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Original Article

Relationships between mini nutritional assessment and functional status in elderly Iranian people living in nursing homes

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Background: Nutrition status is an important constituent of health in an elderly and evaluation of these groups are necessary for development of treatment protocols. The study aimed to estimate the prevalence of malnutrition with mini nutritional assessment (MNA) tool in the elderly living in nursing homes. In addition, the association of MNA results and functional status was investigated.
Methods: 245 of elderly residents in nursing homes in Tehran (90 men and 155 women) were studied. Data were collected using the MNA, anthropometric measurement, and functional evaluations by Katz Index.
Results: 35.1% showed normal status while 55.9% have been classified at risk malnutrition and 9% suffered from severe malnutrition based on MNA scores. Katz score showed that 20.4% older people absolutely depended on others for all of activities for daily living. There was significant difference in score of Katz index according to gender ($p < 0.050$). A positive correlation was found between MNA scale and Katz index ($r = 0.251$, $n = 245$, and $p = 0.001$). Analysis of logistic regression controlled for age and gender showed in those at risk of malnutrition a higher MNA score significantly lowered the risk of being dependent based on Katz index (odds ratio: 2.14, confidence interval: 1.15-3.98 and $p = 0.016$), however this relationship was not observed elderly subjects who were malnourished [2.53 (0.92-6.95) and $p = 0.070$).
Conclusion: The study demonstrates high provenance of risk malnutrition, as well as the close association between functional status and nutritional status in the elderly subjects. Considering the results, a larger study concerning nutritional status and functionality in the elderly living in nursing homes is warranted.

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Introduction

The older people are symbolic of the customs and culture of nations and vulnerable groups to malnutrition [1, 2]. Several factors, such as physiological needs, economic, and social, have detrimental effects in their physical and mental performance [3]. Several factors can be also

attributed to nutritional status, including social isolation, monotonous diets, and physiopathological, leading to disabilities as well as malnutrition [4-7].

Malnutrition is a condition comprising negative effects in a large proportion of elderly people in different countries [8-10]. The prevalence of malnutrition in the elderly living in nursing homes or hospitals is greater than at home ranging from 30% to 60% versus 5% to 10%, respectively [11, 12]. Therefore, assessment of nutritional status of geriatrics is important for nutritional intervention and treatment.

Malnutrition is associated with loss of body weight which leading to loss of skeletal muscle mass and muscle strength [13]. Then, sarcopenia and frailty are two known syndromes and consequence of malnutrition in older persons, which expedite functional status impairment [14]. Since maintaining functional status at a high level implies independence and quality of life [15], it is of crucial importance for this population. Several evidences show that nutritional status is closely related to functional status in older adults in different settings such as nursing homes [16], home care setting [17], and in the community [18].

The applicable method of determining nutritional status in older people is mini nutritional assessment (MNA) which has been validated in several studies [19, 20]. The aim of MNA is to permit intervene earlier, to provide adequate nutritional support, to prevent further deterioration, and to improve patient health. To evaluate the level of functionality and ability to perform activities of daily living (ADL) independently, Katz Index or Katz ADL is usually used. The aim of this scale is to find out the ranges of autonomy exertion [21].

Several acute or chronic diseases may put elderly people at high risk of malnutrition, as well as functional impairment. Regarding the association between nutritional and functional status, it was demonstrated that disability in ADL as assessed by Katz Index was associated with low body mass index (BMI) in geriatric patients [22] as well as malnutrition according to the MNA.

There is limited research has been conducted to assess the relationship between nutritional and functional status. Therefore, the aim of this study was to examine the association between nutritional status and functional status in older people living in nursing homes.

Methods

This exploratory cross-sectional study was performed in the nursing homes. All geriatric subjects were recruited consecutively from nursing homes of Tehran and Shemiranat in 2015. All patients were informed about the study and consent was obtained from all participants or their legal proxies. The study was approved by the Ethics Committee of the Tehran University of Medical Sciences (No. 161-26651).

245 subjects were interested in this study (90 men and 155 women). Inclusion criteria were (a) age over 60 years old (b) willingness to participate. The exclusion criteria were younger than 60 years old and moderate to severe psychiatric disorders and inability to respond or measured anthropometric and blood drawing.

Age and gender, level of education and vocation, marital status, and smoking habits were recorded using questionnaire and face to face interview and when it was too difficult to question the older (dementia, problem language); the data were completed with the aid of Head nurse's center. Common chronic disease and a number of drugs were recorded upon admission. The drugs were classified base on Iranian Official Pharmacopoeia [23].

Older people were weighted without shoes, in light clothing and height was calculated using age and knee height (KH) according to recommended World Health Organization [24, 25]. To measure KH, the person must be able to bend the knee and the ankle of left leg to degree angles, and then measured between the thigh and heel. The brachial circumference was measured on the forearm half way between acromial surface of the scapula and the olecranon process of the elbow on the back of the arm. Calf circumference was measured where the circumference was widest. All of the measurement repeated 3 times and were made by one person.

The nutritional status of each elderly was assessed by full-form MNA questionnaire. It includes 18 items in 2 sections (screen and evaluation form). The former section has 6 and the latter has 12 questions. A maximum of 30 points can be achieved. Total point from the assessment section of the elderly classifies in three categories: Malnourished (< 17 point), at risk of malnutrition (17-23.5 point) and well-nourished (> 24 point). Moreover, we calculated BMI as weight/height^2 (kg/m^2). Elderly people with a BMI < 23 classified as "underweight," between 24 and 30 "normal weight" and above 31 to "overweight" were considered [26].

The older people degree of autonomy was assessed by the Katz scale [21]. The index ranks adequacy of performance in six functions of bathing, dressing, toileting, transferring, continence, and feeding. Each item being scored yes/no (yes; 1 and No: 0 point). The score of 6 indicates the full function independency, 4-5 points indicate mild impairment and 3 or less indicate moderate to severe functional dependence. Each item (1-6) assessing the dependency function was studied separately.

For descriptive and bivariate analysis, data were stratified by the three MNA categories. Continuous data were tested for normal distribution by Kolmogorov–Smirnov test and are presented as a mean ± standard deviation in the case of normally distributed data, and as median and interquartile range for non-normally distributed data. For continuous variables (age and BMI) statistical comparison of MNA categories was performed by ANOVA with subsequent comparison of means by Turkey or by Kruskal–Wallis test followed by Mann–Whitney U-test depending on distribution of the variables. The remaining results are expressed as frequency (percentage). Proportions were compared by the chi-square test for qualities variable. Pearson's correlation coefficients were used to measure the assessment between MNA and Katz scale. Binary Logistic regression was performed to assess the impact of a number of factors on the likelihood that elderly would report that they had dysfunctional status. All results were considered to be significant at the 5% critical level ($p < 0.050$). The statistical study was carried out with SPSS (version 19; SPSS, Inc., Chicago, IL, USA).

Results

The demographic characteristic of the 245 elderly in the study are displayed in table 1. 63.3% of the participant were woman in an age range of 75-89 years old (52.6%) and had a normal BMI (19-25 kg/m^2) (24.97%). 69.2% of women were illiterate and did not receive any salary. The majority of women are widowed housewife (84.8%). 69.2% were nonsmoker and only 4.9% of smokers used 6-14 cigarettes per day. The main chronic disease was high blood pressure (49.8%), followed by disease of the arthritis (48.6%), cardiovascular diseases (34.7%). The most common used drugs, related to central nervous system drugs (71.8%), cardiovascular drugs (67.8%) and vitamin and mineral supplements (54.3%) (data not shown).

After application of the Katz index, we found that 16.3% of the subjects were independent in all ADL and 21.6-41.6%, were moderate to severe dependency in performance of activities. There was a significant difference between men and women of Katz index ($p = 0.010$). The women were more dependence in all of functions than men (23.9%, 14.4%, respectively). With increasing age, dependency ratios for most of any actions of daily living were raised (11.9%, 22.8%, and 37%, respectively). From six items in Katz scale, bathing (58%) and dressing (58%) were needed helpful from other (Table 3).

In any nutritional status of elderly, the dependence of bathing were higher than other activity and the each of any activities in well-nourished were higher than other groups (Table 4).

There were poor, positive correlation ($r = 0.251$, $n = 245$ and $p = 0.001$) between nutritional status (as measured by MNA) and functional activities (assessment by the Katz index).

Analysis of binary logistic regression in two groups, adjusted by variable associated with functional status of elderly in nursing homes indicated in table 5. For those who were at risk of malnutrition, in crude model, only two main variables, the risk of malnutrition increased odds dependency for any activities daily living significantly [odds ratio (OR): 2.47, confidence interval (CI): 1.38-4.40 and $p = 0.002$). After adjustment for age and gender, the relationship decreased but still remained significant (OR: 2.14, CI: 1.15-3.98 and $p = 0.016$). For malnourished participants also there were a significant increment odds of dependency for any action (OR: 3.10, CI: 1.84-8.11 and $p = 0.021$) in crude model. After adjusting for confounding factors in model 2, the significant relationship was disappeared [2.53 (0.92-6.95) and $p = 0.070$).

Discussion

Findings of this study showed that there is an association between nutritional and functional status in geriatric patients living in nursing homes which was remained significant after controlling for age and sex. Moreover, the population structure in the older population, living in nursing homes were in ranges of age 57-89 and prevalence rates of malnutrition and risk of malnutrition were also high (55.9% and 9% respectively). These findings are the same as those reported recently in some countries [27-30] including Spain and Sweden studies which showed prevalence rates of 61.8% and 51%, respectively [27-30].

Table 1. Demographic characteristics of gender structure in population study

Characteristics	Men	Women	Total	p value
	n (%)	n (%)	n (%)	
Sex	90 (36.7)	155 (63.3)	245 (100)	-
Age* (years)	76 (18)	80 (17)	79 (17)	0.024
BMI (kg/m^2)	25.15 (7.95)	24.59 (9.22)	24.97 (8.59)	0.592
Age				
Young-old	36 (42.9)	48 (57.1)	84 (35.9)	
Aged	44 (35.8)	79 (64.2)	123 (52.6)	0.146
Oldest-old	6 (22.2)	21 (77.8)	27 (11.5)	
Education				
Illiterate	24 (30.8)	54 (69.2)	78 (37.1)	
< 1-12th grade	15 (29.4)	36 (70.6)	51 (24.3)	
≥ 12th grade	21 (48.8)	22 (51.2)	43 (20.5)	0.050
Academic	19 (50)	19 (50)	38 (18.1)	
Marital status				
Single	14 (30.4)	32 (69.6)	46 (20.5)	
Married	34 (73.9)	12 (26.1)	46 (20.5)	0.001
Separated	12 (60)	8 (40)	20 (8.9)	
Died	17 (15.2)	95 (84.8)	112 (50)	
Vocation status				
Retired salaried	62 (65.3)	33 (34.7)	95 (42.2)	
Retired without paid	18 (94.7)	1 (5.3)	19 (8.4)	0.001
Housewife without paid	0 (0)	101 (100)	101 (44.9)	
Unemployed without paid	5 (50)	5 (50)	10 (4.4)	
Smoking habit				
No smoking	54 (28.9)	133 (71.1)	178 (83.1)	
Former smoking	4 (44.4)	5 (55.6)	9 (4)	0.001
Smoking	27 (93.1)	2 (6.9)	29 (12.9)	
Consumption of cigarettes (at least 1 year)				
Up to 5	7 (70)	3 (30)	10 (4.1)	
6-14	10 (83.3)	2 (16.7)	12 (4.9)	0.001
15-25	6 (100)	0 (0)	6 (2.4)	
≥ 25	5 (100)	0 (0)	5 (2)	
Most common disease				
Arthritis	46 (38.7)	73 (61.3)	119 (48.6)	0.437
High blood pressure	48 (39.3)	74 (60.7)	122 (49.8)	0.428
Cardiovascular	30 (35.3)	55 (64.7)	85 (34.7)	0.782
Blood fat disorders	21 (35)	39 (65)	60 (24.5)	0.878
Diabetes	13 (25.5)	38 (74.5)	51 (20.8)	0.073
Asthma	7 (38.9)	11 (61.1)	18 (7.3)	1.000
Parkinson	4 (40)	6 (60)	10 (4.1)	1.000
Alzheimer	25 (38.5)	40 (61.5)	65 (26.5)	0.765
Thyroid disorders	6 (35.3)	11 (64.7)	17 (6.9)	1.000
Prostatic hypertrophy	8 (88.9)	1 (11)	10 (4.1)	0.002
Stroke	4 (40)	6 (60)	10 (4.1)	1.000
Any fracture	1 (12.5)	7 (87.5)	8 (3.3)	0.264
Epilepsy and seizures	4 (25)	12 (75)	16 (6.5)	0.424

*Differences assessed by chi-square test. Values of age and BMI is presented by median (interquartile range). Values are presented as frequency (percentage). BMI = Body mass index

Table 2. Nutritional status according to MNA and age, gender (n = 245)

Nutritional status according to MNA	Well nourished	Risk of malnutrition	Malnutrition	p value
Variable	n (%)	n (%)	n (%)	
Gender				0.370
Male (n = 90)	36 (40.0)	48 (53.3)	6 (6.7)	
Female (n = 155)	24 (27.3)	52 (59.1)	12 (13.6)	
Age group				0.022
60-74 years old	41 (48.8)	36 (42.9)	7 (8.3)	
75-89 years old	35 (28.5)	76 (61.8)	12 (9.8)	
+ 90 years old	6 (22.2)	18 (66.7)	3 (11.1)	
Median age	74 (16)	81 (18)	80 (17)	0.036
Median BMI	28.82 (8.70)	23.97 (7.77)	20.38 (5.07)	0.001
Katz (points/max)	(5/29.1)	(4/24.1)	(1/27.3)	0.001

*Differences assessed by chi-square test. MNA = Mini nutritional assessment, BMI = Body mass index

Table 3. Katz Index of dependence in activity of daily living in examined group

Functional status according to Katz score		≤ 1	2-3	4-5	≥ 6	p value*
Gender						
Total (n = 245)		50 (20.4)	53 (21.6)	102 (41.6)	40 (16.3)	0.010
Male(n = 90)		13 (14.4)	13 (14.4)	43 (47.8)	21 (23.3)	
Female(n = 155)		37 (23.9)	40 (25.8)	59 (38.1)	19 (12.3)	
Age group						
60-74 years old		10 (11.9)	14 (16.7)	37 (44)	23 (27.4)	0.001
75-89 years old		28 (22.8)	30 (24.4)	52 (42.3)	13 (10.6)	
+ 90 years old		10 (37)	8 (29.6)	8 (29.6)	1 (3.7)	
Type of activity	Bathing	Dressing	Toileting	Transferring	Continence	Feeding
Dependency	142 (58)	142 (58)	78 (31.8)	65 (26.5)	98 (40)	6 (2.4)
independency	103 (42)	103 (42)	167 (68.2)	180 (73.5)	147 (60)	239 (97.6)

*Differences assessed by chi-square test. Katz score: ≤ 1: Absolutely dependent, 2-3: Average dependent, 4-5: Mild dependent and ≥ 6: Independent

Table 4. Nutritional and functional status in examined group

Nutritional and	Malnutrition		At risk of malnutrition		Well-nourished	
Functional status	Independency	Dependency	Independency	Dependency	Independency	Dependency
Bathing	7 (31.8)	15 (68.2)	21 (15.3)	116 (84.7)	20 (23.3)	66 (76.7)
Dressing	12 (54.5)	10 (45.5)	54 (39.4)	83 (60.6)	37 (43.0)	49 (57.0)
Toileting	17 (77.3)	5 (22.7)	86 (62.8)	51 (37.2)	64 (74.4)	22 (25.6)
Transferring	16 (72.7)	6 (27.3)	74 (54.0)	63 (46.0)	57 (66.3)	29 (33.7)
Continence	16 (72.7)	6 (27.3)	74 (54.0)	63 (46.0)	57 (66.3)	29 (33.7)
Feeding	21 (95.5)	1 (4.5)	135 (98.5)	2 (1.5)	83 (98.5)	3 (3.5)

Values are presented as frequency (percentage)

Table 5. Analysis of binary logistic regression in two groups, adjusted by variable associated with functional status of elderly in nursing homes

Nutritional status*	OR for functional status	
	OR (CI 95%)	p value
At risk of malnutrition		
Model[1]	2.47 (1.38-4.40)	0.002
Model[2]	2.14 (1.15-3.98)	0.016
Malnourished		
Model[1]	3.10 (1.18-8.11)	0.021
Model[2]	2.53 (0.92-6.95)	0.070

*The category of the Reference group that received OR of 1.00 was elderly with normal nutritional status. The reference category of the outcome is independence. [1]Crude. [2]Adjusted for: age, gender. OR = Odds ratio; CI = Confidence interval

In accordance with previous reports [31], even though the score of MNA was lower in women, no significant difference observed between gender subgroups.

Only about 16% of the patients were independent in ADL. Functional impairment in our investigation was also lower than previously published studies which observed impairment or difficulties in ADL in about 50 % of the patients [30, 32, 33]. As the nature of the natural ADL index with Katz is similar to personal actions at homes, older women, due to a lack of ownership, low degrees of literacy and independence of the revenue and inadequate protection of the children, are more vulnerable to low functional status than older men. Some other researchers also demonstrated that the higher degrees of malnutrition disturbances in nursing homes are associated with activating daily living dependency in older people [30, 34]. Of elderly were dependent for all actions, men had lower dependency than women (14.4 vs. 23.9%, respectively).

Another finding in our study was that there was a close association between nutritional and functional status and independence in performing basic as ADL decreased with deterioration in nutritional status. In other words, the proportion of patients in need of help was highest in the malnourished group. Although the other studies used different instruments for assessing of malnutrition and functional status [35, 36], our findings are in accord with their results. In addition to the total score, a detailed

analysis of Katz index with all single items of the BI was associated with the MNA. Oliviera et al., and Schrader et al., also showed an association between all ADL items of the Katz Index and the MNA in hospitalized old patients. This finding is not strange because of the fact that the MNA includes several questions regarding functional performance and independence (e.g., mobility, independent living, pressure sores as an indicator for immobility, autonomy of eating). Therefore, it seems that the MNA is not only an instrument to assess malnutrition, but also to determine functional status especially that according to several reports, the MNA is a good instrument to detect frailty in geriatric patients [37]. Moreover, it is suggested that this relationship is independent of the instrument used to assess nutritional status [38, 39]. Malnutrition contributes to muscle atrophy and dysfunction [40-43]. Some studies have shown that optimum nutritional status improves functional autonomy [44-46].

One limitation of the study is the use of one performance-based functional test only. There are numerous different tests to assess mobility in older persons. Moreover, in the present study sample size was moderate, indicating that we may have a type II statistical error when considering the relationship between malnutrition and the functional status in elderly. It is recommended that correlations compared with large population and further research work is required to find out which portion of the daily activities better explain these relationships.

Conclusion

We found an association between nutritional status according to MNA and functional status as evaluated by the Katz index, two commonly used and easily applicable tools in geriatric assessment. After consideration of potential confounders including this association remained unchanged. It is recommended that more attention be paid to nutritional screening in geriatric assessment because timely identification of improperly nutritional status and appropriate therapy might counteract malnutrition and thus, improve functional status.

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Conflict of interest

None of the authors had any personal or financial conflicts of interest.

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