Res Cardiovasc Med. 2017 January; 6(1):e31898. doi: 10.5812/cardiovascmed.31898.

Published online 2016 August 9. **Research Article**

Nutritional Status Assessment of the Elderly Patients with Congestive Heart Failure by Mini Nutritional Assessment Test

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Received 2015 July 28; **Revised** 2016 January 11; **Accepted** 2016 January 23.

Abstract

Background: Malnutrition is a common problem among elderly patients, especially those with heart failure, and is known to increase mortality rates.
Objectives: The current study evaluated nutritional status to identify changes in the elderly patients with congestive heart failure (CHF) during hospital stay.
Patients and Methods: This cross-sectional study recruited 225 CHF hospitalized elderly patients, comprised of 154 males (68.4%) and 71 females (31.6%) at a mean age of 71.1 $\pm$ 7.35 years. The mini nutritional assessment (MNA) was performed to estimate functional, cognitive and nutritional status. The MNA, an18-item tool to evaluate subjective and objective findings, including anthropometric measurements for nutritional risk, is found to be sensitive, specific and accurate in identifying elderly people at nutritional risk.
Results: According to the MNA questionnaire, 9.8% of the elderly were malnourished, 80.9% at risk of malnutrition and 9.3% well nourished. Weight loss, bedsore, and level of knowledge and income had a significant relationship with nutritional status based on the MNA (P value $<$ 0.05).
Conclusions: Considering the high percentage of elderly patients with malnutrition or at risk of malnutrition, the need for nutritional intervention is obvious. The MNA seems to be a reliable tool to identify individuals at risk of malnutrition. To decrease hospital stay duration and cost, application of the MNA is suggested.

Keywords: Heart Failure, Elderly Nutritional Status, Malnutrition, Mini Nutritional Assessment

1. Background

CHF is the leading cause of hospitalization in older adults. Older adults are predisposed to developing CHF as a result of age-related changes in the cardiovascular system; the high prevalence of hypertension, coronary artery disease and valvular heart disease are common in this age group (1).

Malnutrition is described as the imbalance between intake and requirement, resulting in altered metabolism, impaired function and loss of body mass (2). However, there is still no globally accepted criterion to diagnose malnutrition, which probably explains part of the reported wide range of its prevalence in hospitals (3).

The elderly are more susceptible to malnutrition in consequence of increased risk of poor economic status, social isolation and inappropriate or inadequate food intake (4). The risk of malnu-trition rises considerably in institutionalized and hospitalized old people (5).

The prevalence of hospital malnutrition ranges from 20% to 50% and is even higher in elderly patients (6), in whom malnutrition is a strong independent risk factor for mortality during hospital discharge in the subsequent 4.5 years (7).

Malnutrition is common in patients with severe congestive heart failure (CHF) and has a poor outcome in patients with cardiovascular diseases (3, 8, 9).

However, there is currently no data on the prevalence of malnutrition according to the MNA in hospitalized patients with heart failure (HF); therefore, its prognostic value for this group of patients is not known.

2. Objectives

The current study aimed to analyze the prevalence and risk of malnutrition using the MNA in patients hospitalized with HF, and also apply the MNA to evaluate the relationship between demographic factors, biochemical

markers and nutritional status in elderly patients with CHF.

3. Patients and Methods

The current cross-sectional study evaluated the nutritional status and factors related to heart failure in 225 consecutive hospitalized elderly males and females in Rajaie cardiovascular medical and research center, Iran University of Medical Sciences, Tehran, Iran, on nutrition assessment of the elderly in 2011. The inclusion criteria consisted of age over 65 years, CHF, and New York heart association (NYHA) class III-IV (reduced left ventricular ejection fraction (LVEF). Patients (age > 65 years) who had an LVEF less than 45% and were diagnosed to have heart failure by an expert cardiologist and were admitted with an impression of decompensated HF were included in the study. Patients with diabetes mellitus were excluded from the study. The patients had been admitted and hospitalized due to exacerbation of CHF symptoms (dyspnea, generalized edema, congested lung and irregular heartbeats). An informed consent was taken from all of the patients. Biochemical markers were determined. Blood sample was collected at seven-o'clock in the morning after twelve hours of fasting overnight and hematological and biochemical analyses were performed.

3.1. Data Collection

The patients' height and weight were measured, and weight loss (patients who had more than 3 kg weight loss in a month) was determined. The mid-arm circumference (MAC) and the calf circumference (CC) were measured. The body mass index (BMI) was calculated according to the studies (5, 10).

3.2. Mini Nutritional Assessments

The MNA questionnaire was completed by investigator. The MNA includes variables such as age, gender, BMI, height, MAC, CC, weight loss, loneliness, drug use, acute disease, psychological stress, mobility problems, mental and psychological problems, daily eating habits, protein intake, ability to eat, personal assessment of nutritional status, health self-assessment and final evaluation. The variable values were added together to reach a total score. Other related factors such as income, level of knowledge, bedsore, biochemical markers, sleeping duration, exercise and gastrointestinal diseases were also determined and evaluated separately.

The mini nutritional assessment (MNA) was performed to estimate functional, cognitive and nutritional status. The MNA, an 18-item tool to evaluate subjective and objective findings, including anthropometric measurements for nutritional risk, is found to be sensitive, specific, and accurate in identifying elderly people at nutritional risk. The MNA status is defined as follows: malnourished < 17 points, at risk of malnutrition 17 - 23.5 points and normal nutritional status 24 - 30 points.

The MNA questioner was previously used for elderly patients to evaluate their nutritional status (4). In this method, sensitivity, specificity and predictive values were determined as 96%, 98% and 97%, respectively. The MNA is generally deemed a death predictive index with low cost in many hospitals. It requires no biochemical tests and is a cost-effective and non-invasive tool to evaluate and intervene in the nutritional status of patients (11). Studies probing into the relativity of the MNA questioner reported a Cronbach's alpha of 0.83, demonstrating that the questions bear a strong relationship with one another.

3.3. Statistics

The mean and standard deviations for the qualitative variables were determined. The Mann-Whitney U test was used to measure the relationship between the MNA and the two versions of variables. The relationship between the MNA and the binary variables was assessed using ordinal and numerical variables via the Kruskal-Wallis test. The one-way variance analysis was employed to evaluate the association between the MNA and the numerical variables. The multivariable analysis was conducted to evaluate the association between the nutritional statuses of the patients using the patients' MNA scores. And finally, the ordinal logistic regression model was drawn upon to compare the patients in terms of their income level, level of knowledge, amount of exercise, gastrointestinal diseases, depression, and lifestyle.

SPSS ver. 15 (SPSS Inc. Chicago, Illinois) was used for statistical analysis.

Level of significance was established as a p-value < 0.05.

4. Results

4.1. Demographic Data

The study selected 225 elderly patients, comprised of 154 (68.4%) males and 71 (31.5%) females at a mean age of 71.1 $\pm$ 1.35 years, who were hospitalized in Rajaie cardiovascular medical and research center with a diagnosis of CHF.

4.2. MNA Result

The results showed that 9.8% of the patients were malnourished, 80.9% were at risk of malnutrition, and the rest (9.3%) were well-nourished. The nutritional variables and demographic data, both in the overall study population, are presented in demonstrating demonstrating a relationship between nutritionals status and the MNA subjective factors and variables.

The difference between age and the MNA was not significant (P value = 0.79). The mean of the BMI in the well-nourished patients, according to the MNA, was significantly more than that of the patients who were undernourished. The BMI in the undernourished patients was also higher than that of the patients with malnutrition (27.1 ± 4.2, 26.4 ± 5, and 21 ± 3.5, respectively) (P value = 0.001) (Table 1).

The greatest mean weight was observed in the patients with good nutritional status (73.61 ± 10.8 kg). The mean of the lumbar and hip circumference, according to the MNA, in the well-nourished patients was higher than those of the other group (92.85 ± 10.87 and 98.57 ± 9.7, respectively) (P value < 0.001) (Table 1).

There was also a statistically significant relationship between nutritional status and living status (P value < 0.01): only 9.5% of those who lived alone enjoyed a good nutritional status as opposed to 42.8% of the ones who lived with their children (Table 2).

The correlation between the level of knowledge and nutritional status was also statistically significant (P value = 0.03): in the malnourished patients, the illiterate ones (81.8%) and the ones under diploma (13.6%) had a poor nutritional status in comparison with the patients with diploma or higher qualifications (4.5%) (Table 3).

The relationship between income and nutritional status was significant since in the well-nourished patients with personal income (100%), nutritional status was good in the majority in comparison with the patients who were financially dependent on charities (0) (Table 4).

There was a significant correlation between the patients' nutritional status and bedsore according to the MNA (P value = 0.03): in the well-nourished patients, most of the ones who had bedsore had a poor nutritional status (< 1%) in comparison with the ones with no bedsore (9.5%). No significant relationship was found between family size (P value = 0.21) and amount of sleep during a twenty-four-hour period (P value = 0.9) and nutritional status.

In the biochemical markers, there was no significant relationship between nutritional status and the mean of hemoglobin (P value = 0.65), hematocrit (P value = 0.46), mean corpuscular volume (MCV) (P value = 0.49), mean corpuscular hemoglobin concentration (MCHC) (P value = 0.99), fasting blood sugar (FBS) (P value = 0.84), blood urea nitrogen (BUN) (P value = 0.90), Cr (P value = 0.530), Na (P value = 0.52), and K (P value = 0.63) (Table 5).

The ordinal logistic regression was performed by considering nutritional status according to the MNA as a dependent variable and living with others, income, age, gender, BMI and knowledge as independent factors. After adjusting, income had a significant relationship with malnutrition (P value < 0.001) (Table 6).

5. Discussion

Up to the knowledge of previous articles, MNA questionnaire had not been performed on CHF patients and more articles are about older people who live in nursing homes. Authors decided to conduct this questionnaire in CHF patients because most of them were older than 65 years.

The current study aimed to assess whether MNA on elderly patients with CHF has similar results with the elderly in nursing homes or if that is usable for older people with CHF.

The results of the study were compared with those of the studies on patients who lived in nursing homes.

Among the 225 elderly recruited in the present study, most of them were male (68.4%) and 14.1% of them had malnutrition. The relationship between gender and nutritional status according to the MNA was not statistically significant. Other studies support the current study results (12-14).

In the current study, the relationship between age and nutritional status was not significant. There is controversy between studies, since some studies support the current study results (11, 15), but another study demonstrated that age has a negative impact on nutritional status. The prevalence of malnutrition according to the MNA in patients hospitalized for medical conditions is fewer in younger patients (16).

The current study demonstrated that the BMI was significantly higher in well-nourished patients. Other studies showed that the percentage of malnutrition was related to the decreased BMI (12-14). The BMI has a direct relationship with the MNA score: the higher the BMI, the better the patient's Nova Scotia (NS) (17).

Based on the MNA, in the understudy elderly patients with CHF, 22 (9.8%) were malnourished, 182 (80.9%) were at risk of malnutrition and 21 (9.3%) were well-nourished. In other words, 204 (90.7%) of the study population were at risk or already had malnutrition. In a study of 94 elders, 38% were at risk of malnutrition according to the MNA questioner (18). Another study on 150 elderly patients showed that 27% were at risk or had malnutrition (19). It was shown that the prevalence of malnutrition was

Table 1. The Relationship Between Nutritional Status and Risk Factors

Variables	Malnourished, N = 22	At Risk of Malnutrition, N = 182	Well-Nourished, N = 21	Total, N = 225	P Value
Age	72 ± 10.2	71 ± 6.9	71 ± 8.4	71.1 ± 7.3	0.79
BMI	21 ± 3.5	26.4 ± 5	27.1 ± 4.2	26 ± 5.1	0.001
Weight	54.75 ± 9.4	69.28 ± 13.5	73.61 ± 10.8	68.37 ± 13.7	< 0.001
Height	160.75 ± 10	162.07 ± 9.2	165.04 ± 9.7	162.22 ± 9.3	0.28
Knee height	49.54 ± 3.6	49.18 ± 3.2	50.71 ± 2.9	49.37 ± 3.3	0.12
Lumbar circumference	79.78 ± 8.6	90.85 ± 10.8	92.85 ± 10.7	90.1 ± 11.1	< 0.001
Hip circumference	86.42 ± 6.1	95.75 ± 11.2	98.57 ± 9.7	95.14 ± 11	0.001
Lumbar C to hip C	0.92 ± 0.1	0.95 ± 0.1	0.94 ± 0.1	0.94 ± 0.1	0.500
Right wrist circumference	16.56 ± 1.9	17.39 ± 1.2	17.78 ± 1.05	17.35 ± 1.2	0.003
Sleep duration	8.4 ± 2.4	8.4 ± 2.1	8.4 ± 3.2	8.4 ± 2.2	0.990

Abbreviation: BMI, body mass index.

Table 2. Nutritional Status and Life Style

	Malnourished, N = 21	Undernourished, N = 177	Well-Nourished, N = 21	P Value
Living alone	4 (19)	18 (10.2)	2 (9.5)	< 0.001
Living with children	2 (9.5)	41 (23.2)	9 (42.8)	
Living with spouse	15 (71.5)	118 (66.6)	10 (47.6)	

Table 3. Nutritional Status According to Mini Nutritional Assessment and Education Level

	Malnourished, N = 22	At Risk of Malnutrition, N = 181	Well-Nourished, N = 21	P Value
Uneducated	18 (81.8)	116 (63.7)	11 (52.4)	0.03
Under diploma	3 (13.6)	45 (24.6)	5 (23.8)	
Diploma and over	1 (4.5)	21 (11.5)	5 (23.8)	

Table 4. Nutritional Status According to Mini Nutritional Assessment and Income Status[a]

	Malnourished, N = 22	At Risk of Malnutrition, N = 181	Well- Nourished, N = 21	P Value
Personal income	8 (36.4)	131 (72.4)	21 (100)	< 0.001
Dependent on family	9 (40.9)	42 (23.2)	0	
Other[b]	5 (22.7)	8 (4.4)	0	

[a] The data are defined as percentages both according to nutritional status and income status.
[b] Patients who were financially dependent on charities.

higher in elders residing in nursing homes than that of those living in their own homes; according to the MNA, out of a total of 89 elderly patients, 7.9% were malnourished, 61.8% were undernourished and 30.3% were well-nourished, with the total MNA score standing at 21.6 (11). According to another study conducted in a nursing home, 15% were malnourished, 58% were at risk and 27% were well-nourished based on the MNA (19). A study on 192 patients showed that 25% had malnutrition and 25% were at risk (20). The difference between the results of the current study and the above mentioned studies may be due to the fact that they were performed in different countries and had dissimilar hospital durations. Furthermore, the current study sample size of patients with CHF was consider-

Table 5. Nutritional Status in Terms of Biochemical Markers

	Malnourished	At Risk of Malnutrition	Good Nutritional Status	Total	P Value
Hct	34.32 ± 4.7	37.3 ± 5.2	37.57 ± 4.9	37.04 ± 5.2	0.46
Hb	11.03 ± 1.36	11.92 ± 1.69	11.97 ± 1.55	11.84 ± 1.66	0.65
MCV	90.61 ± 14.51	87.81 ± 9.48	88.87 ± 9.24	87.95 ± 9.94	0.49
MCHC	31.85 ± 1.37	31.88 ± 5.71	31.92 ± 1.45	31.88 ± 5.21	0.99
BUN	24.91 ± 9.21	25.94 ± 14.5	24.85 ± 8.1	25.73 ± 13.53	0.9
Cr	1.33 ± 0.42	1.46 ± 0.61	1.39 ± 0.34	1.44 ± 0.57	0.53
Na	139.95 ± 4.95	140.33 ± 9.31	142.55 ± 2.89	140.5 ± 8.57	0.52
K	4.11 ± 0.47	4.42 ± 1.53	4.32 ± 0.26	4.38±1.39	0.63
FBS	107.1 ± 26.9	110.58 ± 28.42	112.06 ± 30.88	110.34 ± 28.37	0.84
TG	108.05 ± 57.6	131.37 ± 75.24	143.72 ± 89.36	130.17 ± 75.20	0.32
Total cholesterol	151.58 ± 31.6	168.97 ± 45.56	172.78 ± 48.49	167.55 ± 44.76	0.24
LDL	80.74 ± 20.87	91.37 ± 30.41	97 ± 36.32	0.82 ± 30.29	0.23
HDL	35.79 ± 10	36.98 ± 10.45	34.33 ± 9.97	36.3 ± 10.35	0.55
VLDL	35.05 ± 16.45	40.48 ± 19.95	41.39 ± 19.67	40.01 ± 19.57	0.50

Abbreviations: BUN, blood urea nitrogen; Cr, creatinine; FBS, fasting blood suger; Hb, hemoglobin; Hct, Hematocrit; HDL, high density lipoprotein; K, potassium; LDL, low density lipoprotein MCV; mean corpuscular volume; MCHC, mean corpuscular hemoglobin concentration; Na, sodium; TG, trigliserid; VLDL, very low density lipoprotein.

Table 6. Variables After Ordinal Logistic Regression[a]

	Coefficient ± SE	Odds Ratio (CI 95%)	P Value
Age	- 0.36 ± 0.02	0.99 (0.94 - 1.04)	0.722
Gender	- 0.70 ± 0.30	0.76 (0.35 - 1.65)	0.486
Education	0.52 ± 0.33	1.16 (0.66 - 2.04)	0.600
Living with others	- 0.76 ± 0.20	0.83 (0.51 - 1.34)	0.450
Income	- 4.18 ± 0.08	0.26 (0.14 - 0.48)	< 0.001

[a]Data are defined as mean ± SD. 95%CI: confidence interval.

ably greater than those of the studies cited previously.

According to these results, the overall nutritional status in the elderly living in their own homes and nursing homes is better than that of hospitalized and the rate of malnutrition will increase in patients residing in their own homes compared to that of the ones hospitalized. However, there is a difference between the countries in this trend but the trend is approximately observed in all countries.

The relationship between weight loss and malnutrition was significant as patients who had more than 3 kg weight loss in a month were more likely to be malnourished. Other studies confirmed the relationship between appetite and food intake (12, 21). The differences between the current study and the other related studies may stem from the fact that the current study population was comprised of elderly with CHF, who had a low food intake. The normal chemosensory changes of diminished sense of smell and tastes, as well as difficulty in recognizing taste mixtures, lead to decreased appetite and subsequent low intake.

The prevalence of bedsore in patients was assessed by another study and anemia, insufficient nutrition and diabetes were reported as important risk factors (22). A significant correlation was observed between the nutritional status and bedsore among the current study population. The findings of other related studies also support this result (22).

There is evidence that only a small percentage of malnourished patients are likely to receive nutritional support (23-25). This is due to a lack of knowledge on the part of hospital staff. There was a significant relationship between

knowledge and nutritional status in the current study.

A significant correlation between income and nutritional status was observed in the current study. Patients with personal income had less malnutrition than the others but the amount of income had no significant relationship with nutritional status, as patients who had low income were less at risk or malnourished. Poverty may affect both quality and quantity of food intake (12). People with lower socioeconomic status have some predictable barriers to eating a healthy diet; factors such as financial constraints, mobility problems, lack of education about healthy diet. As a result, diets among older people with lower socioeconomic status tend to be high in some food products. Intake of fresh food and fruits and vegetables may be low, and levels of essential nutrients such as calcium, iron and folic acid are often inadequate (26).

In a study, only a significant relationship was found between the level of hemoglobin and MNA (4) which can result from the selection of the study population from hospitalized patients with heart failure.

The MNA malnutrition status is shown as a powerful independent predictor of long-term mortality in patients with HF (27). It was originally designed to assess malnutrition in the elderly population (28) and its application in a series of patients with HF is rarely tried (27) and its usefulness is evident when considering the prognostic value, which is not yet described. It found a high prevalence of malnutrition and risk of malnutrition in patients hospitalized for HF. Malnutrition and the risk of malnutrition are highly prevalent in patients hospitalized for heart failure. Furthermore, the current study found that the state of malnutrition as defined by the mini nutritional assessment survey is an independent predictor of mortality in such patients (27).

5.1. Conclusion

In the current study based on the MNA, 9.8% of the elderly patients with CHF were malnourished, 80.9% were at risk and 9.3% had a good nutritional status. In other words, 90.7% of the seniors were at risk of malnutrition or had malnutrition. Some factors relating to the nutritional status of patients with heart failure, i e. weight loss, bedsore, living alone or with others and income status had a strong effect on the patients' nutritional status and the relationship was significant. Screening by the MNA can assist to identify nutritional risks and devise prompt interventional or preventive programs to ensure that an old person's nutritional status is well managed. Most of these factors can be prevented if diagnosed and treated early.

5.2. Suggestions

The MNA is a comprehensive, safe and low-cost assessment tool; it is recommended that at hospital admission, the MNA questionnaire be filled for every senior patient to screen those at risk of malnutrition and detect the ones already have it. Secondly, it is suggested that hospital stay durations and costs be curtailed. Attaining a desirable nutritional status in the elderly is of great significance. It is, therefore, advisable that due heed be paid to the provision of sufficient intakes of essential nutrients in the care of this particular age group.

Acknowledgments

Authors thank Mr. Amoozadeh for editing.

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