderly especially when BMI is unavailable.

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Introduction

Nutritional status of older people is an important determinant of quality of life.[1]It is recognized as an important predictor of morbidity and mortality related to increased demands on health services and higher hospitalization rate.[2] Therefore, nutritional assessment and early identification of the risk of malnutrition plays a key role in the successful interventions in elderly population. In this regard, several tools are currently available for detecting under-nutrition.[3] Among these methods,

the Mini Nutritional Assessment (MNA) has been revealed as probably the best and appropriate screening tool to detect malnourished elders and those at risk of malnutrition.[4] The MNA full form was developed and published in 1994 and consisted of eighteen items including anthropometric measurements, general, dietary and self-assessments.[5] This test classifies the individuals as "malnourished", "at risk of malnutrition" and "well nourished".

Recently, in order to detect malnourished subjects, needed of an urgent nutritional interventions, MNA short form tests (MNA-SFs) have been developed and confirmed to work well in a population of older people from different settings.[6-8] In 2001, the MNA-SF was developed which included six items (including BMI) from the full MNA and only classified subjects in two categories, "well-nourished" and the "possibility of malnutrition" without distinguishing specifically people at risk. This MNA-SF was strongly correlated with the total MNA score (r=.945). Moreover, sensitivity, specificity and diagnostic accuracy of this tool were 97.9%, 100% and 98.7%, respectively for predicting under-nutrition.[7] Kaiser et al. validated two MNA-SF tests (including BMI or CC) with respect to the agreement with full MNA classification in community-dwelling older people, nursing home residents and older adults in rehabilitation units. Agreement between the full MNA and MNA-SFs was 84.6% when the MNA-SF using body mass index (BMI) was applied and 81.4% when the MNA-SF using calf circumference (CC) was considered. Two studied MNA-SFs represented a valuable tool for rapid and reliable nutritional screening in elderly population in society.[8]

In Iran, the modified MNA with nine items (without including BMI) has been developed from the full MNA and classified old individuals as "malnourished", "at risk of malnutrition" and "well-nourished". This rapid and easy tool is used widely for nutritional assessment of elderly in community settings. To the best of our knowledge, diagnostic accuracy of the developed MNA-SFs against the full MNA has not been studied; therefore, this study was aimed to assess agreement and accuracy of 9-item MNA-SF in community-dwelling older people.

Materials and Methods

In this cross-sectional study, 205 community-dwelling volunteer subjects (including 54.6% males & 45.4% females) aged 65 yr or older with mean age of 73.7(SD 8.9) years were recruited using cluster sampling from all over Markazi Province (Iran). The exclusion criteria were receiving supplements or tube feeding, suffering from acute disease at the beginning of the study, being in a terminal condition of health, suffering from cognitive impairment.

In the present study, the "original" MNA was used as a gold standard for nutritional assessment. It consists of 18 questions grouped into 4 parts: anthropometry [BMI, weight loss, mid upper arm and calf circumferences], clinical status (medications, mobility, pressure sores and skin ulcers, lifestyle, psychological stress or neuropsychological diseases), dietary assessment (autonomy on feeding, quality and number of meals, fluid intake) and self-perception of health status and nutrition. The total score ranges from 0 to 30 points. MNA score <17 points indicates malnutrition; from 17 to 23.5 score is an indicator of at risk of malnutrition and score ≥ 24 is an indicator of a good nutritional status.[9] Calf circumference was the best indicator in predicting nutritional status and health conditions, followed by muscle arm circumference and then BMI.[10] A modified version of MNA-Short Form considering calf circumference instead of BMI has been confirmed to work well in a population of older people from different settings.[8] Therefore, Iranian version of MNA (called MNA-SF) is a modified MNA with 9 questions comprising anthropometric measurements (mid-arm and calf circumferences) combined with questions regarding clinical status (medications), dietary assessment (autonomy on feeding, quality and number of meals, fluid intake) and self-perception of health status and nutrition. The total score ranges from 0 to 13 points. MNA-SF score < 5 points indicates malnutrition; from 5 to 9.5 score

is an indicator of at risk of malnutrition and score ≥ 10 is an indicator of good nutritional status.[11] Body weight of each subject was measured in duplicate with barefoot and wearing light clothing to the nearest 0.1 kg with a Seca (Dubai, United Arab Emirates) scale.

Height of each subject was measured with barefoot and using a measuring tape with the subject's head positioned in the Frankfurt Plane and arms hanging freely at both sides and recorded to the nearest 0.5 cm. The body mass index (BMI) was calculated as weight (kg) divided by height^2 (m^2). Mid-arm circumference was measured with a tape measure to the nearest 0.1 cm at the midpoint of the arm between the tips of the acromion process and the olecranon process.[12] Calf circumference was measured with a tape to the nearest 0.1 cm at the widest part around the calf.[12] Both the original MNA and MNA-SF tests were completed for all subjects by a trained nutritionist.

Ethical Issues

The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences, Iran. All subjects were made aware of the content of the study and a written informed consent was obtained from each subject.

Statistical analyses

Statistical analyses were performed using SPSS statistics 11.5 (SPSS Inc. Chicago IL, USA). Means and standard deviations (SD) were used as descriptive statistics for quantitative variables. Proportions were used to describe qualitative variables. Sensitivity, specificity, predictive values and Youden index (sensitivity+specificity-1) were calculated as diagnostic measurements for categories "malnourished-risk" vs. "well nourished". Additionally, area under ROC curve was calculated in order to assess the diagnostic accuracy of the test. Weighted kappa index was obtained to quantify agreement beyond chance between the MNA-SF and full MNA classification. Pearson's model was used to analyze correlations between the MNA-SF and full MNA.

Results

Table 1 shows the number of subjects who were classified by MNA-SF into each category and the crossed results with the full MNA. The full MNA classified 8.3% (n=17) of the studied elderly population as malnourished, 37.1% (n=76) as at risk of malnutrition and 54.6% (n=112) as well nourished. The results according to the MNA-SF were 5.4% (n=11) malnourished individuals, 59% (n=121) of individuals at risk of malnutrition and 35.6% (n=73) well-nourished subjects. Agreement between the MNA-SF and the full MNA was obtained as the percentage of correct classifications. As indicated in Table 1, the MNA-SF classified 72.2% (n=148) correctly. Forty-two subjects who were well nourished were classified as at risk of malnutrition based on the MNA-SF and three subjects who were at risk of malnutrition were classified as well nourished. Kappa value was 0.633, indicating substantial agreement with the full MNA, according to Landis and Koch classification (Table 1).[13]

Table 1: Agreement between nutrition status categorizations for MNA and MNA-SF (n=205)

		Full MNA			
		Malnourished	**At risk of malnutrition**	**Well nourished**	**Total**
MNA-SF	Malnourished	8 (3.9%)	3 (1.5%)	0 (0.0%)	11 (5.4%)
	At risk of malnutrition	9 (4.4%)	70 (34.1%)	42 (20.5%)	121 (59.0%)
	Well nourished	0 (0.0%)	3 (1.5%)	70 (34.1%)	73 (35.6%)
	Total	17 (8.3%)	76 (37.1%)	112 (54.6%)	205 (100.0%)

Weighted kappa = 0.633 (95% CI=0.51-0.75)

As presented in Table 2, high sensitivity and negative predictive values (NPV) and relatively high specificity, Youden index and positive predictive values (PPV) were found for MNA-SF against the full MNA while the dichotomized categorization of "malnourished-risk" vs. "well nourished" was considered. Area under the ROC curve also showed fair accuracy (AUC=0.796) with the full MNA (Table 2). Moreover, high association was observed between the full MNA and MNA-SF according to the Pearson's correlation model (Pearson's coefficient r=0.868; *P*<0.001).

Table 2: Diagnostic accuracy of the MNA-SF with the MNA-full for the dichotomized categorization "malnourished-risk" vs. "well nourished"

Measurements	Values
	Malnourished-risk vs well nourished
Sensitivity (95% CI)	.97 (0.75-0.99)
Specificity (95% CI)	.63 (0.50-0.72)
Positive predictive value (PPV) (95% CI)	.68 (0.59-0.77)
Negative predictive value (NPV) (95% CI)	.96 (0.89-0.99)
Youden index	.59
AUC* (95% CI)	0.796 (0.734-0.859)**

*Area under the ROC (receiver operating characteristic) curve; Classification according to the traditional academic point system: 0.90-1 = excellent, 0.80-0.90 = good, 0.70-0.80 = fair, 0.60-0.70 = poor, 0.50-0.60 = fail. ** *P*-value < 0.001

Discussion

This study is one of the first investigations conducted to assess the diagnostic accuracy of a new proposed MNA-SF in community-dwelling older population in the central region of Iran. The new proposed MNA-SF, with just nine questions, provide more rapid nutritional assessment classifying subjects into the same categories given by the original MNA.[11] In present study, the MNA-SF correlated strongly with the full MNA (r=0.868), however MNA-SF tended to underestimate nutritional status and it still misclassifies some individuals especially "at risk" category (Table 1). In addition, substantial level of agreement with the full MNA was found (Table 1). Consistent with the findings of present study, Garcia-Meseguer and Serrano-Urrea[6] reported that the MNA-SF with just six questions correlated strongly with the full MNA (Pearson's correlation coefficient r=0.904; *P*<0.001). Moreover, MNA-SF including calf circumference (CC-MNA-SF) classified 78.55% correctly ($\varkappa$ =0.596).[6] Kaiser et al.[8] reported moderate agreement ($\varkappa$ =0.575) between CC-MNA-SF, including just six questions, with the full MNA in community-dwelling older population which was similar to our study.

To assess the diagnostic accuracy of the MNA-SF with the full MNA, the dichotomized categorization "malnourished-risk" vs. "well nourished" was considered (Table 2). According to our results, MNA-SF showed higher sensitivity (96.77%) which means that more undernourished subjects were correctly identified as being at nutritional risk. In a study of 184 elderly subjects, Lei et al.[14] showed that MNA-SF was highly sensitive (89.5%) which was in line with our study. In evaluating diagnostic accuracy of MNA-SF with the full MNA in 5334 elderly subjects with mean age of 81.75 (SD 7.5), Vandewoud et al.[15] found 97% sensitivity and 52% specificity for MNA-SF in subjects aged less than 90 years which was in line with our study. Moreover, they[15] reported 26% PPV and 99% NPV for MNA-SF in subjects aged less than 90 years and 32% PPV and 99% NPV in their studied subjects, which was consistent with present findings. Similar to our study, Garcia-Meseguer and Serrano-Urrea[6] found high values of sensitivity and negative predictive values for the CC-MNA-SF against the full-MNA when the dichotomized categorizations "malnourished-at risk of malnutrition" vs. "well nourished" were considered. Consistent with our findings, Cuervo et al.[4] found 85.2% sensitivity and 93.4% NPV with the MNA-SF consisted of six questions concerning recent appetite and weight loss, mobility, acute disease or psychological stress, neuropsychological problems and BMI. Moreover, they[4] reported 88.9% specificity and 76.4% PPV that was in contrast to our results. Similar to our findings, Donini et al.[3] found that CC-MAC-MNA had 81.1% sensitivity and 94.4% NPV in comparison with the MNA. However, our specificity (62.5%) and positive predictive values (68.18%) were lower than

the values (97.1% specificity and 94.2% PPV) reported by Donini et al.[3] in free living or institutionalized elderly subjects. Relatively low specificity found within our study means that residents with false-positive diagnoses of under-nutrition might withdraw resources from those in real need of nutritional measures. The sensitivity value (96.77%) found with the MNA-SF within present study was higher than the value (72%) reported by Sheean et al.[16] Moreover, they[16] reported that MNA-SF with only 6 questions was highly specific (98%) which was in contrast to our findings. In contrast to present results, Garcia-Meseguer and Serrano-Urrea[6] reported higher specificity (83.4%) and positive predictive values (77.6%) for the CC-MNA-SF against the full-MNA in institutionalized elderly people when the dichotomized categorizations "malnourished-at risk of malnutrition" vs. "well nourished" were considered. Area under the ROC curve also reached high value (0.923) showing the test's excellent accuracy with the full-MNA[6], which was not in line with our study. The discrepancy in specificity and PPVs might be due to the different residencies, ethnic groups, and/or using different versions of MNA-SFs. The Youden index (59.27%) found in our study was to some extent similar to the value (69.5%) reported by Garcia-Meseguer and Serrano-Urrea[6] which indicated that the MNA-SF had good accuracy in isolation of the malnourished and well-nourished subjects.

Limitations of the generalizability of our findings include the small sample size, lack of geographic variation and exclusion of elderly living in nursing homes and rehabilitation settings. Despite these drawbacks, it seems that the Iranian version of MNA-SF is an applicable screening tool for quick detection of malnutrition or at risk of malnutrition in community-dwelling elderly subjects. However, further studies are needed to make concise conclusions.

Conclusion

The revised MNA-SF has shown substantial levels of agreement with the full MNA, considered as the gold standard, in community-dwelling elderly population in Iran. The revised MNA-SF seems to be rapid, easy and reliable tool capable to identify malnourished individuals and those who are at risk of malnutrition. Moreover, due to the special characteristics of elderly people (especially subjects with mobility problems, using wheelchairs or confined to bed), this version of MNA-SF is a good option to replace the BMI-MNA-SF when BMI is not available.

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Conflict of interests

The authors declare no conflicts of interest.

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