Assessment of Nutritional Status and Its Association with Length of Hospital Stay and Food Consumption in Elderly Cardiovascular Patients

Kardiyovasküler Hastalığı Olan Yaşlı Bireylerin Beslenme Durumunun Saptanması ve Hastanede Kalış Süresi ile Besin Tüketimi İlişkisi

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ABSTRACT Objective: Elderly hospitalized patients have increased risks for malnutrition, long hospital stay and complications. The objectives of this study were to assess the nutritional status of elderly (65 years and older) cardiovascular patients and to reveal its association with length of stay and food intake. **Material and Methods:** A total of 211 patients (119 males and 92 females) were included in the study. Anthropometric measurements were done, full MNA® form was applied to assess nutritional status, and food consumption was questioned after admission to the hospital. The days following the admission, the patients' food consumptions were assessed, and this assessment was repeated during their stay in hospital. Full MNA® form was applied again at discharge. **Results:** Out of total, 48.4 % of patients were well nourished, while 43.10 % were at risk of malnutrition and 8.50 % were malnourished. Malnourished and at risk patients consumed less amounts of meat, poultry, fish (p=0.010), eggs, lentils (p=0.032), fruits and vegetables (p=0.024), and had longer lengths of stay (p<0.001) at hospital compared to well-nourished patients. The analysis of food consumption revealed that micronutrient intake was significantly more inadequate in patients with malnutrition and at risk for malnutrition when compared to the patients with normal nutritional status. **Conclusion:** In this study, risk and prevalence of malnutrition among elderly cardiac patients was found high (51.6%). In addition to this, micronutrient intake was significantly more inadequate in patients with malnutrition and at risk of malnutrition, and these patients had longer lengths of stay compared to the patients with a normal nutritional status. It could be recommended that nutritional status of elderly people should be assessed and monitored at home, on their admission to hospital and during their stay in hospital.

Key Words: Malnutrition; aged; length of stay; food

ÖZET Amaç: Hastaneye yatan yaşlı bireylerde malnutrisyon riskinin, komplikasyonların ve hastanede kalış süresinin arttığı bilinmektedir. Bu araştırmada kardiyovasküler hastalığı nedeniyle hastaneye yatan 65 yaş üstü bireylerin beslenme durumunun değerlendirilmesi, ve beslenme durumu ile hastanede kalış süresi ve besin tüketimi arasındaki ilişkinin belirlenmesi amaçlanmıştır. **Gereç ve Yöntemler:** Bu çalışmaya toplam 211 hasta birey (92 kadın, 119 erkek) dahil edilmiştir. Hastaneye yatarken hastaların antropometrik ölçümleri ve bir günlük besin tüketimleri alınarak, tam Mini Nutrisyonel Değerlendirme (MND) testi yüz yüze uygulanmıştır. Hastanede kaldıkları süre boyunca besin tüketimi sorgulaması yapılmış ve hastaneden çıkışta da tam MND testi tekrarlanmıştır. **Bulgular:** Hastaneye yatış sırasında MND ile hastaların %48,40'ının beslenme durumunun iyi olduğu, %43,10'unun malnutrisyon riski olduğu, % 8,50'sinin ise malnutrisyonunun olduğu tespit edilmiştir. Hastanede kalış süresi incelendiğinde, malnutrisyon riski ve malnutrisyonu olan bireylerin iyi beslenen bireylere göre daha uzun süre hastanede kaldığı (p<0,001), daha az sıklıkta ve miktarda kuru baklagil, yumurta (p=0,032), et, tavuk, balık (p=0,010), sebze ve meyve (p=0.024) tükettiği bulunmuştur. Besin tüketimleri incelendiğinde, malnutrisyon riski ve malnutrisyonu olan bireylerin mikro besin öğelerini yetersiz tüketme oranlarının beslenme durumu iyi olan bireylerden istatistiksel olarak anlamlı şekilde yüksek olduğu bulunmuştur. **Sonuç:** Kardiyovasküler hastalığı nedeniyle hastaneye yatan yaşlı bireylerin malnutrisyon/malnutrisyon riski oranı yüksek olup, malnutrisyon riski ve malnutrisyonu yüksek olan hastaların beslenme durumu iyi olan hastalara göre hastanede kalış sürelerinin daha uzun olduğu, besin tüketimlerinin ise özellikle mikro besin öğeleri yönünden yetersiz olduğu bulunmuştur. Yaşlı bireylerin evde, hastaneye yatış sırasında ve hastanede kaldıkları süre içerisinde beslenme durumlarının saptanması ve izlenmesi önerilmektedir.

Anahtar Kelimeler: Malnutrisyon; yaşlı; yatış süresi; besin

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Although a high malnutrition prevalence was first identified more than 20 years ago in hospital inpatients, malnutrition is still prevalent (30-65%) in hospitalized elderly patients.[1-4]

Chronic diseases are the most common causes of mortality and morbidity in elderly.[5] It has been reported that 90% of the elderly people have one chronic disease, 35% have two, 23% have three and 15% have four or more chronic diseases.[6] Cardiovascular diseases, diabetes, hypertension and respiratory diseases are the most common diseases prevalent in the elderly.[5]

Metabolic effects of the underlying disease and reduced nutritional intake are both significant reasons of malnutrition.[7] Malnutrition increases length of hospital stay and mortality while it decreases the quality of life.[8-12] Cardiac patients with moderate or severe protein-energy malnutrition has twice or more mortality risk.[13] Therefore, it is important to identify malnutrition at admission to hospital, in order to prevent complications of malnutrition and to improve progress in the treatment.

The aim of this study was to analyze the prevalence of malnutrition and malnutrition risk by using the Mini Nutritional Assessment (MNA®) at both admission and discharge in elderly patients hospitalized for cardiovascular diseases, to assess the association of nutritional status with length of hospital stay and to evaluate nutritional intake of the patients and its association with their nutritional status.

MATERIAL AND METHODS

STUDY DESIGN

The current study was conducted on patients aged 65 years and more and had a hospital stay of 3 or more days at Cardiology and Cardiovascular Surgery wards, between January-August 2011 in Dr. Burhan Nalbantoğlu State Hospital, Nicosia, Turkish Republic of Northern Cyprus (TRNC). The patients aged below 65 years, immobilized, unable to communicate, not willing to give an informed consent and the ones who stayed in the hospital than 3 days were not included to the study. During data collection period, 239 patients fulfilled the inclusion criteria. Less than 5% of these patients refused to give their informed consents, less than 2% of the patients died during the study period, and approximately 7% of the patients who were discharged without informing the researcher were excluded from the study. At the end, 92 females and 119 males, and a total of 211 patients were included in the study.

ASSESSMENT OF NUTRITIONAL STATUS AND DEFINITION OF NUTRITIONAL RISK

The nutritional status of patients was assessed by full MNA®. The full MNA® was developed by the joint effort of the Centre for Internal Medicine and Clinical Gerontology of Toulouse, the Clinical Nutrition Program at the University of New Mexico, and the Nestlé Research Centre in Lausanne in order to assess nutritional status as a part of the standard evaluation of elderly patients in clinics, nursing homes, hospitals, or among those who are otherwise frail. Then it was validated in three studies on more than 600 elderly subjects.[14] According to full MNA®, nutritional status is evaluated as follows: a total score <17 indicates malnutrition, a score between 17 and 24 indicates risk of malnutrition, and a score >24 indicates a satisfactory nutritional status.[14,15] Although 3 types of nutritional statuses were obtained as result of full MNA®, patients with malnutrition and at risk of malnutrition were evaluated together as one group, and all statistical analyses were performed in two groups in this study.

DATA COLLECTION

Body weight, height, mid-upper arm circumference (MUAC) and calf circumference of the patients were measured, full MNA® form was applied and food consumption was obtained with 24-hour recall method in first 48 hours after admission to the hospital. The days following the admission, patients' food consumptions were assessed, and the assessment was repeated every seven days with a 24-hour recall method until the patient is discharged from the hospital. Food consumption data obtained from the patients were evaluated with a computer based program called "Beslenme Bilgi Sistemleri" (BeBis®).

The entry of standard cooking recipes of hospital catering service was applied to the program, and patients' consumptions were calculated as energy and nutrients. Patients having a hospital stay more than seven days had two or more days of food records, which were converted into one day as an arithmetic mean by BeBis. Both mean/median energy and nutrient intake of the patients and adequacy of these intakes according to recommended daily allowances (RDA) were compared with nutritional status obtained from MNA®.[14,15,16]

The patients whose energy and nutrient intakes found below 67% of the recommended daily allowances were considered as having an inadequate intake, and the ones above 67% were considered vice versa.[17] All anthropometric measurements and full MNA application were repeated at discharge.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Near East University Scientific Research Evaluation Ethical Committee (No: 003-2011, Date:10.01.2011). The study was also approved by the chief medical office of Dr. Burhan Nalbantoğlu State Hospital.

STATISTICAL ANALYSES

Independent Samples T test was used to compare mean results and the Mann Whitney U test was undertaken if data were not normally distributed. Differences in rates were analyzed using χ^2 test. McNemar test was used for comparison of admission and discharge values of the same variable. Data are presented as rates, means and standard deviations or medians, unless otherwise indicated. Analysis was performed using SPSS statistical software package, version 15.0. Statistical significance was defined as $p<0.05$.

RESULTS

During the study period, 119 males (mean age: 73.38±7.29 years) and 92 females (mean age: 73.93±6.37 years) were screened. Of these patients; 27.30% had heart failure, 15.60% had cardiovascular surgery and 62.10% had a variety of other cardiovascular diseases. Nutritional status of the patients is shown in Figure 1. According to MNA® scores; 51.60% of the patients (malnourished patients: 8.50%, risk of malnutrition 43.10%) were malnourished and were at risk of malnutrition on admission, while 56.90 % of the patients (malnourished patients: 9.50%, risk of malnutrition 47.40%) were malnourished and at risk of malnutrition at discharge. There was an increase in the percentage of malnutrition and malnutrition risk (p=0.152) (Figure 1). Patients who were at malnutrition risk and malnourished had longer lengths of hospital stay (8.5 days) compared the ones with normal nutritional statuses (6.5 days) ($p<0.001$) (Figure 2).

Patients who were malnourished or at risk of malnutrition reported significantly higher rates of chewing and swallowing difficulties (p=0.001), loss

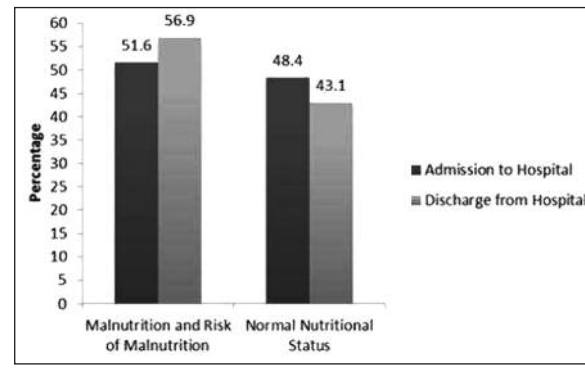

FIGURE 1: The percentage of patients' malnutrition and risk of malnutrition on their admission to hospital and at their discharge.
*McNemar Test: p=0.001.

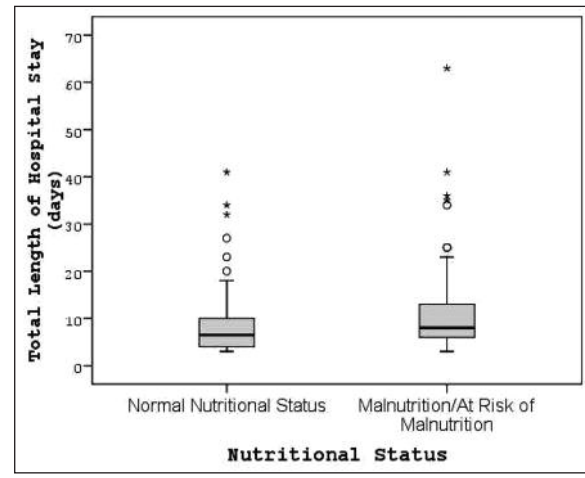

FIGURE 2: The length of hospital stay according to the nutritional status assessed on the admission to the hospital (days).
*Mann Whitney U Test, p<0.001.

of appetite (p<0.001), oral dryness (p=0.001), changes in taste perceptions (p=0.024) and nausea (p<0.001) during last month before admitting to the hospital. Factors like diarrhea, vomiting more than three days and mouth lesions showed no significant difference between malnourished/at risk group and patients with normal nutritional status (Table 1).

According to the nutritional evaluation section found in MNA® (MNA-III), malnourished and at risk patients were consuming less lentils and eggs (2 servings/weekly) (p=0.032), meat, poultry, fish (per day) (p=0.010) and fruits and vegetables (2 portions/daily) (p=0.024). There was no significant difference for milk and milk product consumptions (at least 1 serving/daily) between the groups. In addition to these, the rate of the patients consuming ≤5 cups of fluids (p<0.001) and ≤2 full meals daily (p<0.001) was significantly higher in malnutrition/at risk group compared to the normal nutritional status group (Table 2).

TABLE 1: The analysis of patient factors for nutritional status on admission to hospital (n=211).

	Nutritional Status						
	Normal nutritional status		Malnutrition and at risk of malnutrition				
	n=102		n=109		Total		
Presence of patient factors	**n**	**%**	**n**	**%**	**n**	**%**	**p***
Diarrhea	11	35.50	20	64.50	31	100.00	p=0.121
Loss of appetite	17	25.00	51	75.00	68	100.00	p<0.001
Swallowing difficulties	18	30.00	42	70.00	60	100.00	p=0.001
Oral dryness	27	33.30	54	66.70	81	100.00	p=0.001
Mouth lesions	2	25.00	6	75.00	8	100.00	p=0.282**
Nausea	20	29.90	47	70.10	67	100.00	p<0.001
Vomiting more than 3 days	7	41.20	10	58.80	17	100.00	p=0.538
Changes in taste perceptions	2	16.70	10	83.30	12	100.00	p=0.024

*χ^2, ** Fisher's Exact Test.

TABLE 2: The analysis of dietary assessment part in MNA® according to the nutritional status as assessed on admission to hospital.

	Normal nutritional status		Malnutrition and at risk of malnutrition				
	n=102		n=109		Total		
Presence of patient factors	**n**	**%**	**n**	**%**	**n**	**%**	**p***
At least one serving of dairy products (milk, cheese, yogurt) daily	96	49.70	97	50.30	193	100.00	p=0.183
Two or more servings of legumes or eggs weekly	80	53.00	71	47.00	151	100.00	p=0.032
Meat, fish or poultry daily	62	56.90	47	43.10	109	100.00	p=0.010
Two or more servings of fruits or vegetables daily	96	51.10	92	48.90	188	100.00	p=0.24
Number of full meals							
≤ 2 meals	3	12.50	21	87.50	24	100.00	p<0.001
3 meals	99	52.90	88	47.10	187	100.00	
Total fluid consumption							
≤ 5 cups	3	13.00	20	87.00	23	100.00	p<0.001
> 5 cups	99	52.90	88	47.10	187	100.00	

*χ^2 test.

According to food consumption records obtained from the patients during hospital stay, it was found that patients with normal nutritional status consumed higher amounts of fat (p=0.012), folic acid (p=0.013), calcium (p=0.037), magnesium (p=0.023), iron (p=0.026), zinc (p=0.045), manganese (p=0.029), oleic acid (p=0.040), vitamin A (p=0.034), carotene (p=0.023), vitamin K (p=0.019) and vitamin C (p=0.035) compared to the patients with malnutrition and at risk of malnutrition. Although malnourished and at risk patients consumed less amounts of energy, protein, carbohydrates, fiber, retinol, vitamin E, thiamine, riboflavin, niacin, pantothenic acid, vitamin B_6, biotin, vitamin B_{12}, phosphorus, chloride, copper, fluoride, potassium, plant origined protein, saturated fatty acids, mono-unsaturated fatty acids, linoleic acid, linolenic acid, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), poly-unsaturated fatty acids, short-, medium- and long-chained fatty acids and cholesterol compared to the patients with normal nutritional status, no statistically significant difference was found between them (p>0.05) (Tables 3, 4).

Energy and nutrient intakes of patients which were classified according to RDA are shown in Table 5.[16] Patients with malnutrition and at malnutrition risk had significantly higher inadequate consumption rate for carbohydrates, biotin, iron, copper and vitamin C compared to the patients with normal nutritional status. No significant difference was found about the intake of energy and other nutrients according to RDA values.[16] Although no difference was observed between the two groups, more than 50% of both groups of patients consumed inadequate energy, fiber, vitamin E, thiamine, folic acid, potassium, calcium, magnesium, linoleic and linolenic acid.

DISCUSSION

According to the full MNA® scores, 51.60% of the patients were malnourished or at risk of malnutrition on their admission to hospital while 56.90% of them were malnourished or at risk of malnutrition at their discharge from the hospital in this study. In a meta-analysis including 36 studies which assessed malnutrition in elderly patients by using MNA®, it was stated that 23% of the patients had malnutrition and 46% of the patients were at risk for malnutrition.[14] Different studies using different nutritional assessment methods showed malnutrition rates varying from 10% to 60%.[8,9,11,18-21] Only a few studies assessed nutritional status of elderly hospitalized patients in Turkey. Korfalı and colleagues[22] found malnutrition risk as 25% using Nutritional Risk Screening 2002 (NRS-2002) in their study which included 62 hospitals and 10,325 patients 60 years and older.[22] In a different study which was conducted on 413 patients who were admitted to İstanbul University Hospital Department of Internal Medicine, malnutrition and malnutrition risk were determined as 13% and 31%, respectively.[23] No data were found about the nutritional status of the elderly patients in TRNC. The malnutrition prevalence has been reported in a wide range in various studies due to several factors influencing the prevalence of malnutrition risk. Among these, characteristics of the selected patients, different hospital settings, different medical or geographic settings and a wide variety of nutritional assessment methods may be mentioned.[7,24]

Due to the increased morbidity, malnourished patients experience a significantly prolonged treatment duration and hospital stay.[7] In this study, patients with malnutrition and at malnutrition risk had significantly longer hospital stays compared to the patients with normal nutritional status (p<0.001). A number of studies showed similar results.[8,9,11,25-27] On the contrary, some studies indicated no significant relationship between the length of stay and the nutritional status.[28-30]

When we analyzed the food choices of patients in this study, we found that malnourished and at risk patients consumed significantly less amounts of meat, poultry, fish, eggs, lentils, fruits and vegetables compared to the patients with normal nutritional status. No difference was found for consumption of milk and milk products between two groups. In a similar study which assessed the nutritional status of 22,007 Spanish elderly using MNA®, the elderly who were assessed as malnourished or at risk of malnutrition had statistically significantly lower scores of MNA®-III and lower

TABLE 3: The analysis of mean (±SD) nutrient intakes of the patients according to their nutritional status at discharge from the hospital.

	Normal nutritional status (n=91)	Malnutrition and at risk of malnutrition (n=120)	
Energy and nutrients	**± S**	**± S**	**p**
Energy (kcal)*	1161.66±318.06	1084.46±397.38	p=0.119
Protein(g)*	54.95±17.13	51.57±19.98	p=0.197
Fat (g)*	42.09±13.61	37.01±15.13	**p=0.012**
Carbohydrate (g*)	139.02±41.87	134.19±51.42	p=0.466
Retinol (mcg)*	124.42±78.02	125.40±73.77	p=0.926
Vitamin E (mg)*	9.64±4.29	8.54±4.65	p=0.080
Thiamine (mg)*	0.71±0.23	0.65±0.32	p=0.139
Riboflavine (mg)*	1.10±0.42	1.02±0.46	p=0.198
Niacin (mg)*	10.82±4.42	10.20±4.88	p=0.338
Panthotenic acid (mg)*	3.90±1.52	3.73±1.66	p=0.441
Vitamin B6 (mg)*	1.17±0.42	1.10±0.51	p=0.243
Biotin(mcg)*	29.01±10.71	27.22±12.18	p=0.267
Folic acid (mcg)*	236.77±84.97	203.25±104.66	**p=0.013**
Vitamin B_{12}(mcg)*	3.53±2.11	3.31±1.93	p=0.429
Potassium (mg)*	2200.34±775.63	1983.84±938.85	p=0.068
Calcium (mg)*	735.27±277.89	652.97±286.11	**p=0.037**
Magnesium (mg)*	244.90±104.16	211.18±107.25	**p=0.023**
Phosphorus (mg)*	876.64±290.88	809.27±351.52	p=0.140
Iron (mg)*	9.13±3.79	7.90±4.07	**p=0.026**
Zinc (mg)*	7.68±2.81	6.86±2.99	**p=0.045**
Copper (mg)*	1.12±0.36	1.04±0.46	p=0.165
Manganese (mg)*	3.20±1.20	2.80±1.39	**p=0.029**
Flouride (mcg)*	380.05±150.67	352.25±131.46	p=0.155
Plant origin protein (g)*	19.14±6.35	17.80±9.10	p=0.231
Saturated fatty acids (g)*	10.16±4.37	9.40±4.39	p=0.213
Oleic acid (g)*	10.97±4.30	9.68±4.63	**p=0.040**
Linoleic acid (g)*	7.51±3.45	6.82±3.70	p=0.166
Linolenic acid (g)*	0.59±0.24	0.54±0.31	p=0.135
PUFA[a] (g)*	8.32±3.57	7.51±3.96	p=0.124
Medium chained fatty acids (g)*	0.27±0.20	0.26±0.18	p=0.700
Long chain fatty acids (g)*	29.76±11.09	26.61±11.90	p=0.051
Cholesterol (mg)*	165.51±79.22	163.84±84.50	p=0.880

*Independent Sample T Test.

[a]PUFA: Polyunsaturated Fatty Acids.

rates of full meal consumption. When the questions in MNA®-III were analyzed in detail, it was found that malnourished and at risk subjects consumed less amounts of meat, poultry, fish, eggs, lentils, milk and milk products compared to the elderly with normal nutritional status. In addition, the participants with a body mass index (BMI) <30 kg/m^2 consumed fruit and vegetables less than the ones with higher BMI (≥30 kg/m^2).[31] In another study which was conducted on 457 Indian patients, it was found that malnourished patients had lower MNA®-III scores and smaller number of full meals compared to the patients with normal nutritional status. Similar results were also found for the consumption of meat, poultry, fish, eggs, lentils, milk and milk products, fruits and vegetables.[32] The results of Van Nes and colleagues on 1145 patients are different.[27] Consumption of meat, poultry, fish,

TABLE 4: The analysis of nutrient intakes of the patients according to their nutritional status at their discharge from the hospital.

	Normal nutritional status (n=91)			Malnutrition and at risk of malnutrition (n=120)			
Nutrients	**Median**	**Minimum**	**Maximum**	**Median**	**Minimum**	**Maximum**	**p**
Fiber (g)*	17.73	4.65	35.48	15.52	1.73	65.80	p=0.070
Vitamin A (mcg)*	575.32	82.87	3229.16	458.01	54.58	2447.45	**p=0.034**
Carotene (mg)*	1.89	0.10	14.18	1.59	0.01	14.50	**p=0.023**
Vitamin K (mcg)*	220.42	36.95	1069.56	194.11	21.50	994.87	**p=0.019**
Vitamin C (mg)*	95.61	4.87	312.81	77.59	1.00	294.47	**p=0.035**
Chloride (mg)*	1507.83	570.52	5038.42	1441.38	172.94	4691.35	p=0.050
MUFA[a] (g)*	12.32	0.32	23.19	10.39	1.59	24.46	p=0.052
EPA[a] (g)*	0.01	0.00	0.42	0.01	0.00	0.10	p=0.838
DHA[a] (g)*	0.02	0.00	1.14	0.03	0.00	0.15	p=0.065
Short-chained fatty acids (g)*	0.35	0.00	2.5	0.34	0.00	1.36	p=0.985

* Mann Whitney U Test

[a]MUFA: Mono-unsaturated Fatty Acids, EPA: Eicosapentaenoic Acid, DHA: Docosahexaenoic Acid.

TABLE 5: The adequacy of energy and nutrient intakes according to the nutritional status of the patients as assessed at discharge from the hospital.

	Normal nutritional status (n=91) Inadequate		Malnutrition and at risk of malnutrition (n=120) Inadequate		
Energy and nutrient intakes	**n**	**%**	**n**	**%**	**p***
Energy (kcal)	63	69.20	80	66.70	p=0.693
Protein (g)	8	8.80	21	17.50	p=0.069
Carbohydrate (g)	10	11.00	26	21.70	**p=0.041**
Fiber (g)	43	47.30	67	55.80	p=0.217
Vitamin A (mcg)	44	48.40	69	57.50	p=0.187
Vitamin E (mg)	50	54.90	82	68.30	**p=0.047**
Vitamin K (mcg)	4	4.40	14	11.70	p=0.061
Thiamine (mg)	61	67.00	88	73.30	p=0.320
Riboflavine (mg)	20	22.00	41	34.20	p=0.053
Niacin (mg)	45	49.50	61	50.80	p=0.842
Pantotenic acid (mg)	37	40.70	54	45.00	p=0.528
Vitamin B_6 (mg)	39	42.90	58	48.30	p=0.429
Biotin (mcg)	16	17.60	39	32.50	**p=0.015**
Folic acid (mcg)	62	68.10	94	78.30	p=0.095
Vitamin B_{12} (mcg)	17	18.70	20	16.70	p=0.703
Vitamin C (mg)	18	19.80	40	33.30	**p=0.029**
Potassium	83	91.20	103	85.80	p=0.231
Calcium (mg)	50	54.90	79	65.80	p=0.108
Magnesium (mg)	58	63.70	85	70.80	p=0.275
Phosphorus (mg)	7	7.70	20	16.70	p=0.053
Chloride (mg)	28	30.80	47	39.20	p=0.207
Iron (mg)	12	13.20	39	32.50	**p=0.001**
Zinc (mg)	35	38.50	59	49.20	p=0.121
Copper (mg)	3	3.30	21	17.50	**p=0.001**
Manganese (mg)	5	5.50	14	11.70	p=0.121
Linoleic acid (g)	56	61.50	87	72.50	p=0.092
Linolenic acid (g)	81	89.00	111	92.50	p=0.381

*χ^2 test.

eggs, lentils, milk and milk products, fruits and vegetables and the number of full meals in a day did not make any difference on mortality or the length of hospital stay when malnourished and normally nourished patients were compared.[27] In another study, 75% of malnourished patients consumed two or less full meals daily.[33] In the current study, the food choices and the number of full meals consumed daily were in accordance with other studies, and might be as a result of high prevalence of chewing and swallowing difficulties, loss of appetite, oral dryness and nausea among malnourished and at risk patients.

Malnutrition is a condition which is characterized by decreased food and fluid intake.[34] Therefore, the fluid consumption of patients has also been analyzed in a number of studies.[29,31,35] Cuervo et al. found that patients with a BMI <30 kg/m^2 consumed less amount of water compared to the patients with a BMI ≥30 kg/m^2.[31] The relation between less fluid consumption and malnutrition was also mentioned in another study.[29] On the contrary, Cereda et al. found that patients with normal nutritional status consumed significantly less amount of fluid compared to the patients with a malnutrition risk.[35] In the current study, it was found that malnourished and at risk patients consumed significantly less amount of fluid compared to the patients with normal nutritional status (Table 1), a result in accordance with a nımber of previous studies.[29,31]

The association between the food consumption during hospital stay and nutritional status was analyzed in a number of studies.[36-39] In a study it was found that patients with malnutrition risk had inadequate energy consumption while in another one it was demonstrated that malnourished and at risk patients consumed less energy, protein, fiber, calcium, iron, vitamins B_1, B_2, B_6, and C.[36,39] Ruiz-Lopez and colleagues found that malnourished female elderly consumed less fat than the well-nourished ones, but no significant relationship was found between energy, protein, carbohydrates, fiber, vitamins B_1, B_2, B_6, B_{12}, A, C and E, folate, calcium, magnesium, zinc and iron consumption.[38] In a study conducted on 134 Australian elderly patients, no significant relationship was found between energy intake (analyzed from 3rd and 7th days of hospital stay) and nutritional status assessed with MNA®.[37]

In this study, although more than 50% of both groups of patients consumed inadequate energy, fiber, vitamin E, thiamine, folic acid, potassium, calcium, magnesium, linoleic and linolenic acid, intake of especially carbohydrates, vitamin E, biotin, vitamin C, iron and copper were significantly found to be related to nutritional status. This may be a consequence of less consumption of fruits, vegetables and lentils by malnourished and at risk patients. Although MNA® was designed to assess protein and energy malnutrition, it was shown that in order to achieve normal nutritional status, it is important to have a balanced nutritional pattern including adequate amounts of all micronutrients.

CONCLUSION

The MNA test is a useful screening instrument to identify nutritional status of older people. The high prevalence of malnutrition and malnutrition risk of elderly cardiovascular patients found in this study should be evaluated carefully. Since majority of the patients had inadequate energy and micronutrient intake, it is essential to assess the nutritional status of elderly patients on admission to hospital. In addition to these, both dietary habits and food consumption of elderly patients should be monitored frequently during stay by an experienced dietitian, and nutritional support should be given to the patients who were identified as malnourished or at risk if necessary.

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