Original Article

Comparison of Two Validation Nutrition Tools in Hospitalized Elderly: Full Mini Nutritional Assessment and Short-form Mini Nutritional Assessment

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Abstract

Background: The aim was to determine validity, reliability, and cutoff of full-mini nutritional assessment (MNA) and MNA-short form (SF) also which one was better for the screening of malnutrition in the Iranian hospitalized elderly. **Methods:** In this cross-sectional validation study, 96 hospitalized elderly ≥60 years selected from two hospitals in Tehran. Anthropometric measures (body mass index [BMI], mid-arm circumference [MAC], calf circumference [CC], abdomen, and waist skinfold thickness) and laboratory tests (albumin and hemoglobin levels, and red blood cell count were performed. Nutrition tools (full-MNA and MNA-SF), cognition tool (mini-mental state examination, depression scale (Geriatric Depression Scale15 and activities of daily living (ADL) index (Modified Barthel-ADL) were administered. **Results:** The full-MNA scores were significantly correlated to measures of MAC, BMI, waist, and CC. The MNS-SF scores were significantly related to measures of MAC, waist, and CC. Serum albumin showed a poor correlation with both tools. At cutoff 24 in full-MNA had a sensitivity 75% and specificity 77.8% and the MNA-SF considered 62.5% sensitivity and 65.3% specificity at cutoff 10.50 to detect well-nourished from malnourished subjects. The internal consistencies of both tools were >90%. In exploratory factor analysis, six components found for full-MNA and two components for MNA-SF. Known group validity of full-MNA was reflected significant differences between geriatric patients with expected higher full-MNA scores and patients with expected lower scores (BMI ≥24 vs. BMI <24 or bed ulcer or assisted food intake). **Conclusions:** It seems the Persian version of full-MNA is more appropriate in comparison to MNA-SF for screening malnutrition in the Iranian hospitalized elderly patients.

Keywords: *Aged, nutrition assessment, psychometrics*

Introduction

Nutritional assessment of elderly who suffer from malnutrition in the hospital is essential to avoid mortality outcomes due to malnutrition. Therefore, nutrition tools should be used.[1]

mini nutritional assessment (MNA) is a malnutrition screening tool that utilized in acute care for geriatric patients,[2] by which the risk of malnutrition in the elderly could provide nutritional support.[1] The MNA is useful to predict long-term mortality in institutionalized and hospitalized geriatric patients.'[3] This tool could help to aged care professionals in assessing of nutritional status to guide elderly toward interventions.[3]

Since assessing by full-MNA is much time-consuming, the MNA-short form (SF) has been developed with high sensitivity, specificity that includes the questions related to full-MNA, which less time-consuming and can be used to screen elderly in different settings.[2]

The full-MNA and MNA-SF have not been yet validated in the Iranian hospitalized elderly to determine cutoff points in diagnosing of malnutrition. This study examined validity and reliability, also determined cutoff points full-MNA and MNA-SF tools in the Persian language, and choosing the more proper form of MNA tools to screen and diagnose of malnourished and risk for malnutrition in the Iranian geriatric hospitalized.

Methods

Subjects and sampling

This cross-sectional accuracy diagnostic study conducted on the elderly ≥60 years in

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two general hospitals (Shariati as public and Aria as private hospitals) in Tehran capital city and selected from internal medicine wards from September to December 2017. The elderly participants (n = 96) considered eligible, according to inclusion (communicate verbally and ability to carry out an interview) and exclusion criteria's included: terminally disease, completely bedridden, cognitive impairment according to mini mental state examination (MMSE) <23,[4] and depression (Geriatric Depression Scale [GDS]-15 ≥8).[5] Participants were asked to an agreement to take part in this study by two-trained geriatric nurse in the two hospitals.

Translation

We used the Persian version of full-MNA and MNA-SF, provided by Societe des Pro-Duits Nestle S. A., Vevy, Switzerland, Trademark Owners, which holds the copyright of the instrument: Http://www.mna-elderly.com/.

Data collection

Demographic data and history diseases were collected by interviewing geriatric patients, their caregivers, and admission profile. The Persian versions GDS-15[5] and MMSE[4] tools were asked by a trained nurse to assess of depression and cognitive levels. Activities of daily living (ADL) was assessed by Persian version validated Modified Barthel ADL tool index (B-ADL), graded from 0 to 100, dependent to independent levels.[6]

The instruments

The MNA is a simple and noninvasive clinical scale, contains two-steps nutritional screening of elderly in different settings.[7] The full-MNA is a nutritional summated tool, contained 18 items, with total score 30. The MNA ≥24 categorized as "well-nourished," those at risk for malnutrition graded (MNA = 17–23.5), and scores (MNA <17) identifies undernutrition, protein-calorie.[8] The MNA-SF includes 6 of the 18 items to screen individuals who at risk of malnutrition, along one anthropometric measurement (either body mass index [BMI] or calf circumference [CC]). Maximum score of MNA-SF is 14, which scores ≤11 revealed possible malnutrition that need to more assessment by full-MNA. Scores of MNA-SF ≥12 confirm normal nutritional status.[9]

Anthropometric measurements

Anthropometric measurements included BMI, mid arm circumference (MAC), CC, triceps skinfold thickness (TSF), and waist.[8] Body weight was measured to nearest 0.1 kg for people with light clothes and without shoes.[10] Height was appraised with fixed strip meter while elderly patients standing to nearest 0.1 cm to the wall in vertical position, with nude feet closely together, and behind the head and shoulder, back and heels beside the wall.[11] Waist circumference was measured using a flexible tape accurately above the iliac crest approximately at level of umbilical level at horizontal level.[12] For MAC measuring, the mid-point between top of acromion and olecranon was marked, while a person was kept the forearm in horizontal position. The measuring was performed on nondominant arm of individuals, as hanging freely along the trunk, by a flexible inextensible tape in 0.1 cm accuracy. A low MAC in elderly has been shown to increase a risk of mortality and indicates loss of peripheral muscle mass.[13] The CC was measured in the maximum circumference between ankle and knee with a flexible tape, in sit position, so that the foot was pressed on the floor completely, the knee bended 90º, and then from the largest portion of the calf was measured (in centimeters with a sensitivity of 0.1 cm).[14,15] The CC <31 cm will indicate muscle loss, especially in lower limb and sarcopenia cases.[16] BMI was calculated by dividing a subject's weight in kilograms by height in meter square. BMI of 24-29 kg/m^2 is a recommended reference interval for people >65 years.[15]

The skinfold caliper is a simple and inexpensive tool. Accuracy in skinfold caliper measure indifferent, based on the location of measurement site or obesity level of individuals.[17] We measured the abdomen skinfold thickness based on millimeter in the Iranian elderly by skinfold caliper.

Laboratory tests

Biochemical markers to assess nutritional status, in this study included serum albumin levels, hemoglobin, and red blood cell count (RBC). Blood samples were gathered after overnight fasting, collected on the tubes with and without containing ethylene-diaminetetra-acetic acid. RBCs and hemoglobin were measured by a coulter counter machine (Sys Mex, KX21N, Japan). After taking blood sample, serum was separated from clot using a centrifuge (6000 rpm). The serum was stored in freezers under −20°C until the time of testing. Serum albumin levels were determined using an auto-analyzer (Hitachi 902, Japan and Pars albumin Test Kit), the albumin levels of lower than 3.5 g/dl were considered as an indicator of malnutrition.[18]

Statistical analysis

Significant levels were defined at $\alpha < 0.05$. Internal consistency of items MNA tools were assessed using Cronbach's alpha coefficient and values >0.7 considered as a good internal consistency. Spearman's rank correlation coefficients the full-MNA and MNA-SF tools with serum

albumin, hemoglobin, RBC, and anthropometric measures, including CC, MAC, TSF, and BMI were considered as criteria validity. Known group validity of full-MNA was reflected in significant differences between MNA scores in patients with expected good and poor nutritional status. The Persian version construct validity, full-MNA and MNA-SF tools were approved by an exploratory factor analyses. Receiver operating characteristic (ROC) curve analyses were utilized to identify the cutoff points for both form long and short MNA.

Ethical considerations

This study conducted according to guidelines laid down in the Declaration of Helsinki and all human procedures that were approved by ethical standards of the Ethics Committee of Endocrinology and Metabolism Research Institute Tehran University of Medical Sciences (Ethics code EC-00305). The aim of the study was explained, and written consent form was signed by elderly participants and their proxies.

Results

Women participants were 49 (51%). Mean age of participants was 69.9 years (standard deviation [SD] = 7.5). The most frequent comorbidity was hypertension 53 (55.2%). The most common geriatric syndromes included visual problems (41.7%), sleep disorders (32.3%), incontinence (32.3%), and falls (30.2%). Malignancies were counted 5 (5.2%) in hospitalized elderly participants. The means included albumin 3.3 (SD = 0.5) g/dl, TSF 24.5 (SD ± 2.0) mm, MAC 25.2 (SD ± 3.7) cm, BMI 24.3 kg/m^2 in men, and 25.6 kg/m^2 in women. Mean full-MNA score was 22.7 (SD ± 4.4) and for MNA-SF was 9.5 (SD ± 2.4) [Table 1].

Table 1: Sociodemographic characteristics, anthropometric measurements, and clinical parameters of the Iranian elderly hospitalized

Measurements	Mean±SD		
	Men (*n*=47)	Women (*n*=49)	Total (*n*=96)
Age (year)	70.5±7.5	69.6±7.5	69.9±7.5
BMI (kg/m^2)	24.3±3.9	25.6±6.8	24.9±5.6
MAC (cm)	25.3±3.5	25.2±3.9	25.2±3.7
CC (cm)	33.6±3.5	33.8±3.5	33.7±3.5
Waist (cm)	97.0±11.9	97.4±17.5	97.2±14.9
Abdominal skinfold thickness (mm)	21.6±1.4	34.2±2.3	28.0±2.0
Modified B-ADL Index score	77.8±7.4	71.2±18.1	74.4±14.3
GDS-15 score	3.1±2.9	4.8±2.9	3.9±3.0
MMSE score	27.9±3.2	25.5±4.5	26.6±4.1
MNA total score	23.1±3.7	22.2±4.9	22.7±4.4
MNA-SF total score	9.5±2.1	9.4±2.7	9.5±2.4
Albumin (g/dl)	3.3±0.4	3.3±0.5	3.3±0.5
RBC count (×10^6)	4.3±0.7	4.2±0.8	4.2±0.8
Hemoglobin (g/dl)	12.1±1.9	12.5±3.9	12.3±3.1

BMI=Body mass index, MAC=Mid-arm circumference, CC=Calf circumference, ADL=Activities of daily living, GDS-15=Geriatric Depression Scale-15, MMSE=Mini Mental State Examination, MNA=Mini nutritional assessment, MNA-SF=MNA short form, RBC=Red blood cells, SD=Standard deviation

Validity

Correlations between full-MNA score with anthropometric measurements (BMI, MAC, CC, TSF, and waist), and laboratory markers (albumin, hemoglobin, and RBC), and physical function scale (modified B-ADL) were significant in the Iranian hospitalized elderly. The highest correlation coefficients were belong to BMI = 0.6; confidence interval (CI) 95% = 0.442–0.706; MAC = 0.6; CI 95% = 0.472–0.725; Waist = 0.6; CI 95% = 0.453–0.713; and serum albumin = 0.4; CI 95% = 0.269–0.592. Correlations between the Persian version MNA-SF score with anthropometric measurements and physical function scale were significant in hospitalized elderly. The strongest MNA-SF associations were obtained from CC, MAC, waist, and serum albumin [Table 2].

Known group validity in full-MNA was reflected significant differences between geriatric patients, with expected higher full-MNA scores and patients with expected lower scores. Values for known group validity displayed in Table 3.

In exploratory factor analysis, six components were extracted for Persian version full-MNA [Table 4]. The first component explained 31.8% of the variance and contained the items about BMI, MAC, and CC. The exploratory factor analysis of MNA-SF Persian version revealed two components. The first component included food intake decline, weight loss, and CC. The second component contained movement, tension/disease, and neuropsychological problem. The first component explained 55.6% of the variance [Table 4].

Reliability

Internal consistency of the Iranian versions was measured for full-MNA by Cronbachs alpha at 0.680 and for MNA-SF at α = 0.683. All items of both full-MNA and MNA-SF tools improved internal consistency [Table 5].

In agreement analysis, full-MNA and MNA-SF tools were repeated by two different raters in 11 subjects. The reliability of intraclass correlation of full-MNA Iranian version was significantly high (intraclass correlation coefficient = 0.901, $P < 0.001$) and MNA-SF obtained 0.858.

Sensitivity and specificity

Analyses of full-MNA indicated 75.0% sensitivity and 77.8% specificity, and MNA-SF tool was 62.5% sensitive and 65.3% according to serum albumin ≥3.5 g/ml. The cutoff points of full-MNA and MNA-SF were 24 and 10.5,

Table 2: Correlations between the Iranian full-mini nutritional assessment and mini nutritional assessment short form scores with anthropometric measurements, and clinical parameters

Measurements	Full-MNA		MNA-SF	
	ρ (95% CI)	*P*	ρ (95% CI)	*P*
CC (cm)	0.5 (0.385-0.670)	<0.001	0.5 (0.357-0.652)	<0.001
BMI (kg/m^2)	0.6 (0.442-0.706)	<0.001	0.5 (0.320-0.627)	<0.001
MAC (cm)	0.6 (0.472-0.725)	<0.001	0.6 (0.453-0.713)	<0.001
Albumin (g/dl)	0.4 (0.269-0.592)	<0.001	0.4 (0.278-0.599)	<0.001
Hemoglobin (g/dl)	0.4 (0.231-0.565)	<0.001	0.3 (0.071-0.443)	<0.001
Abdominal skinfold thickness (mm)	0.2 (0.005-0.389)	<0.001	0.2 (0.057-0.432)	<0.001
Waist (cm)	0.6 (0.453-0.713)	<0.001	0.5 (0.381-0.668)	<0.001
RBC count (×10^6)	0.6 (0.403-0.682)	<0.001	0.4 (0.254-0.582)	<0.001
Modified Barthel ADL Index score	0.3 (0.127-0.488)	<0.001	0.3 (0.105-0.471)	<0.001
MNA-SF score	0.8 (0.765-0.888)	<0.001	-	-

BMI=Body mass index, MAC=Mid-arm circumference, CC=Calf circumference, ADL=Activities of daily living, MNA=Mini nutritional assessment, MNA-SF=MNA short form, RBC=Red blood cells, CI=Confidence interval

Table 3: Comparison of the Iranian full-mini nutritional assessment scores between known groups with expected higher and lower nutritional status

Patients with expected higher nutritional status	*n*	MNA score (mean±SD)	Patients with expected lower nutritional status	*n*	MNA score (mean±SD)
Without pressure ulcer	43	24.8±0.7	With pressure ulcer	9	16.3±4.8
BMI ≥24 kg/m^2	65	26±1.3	BMI ≤24 kg/m^2	34	18.3±4.4
Unassisted food intake	49	25.8±1.3	Assisted food intake	3	12.3±2.1

MNA=Mini nutritional assessment, SD=Standard deviation, BMI=Body mass index

Table 4: Exploratory factor analyses of the Iranian full-mini nutritional assessment and mini nutritional assessment short form

Item content	Full-MNA						MNA-SF	
	Component						Component	
	1	2	3	4	5	6	1	2
BMI (kg/m^2)	0.890	−0.041	0.009	0.134	0.080	−0.043	-	-
MAC (cm)	0.820	0.079	0.077	0.017	−0.080	−0.038	-	-
CC (cm)	0.817	0.095	0.148	0.212	0.146	−0.003	0.561	0.392
Feeding	0.171	0.691	0.103	−0.121	0.284	0.020	-	-
Compare with others	−0.094	0.571	0.200	0.314	−0.091	0.203	-	-
Consumed fluid	−0.045	0.527	0.136	−0.066	0.395	0.248	-	-
Self-view of nutritional status	0.252	0.521	0.482	0.151	0.143	−0.005	-	-
Number of full meal	0.078	0.402	0.110	0.345	−0.380	0.163	-	-
Pressure sores or skin ulcers	−0.027	−0.128	0.741	0.088	0.164	0.092	-	-
Two or more servings of fruits	0.072	0.150	0.697	−0.016	0.108	−0.115	-	-
Serves of high-protein foods	0.156	0.172	0.616	−0.052	−0.292	0.046	-	-
Weight loss	0.091	−0.041	0.062	0.895	−0.002	0.007	0.852	−0.135
Food intake decline	0.235	−0.023	−0.045	0.818	0.010	−0.123	0.882	−0.044
Movement	−0.007	0.186	0.270	0.015	0.754	0.046	0.028	0.723
Neuropsychological problem	0.001	0.148	−0.100	−0.120	0.773	−0.133	−0.113	0.631
Tension/disease	0.205	0.292	−0.121	0.018	0.618	−0.023	0.087	0.726
Lives independently	0.070	−0.096	−0.175	−0.162	−0.091	0.777	-	-
Takes >3 prescription	−0.167	0.214	0.181	0.095	0.131	0.661	-	-

Extraction method=Principal component analysis. Rotation method=Varimax with Kaiser normalization. BMI=Body mass index, MAC=Mid-arm circumference, CC=Calf Circumference, MNA=Mini nutritional assessment, MNA-SF=MNA short form

respectively [Table 6]. The area under the curve (AUC) of those tools based on serum albumin was 0.795 for full-MNA [Figure 1a] and for MNA-SF achieved on 0.744 [Figure 1b].

The cutoff point (22.5) of full-MNA applied to distinguish cases at risk of malnutrition from malnourished, with sensitivity (60.0%) and specificity (63.0%), and AUC (0.643) for full-MNA, according to hypo serum albumin (<3.5) [Figure 1c].

Discussion

The purpose was determining validity and reliability of two nutritional instruments (full-MNA and MNA-SF), and specifying cu-off points full-MNA and MNA-SF among the Iranian elderly admitted in the hospital. Furthermore, compare of both tools to find the best and more appropriate ones in the nutritional status screening of the Iranian elderly patients in hospital setting. We find full-MNA total scores have relatively strong correlations with anthropometric indicators (MAC, waist, and BMI), also biochemical marker (serum albumin), and physical function tool (ADL). These parameters usually are used to evaluate nutritional status[18] because, insufficient nutritional intake, makes muscle weakness cause to function impairment in daily activities.[19] We also observed significant correlations between the MNA-SF score with nutritional parameters (MAC, CC, and waist), biochemical marker (serum albumin), and with the full-MNA score, although, in comparing, correlations were somewhat stronger within full-MNA total score rather than MNA-SF score. In an elderly Japanese study on full-MNA and MNA-SF tools, significant correlations were found between full-MNA score and serum albumin,[18] although, in our study correlation between full-MNA and MNA-SF with serum albumin were lower than Japanese study. This differentiation could be because of using various settings in Japanese study, also, only to apply geriatric frail sample.[18]

Our study from the view of correlation results of full-MNA with anthropometrical parameters and a biochemical marker in comparison with African study has better results.[20] Regarding MNA-SF anthropometric correlations (CC and MAC) our results were better than which carried out in a German study.[21]

Table 5: Item-to-total score correlations of the Iranian full-mini nutritional assessment and mini nutritional assessment short form

Component	Full-MNA		MNA-SF	
	Corrected item-total correlation	Cronbach's alpha if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Food intake decline	0.347	0.672	0.644	0.609
Weight loss	0.309	0.698	0.476	0.623
Movement	0.283	0.680	0.390	0.679
Tension/disease	0.247	0.684	0.307	0.663
Neuropsychological problem	0.225	0.686	0.127	0.682
BMI (kg/m^2)	0.294	0.681	-	-
Lives independently	−0.109	0.699	-	-
Takes >3 prescription	0.167	0.691	-	-
Pressure sores or skin ulcers	0.219	0.687	-	-
Number of full meal	0.269	0.681	-	-
Protein score	0.236	0.685	-	-
Two or more servings of fruits	0.300	0.679	-	-
Consumed fluid	0.325	0.681	-	-
Feeding	0.395	0.678	-	-
Self-view of nutritional status	0.575	0.686	-	-
Compare with others	0.373	0.669	-	-
MAC (cm)	0.350	0.686	-	-
CC (cm)	0.520	0.665	0.259	0.670
Full-MNA alpha coefficient	0.680			
MNA-SF alpha coefficient	0.683			

BMI=Body mass index, MAC=Mid-arm circumference, CC=Calf Circumference, MNA=Mini nutritional assessment, MNA-SF=MNA short form

Table 6: Sensitivity and specificity for full-mini nutritional assessment and mini nutritional assessment short form according to serum albumin ≥3.5 (well-nourished from malnourished)

Tools	Criterion	95% CI			
		Sensitivity	Specificity	Cut-off points	AUC
Full-MNA	Serum albumin ≥3.5	0.750 (0.647-0.826)	0.778 (0.685-0.846)	24	0.795 (0.708-0.858)
MNA-SF	(well-nourished from malnourished)	0.625 (0.487-0.734)	0.653 (0.521-0.754)	10.50	0.744 (0.639-0.821)
Full-MNA	Serum albumin <3.5 (at risk of malnourished from malnourished)	0.600 (0.455-0.714)	0.630 (0.492-0.737)	22.50	0.643 (0.509-0.747)

MNA=Mini nutritional assessment, MNA-SF=MNA short form, AUC=Area under curve, CI=Confidence interval

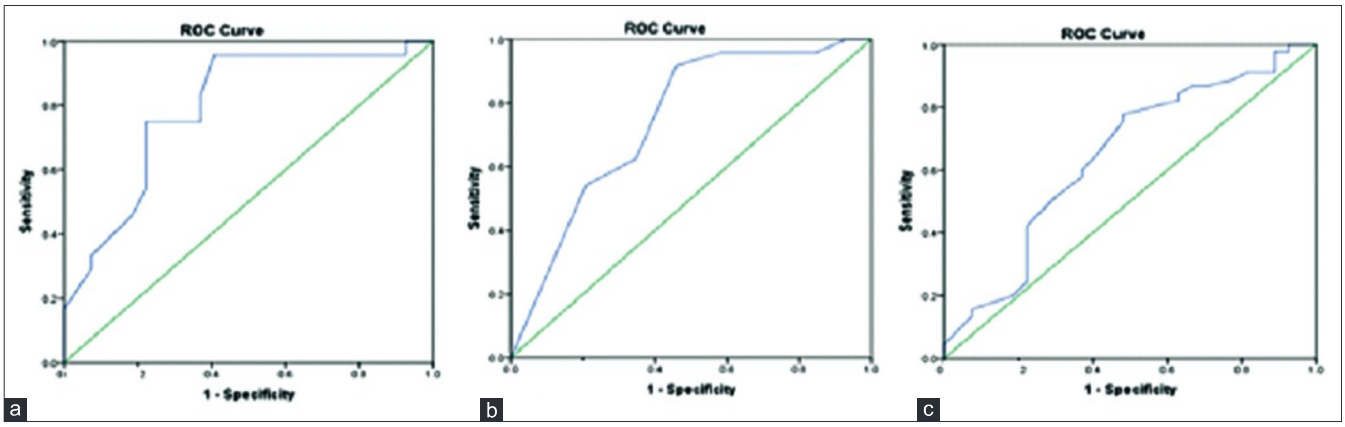

Figure 1: (a) AUC of Full-MNA (well-nourished from malnourished) (b) AUC of MNA-SF (well-nourished from malnourished) (c) AUC of Full-MNA (at risk of malnourished from malnourished)

According to ROC curve, we assessed the accuracy of both forms of MNA for screening energy-protein malnutrition. In this study, full-MNA was supported by known group validity with significant different scores of full-MNA between two groups of older patients with expected good and poor nutritional conditions. Similar results also have found in the MNA Norwegian version[7] and in the MNA Iranian validation study.[15]

Our results showed a fair sensitivity of full-MNA, based on the criterion of serum albumin ≥3.5 as a clinical parameter, although, the insufficient sensitivity of full-MNA was found according to the criterion of hypo albumin <3.5. The sensitivity of MNA-SF in hyper albumin group was insufficient. In studies that carried out in Malaysia and South Africa for the accuracy of MNA-SF tool were reported good sensitivity and specificity, these dissimilarities might be due to select of different gold standards. As we used albumin serum, however, the gold standard in Malaysia study was anthropometric parameters,[9] and in South Africa study was full-MNA.[20]

Moreover, the Brazilian version full-MNA found higher sensitivity in institutionalized elderly.[8] High sensitivity and specificity of full-MNA were found in another Iranian study among nursing home residents.[15] However, in France study, a cutoff point <24 for a total full-MNA score as undernutrition was found with the highest sensitivity and specificity.[22] We obtained cutoff point 24 with full-MNA as for well-nourished hospitalized elderly that seems similar to France study.[22] We also revealed cutoff point 10.5 with MNA-SF which is about near to the original result and also the Norway report.[23,24]

We find cu-off point <22.5 for screening malnutrition from at-risk elderly that is accordance with previous Iranian study in a nursing home.[15] Vellas *et al*. revealed MNA score between 17 and 23.5, as "At risk of malnutrition."[25]

We found a cutoff point 22.5 for full-MNA in hypo albumin group (<3.5) that it seems higher from the study.[25] It should be due to the high consumption of carbohydrates and fat, and less protein intake in Iranian society,[26] which makes the Iranian society are more obese and have low protein calories than the world average.[15]

From the view of internal consistency, both items' of full and short MNA were near 0.7 like the other studies.[27,28] We found a high correlation between MNA-SF and full-MNA like other studies.[20,23] Kaiser *et al*. also confirmed that MNA-SF is valid and well compatible with the full-MNA.[21]

The MNA-SF is easier tool to assess in bedridden or dependent older patients.[2] In a study MNA-SF had high sensitivity and specificity, and great clinical nutrition diagnostic accuracy as good as full-MNA in predicting by serum albumin.[23] Since in aging process, there might be a decreased in serum albumin level;[18,23] therefore, serum albumin cutoff point <3.5 g/dL should apply as undernutrition marker in malnourished group.[15] In Japanese study, serum albumin found as a good predictor for malnutrition screening and diagnosing,[18] although in Turkish validation study serum albumin was not applied as a predictor for screening and diagnosing malnutrition.[14] In our study, serum albumin had fair correlation with full-MNA and MNA-SF.

Concerning the reasons to use CC instead of BMI in MNA-SF tool, should be consider that applying BMI measure alone in hospitalized patients' with cardiac heart failure due to extra body water or dehydration and also patients with kyphosis could not appropriate to assessing of malnutrition, because of changes in weight and height, so utilizing CC could be better,[24] especially in hospital and nursing home settings that weight and height measuring for BMI consumed more time, mainly in bedridden and immobile elderly patients.[29] Therefore, CC and MAC are possible alternatives to BMI, due to the user-friendly with a tape measuring that are also part of full-MNA.[30]

Although full-MNA is more time-consuming in comparison to MNA-SF,[2] but our result showed that the full-MNA correlation with anthropometric and clinical parameters better than MNA-SF.

On the other hand, full-MNA could detect of at-risk undernutrition elderly to reduce mortality rate interventions.[13] Finally, we observed a stronger test–retest reliability of full-MNA in comparison to MNA-SF; this showed the more accurate similarity between two interviewer nurses in filling of full-MNA.

Limitation of this cross-sectional study was financial restrict that we cannot take serum albumin twice, at admission and discharge time, so we could not compare serum albumin levels with MNA score at discharge time. The other limitations were lack of randomized sampling and clinical diagnosis for nutritional status.

Conclusions

We find full-MNA total score have significant correlations with anthropometric indicators (MAC, waist, and BMI), also biochemical marker (serum albumin), and ADL. We also observed that there were significant correlations between MNA-SF score with nutritional parameters.

(MAC, CC, and waist), biochemical marker (serum albumin), and with the full-MNA score, although, in comparing, correlations were stronger with full-MNA total score rather than MNA-SF score. Therefore, it seems full-MNA more appropriate in comparison to MNA-SF for screening malnutrition in the Iranian elderly hospitalized, even though, full-MNA need more time-consuming comparison to MNA-SF.

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Conflicts of interest

There are no conflicts of interest.

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