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Original

MNA® Mini Nutritional Assessment as a nutritional screening tool for hospitalized older adults; rationales and feasibility

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Abstract

The high prevalence of malnutrition in the growing population of older adults makes malnutrition screening critical, especially in hospitalized elderly patients.

The aim of our study was to evaluate the use of the MNA® Mini Nutritional Assessment in hospitalized older adults for rapid evaluation of nutritional risk.

A prospective cohort study was made of 106 patients 65 years old or older admitted to an internal medicine ward of a tertiary-care teaching hospital to evaluate the use of the short form, or screening phase, of the MNA-SF. In the first 48 hours of admission, the full MNA questionnaire was administered and laboratory tests and a dermatologic evaluation were made. The MNA score showed that 77% of the patients were at risk of malnutrition or were frankly malnourished. Low blood levels of albumin, cholesterol and vitamins A and D showed a statistically significant association with malnutrition or risk of malnutrition. Separate evaluation of the MNA-SF showed that it was accurate, sensitive and had predictive value for the screening process.

Routine use of the MNA-SF questionnaire by admission nurses to screen patients is recommended. Patients with MNA-SF scores of 11 or lower should be specifically assessed by the nutritional intervention team.

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Key words: *Elderly. Nutritional status. Malnutrition. MNA® Mini Nutritional Assessment. The short form of the MNA-SF. Mass screening.*

USO DEL MINI NUTRITIONAL ASSESSMENT COMO HERRAMIENTA DE CRIBAJE NUTRICIONAL EN LA POBLACIÓN MAYOR DE 65 AÑOS EN EL ÁMBITO HOSPITALARIO; CONVENIENCIA Y FACTIBILIDAD

Resumen

El envejecimiento de la población y la elevada prevalencia de desnutrición en este colectivo hacen que el cribaje de desnutrición sea fundamental, especialmente en ancianos ingresados.

Realizamos un estudio prospectivo sobre una población de 106 pacientes mayores de 65 años, ingresados en plantas de Medicina Interna de un hospital terciario, en el que se ha seguido la aplicación sistemática de Minimal Nutritional Assessment (MNA) en las primeras 48 horas de ingreso, así como una evaluación hematológica y dermatológica. Hemos detectado situación nutricional de riesgo (RM) o malnutrición (MN) en el 77% de los casos. Los marcadores biológicos que resultaron asociados estadísticamente a la MN o RM fueron la hipoalbuminemia, hipocolesterolemia, así como la hipovitaminosis A y D. Proponemos el empleo rutinario de la fase de cribaje del MNA por la enfermera de hospitalización, y la valoración específica por equipo especializado (Unidad de Nutrición) en caso de puntuación igual o inferior a 11 .

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Palabras clave: *Ancianos. Desnutrición. Mini Nutritional Assessment (MNA). Herramienta de cribaje.*

Introduction

Rising life expectancy and diminished mortality in most developed countries is accompanied by population aging. Consequently, there is a higher prevalence of chronic disease and the number of hospital admissions in conjunction with the changes in nutritional status and body composition that occur during aging. These factors increase the incidence of nutritional deficits in older adults. The development of nutritional deficits is progressive, starting with inadequate nutrient intake during hospitalization[1] and followed by signs of changes in biochemical parameters and body composition. Functional dependence and impaired general health or quality of life correlate poorly with the nutritional status of frail elderly.[2] The large variability in the prevalence of malnutrition in hospitalized older adults is due to the characteristics of the hospital, the population served, the disease of the group studied

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and the nutritional method used.[3,4] No single parameter meets all the requirements of a good marker of nutritional status. A Dutch group studied body mass index (BMI) compared to weight loss > 10% in 6 months as a predictor of malnutrition, and found that only 21% of patients with weight loss > 10% had BMI < 18.5.[5] Most authors agree that a comprehensive assessment of clinical and laboratory markers is needed[6,7].

Hospital malnutrition, according to the series studied and markers used, affects 10-80% of hospitalized patients.[8] The most accepted figures indicate that 30 to 50% of hospitalized patients are malnourished.[9] The prevalence of malnutrition in older adults depends on where they live. Malnutrition affects more than 50% of older adults who are institutionalized[10] and 15% of those living at home.[11]

The World Health Organization declared in 1992 the elderly population as one of the most nutritionally vulnerable groups, due to changes that take place in anatomic and physiologic characteristics during the aging process.[12] Early detection of malnutrition in older adults is a priority for optimizing healthcare and has a significant effect on morbidity and mortality in this population.[13]

We designed a study to assess the prevalence of malnutrition and its impact on blood chemistries and the skin of patients older than 65 years admitted to the internal medicine department of a tertiary public hospital. Our main objective was to evaluate the use of a simple nutritional screening tool in the nursing assessment of patients on admission to ensure early detection of patients requiring specialized nutritional intervention.

Material and methods

A prospective, cross-sectional study was made of patients admitted to three different internal medicine units of La Paz University Hospital (Madrid, Spain) during two months (February and March). Patients with chronic kidney failure, liver disease, or tumoral disease were excluded as a group with higher nutritional risk.

The data were collected in the first 24-48 hours of admission of the patient. The same investigator (IC) did all the interviews to minimize interobserver bias. The complete MNA® Mini Nutritional Assessment (Nestlé Nutrition Institute) (Annex 1), consisting of a screening phase (MNA-SF, or short form) and assessment phase, was administered to all patients. The screening phase (used as a short form to identify patients at risk of malnutrition) consists of six items: a food intake item, two anthropometric parameters (recent weight loss and body mass index, or BMI), and three general parameters (mobility, physical and emotional stress, and neuropsychological). The assessment phase had twelve items: anthropometric (calf and upper arm circumference), general (six questions on lifestyle, medication and mobility), dietary (eight questions related to number of meals, food and fluid intake, and mode of feeding), and subjective assessment (personal view of health and nutritional status). The sum of the MNA scores of both phases distinguishes between elderly patients with adequate nutrition, MNA score ≥ 24; risk of malnutrition, MNA score 17.5-23.5; and protein-calorie malnutrition, MNA < 17.[14]

In the first 24-48 hours of admission, a dermatologic examination was made of the skin (hyperkeratosis, bleeding, edema, and pigmentation), hair (alopecia, capillary fragility), nails (color and thickness), and mucous membranes (hydration and color).

Blood samples were obtained for the white blood cell count and albumin, cholesterol, folic acid, phosphorus, magnesium, zinc and vitamins A, C, D, E and B12 measurements.

All patients were asked to give their informed consent to participate in the study. The study was approved by the Institutional Review Board of the La Paz University Hospital.

Statistical analysis

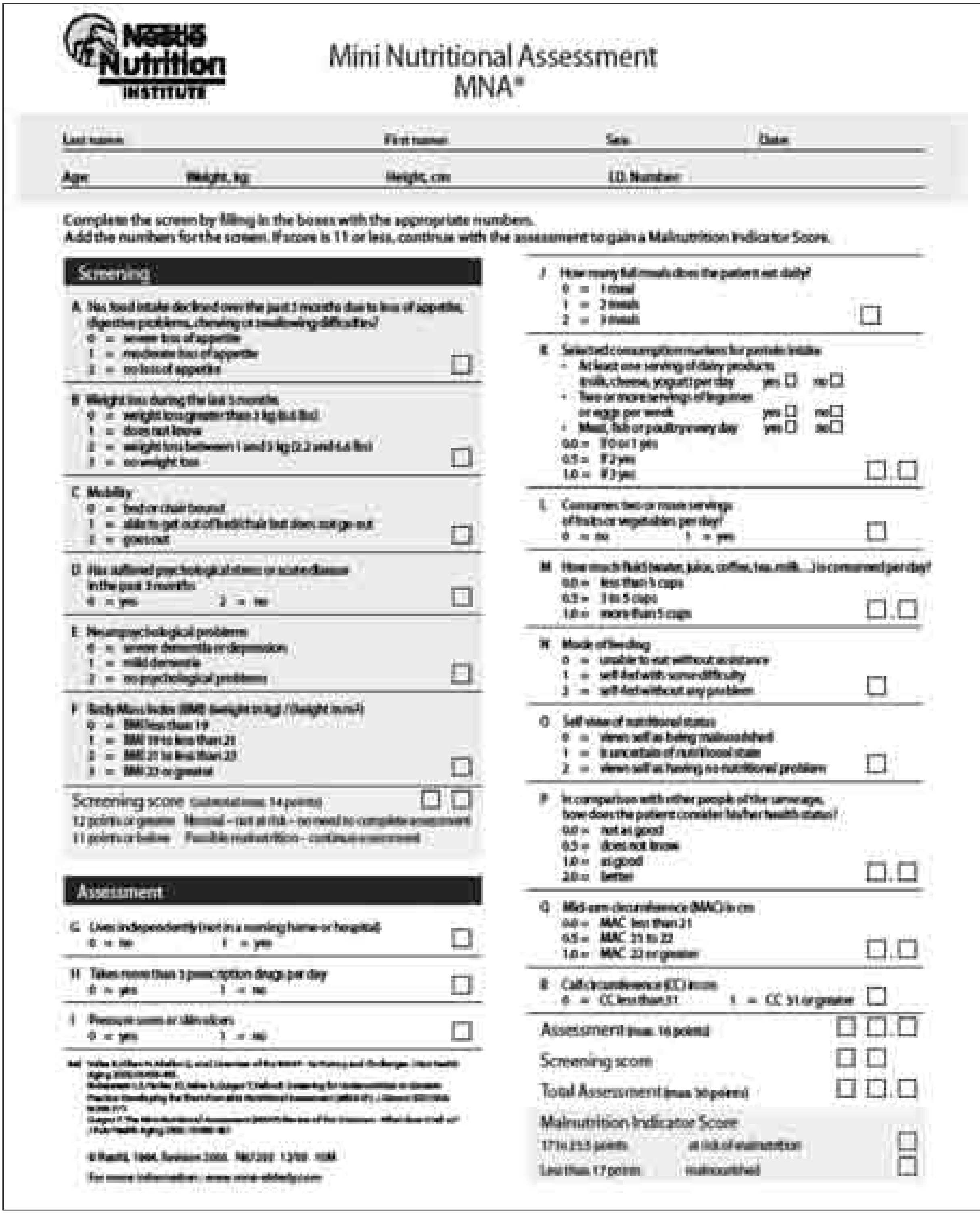
The data were analyzed using the SPSS 9 statistical program. Qualitative data were described as absolute frequencies and percentages and quantitative data as the mean, median, and standard deviation depending on the distribution of data.

Qualitative variables were compared using the chi-square test (Pearson's test or Fisher's test). Quantitative variables were analyzed using the Student t test to compare the distribution of two groups and the ANOVA test to compare the distribution of three groups. The correlation between quantitative variables was analyzed by calculating the Spearman correlation coefficient. All statistical tests were two-sided and significance was set at $p < 0.05$.

Results

One hundred and six patients were included in the study in February and March of 2007: 58 men (54.7%) and 48 women (45.3%), mean age 79.4 years, and body mass index (BMI) 27.1. In this group, 96 patients (90.6%) lived at home (alone or with a family member or caregiver) and 10 (9.4%) in nursing homes.

According to the complete MNA score, 22% of patients were malnourished, 55% were at risk of malnutrition, and 24% were adequately nourished. MNA score correlated negatively with age (r^2 = -0218, P = 0.025). Consequently, patient stratification by age group showed an inverse relationship between MNA score and age (table I). No association was found between malnutrition and gender (74% of men and 79% of women were malnourished or at risk of malnutrition). MNA nutritional status categories showed a significant association with the place of residence,


Nestlé Nutrition Institute

Mini Nutritional Assessment
MNA®

Last name | First name | Sex | Date
Age | Weight, kg | Height, cm | I.D. Number

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe loss of appetite
1 = moderate loss of appetite
2 = no loss of appetite

B Weight loss during the last 3 months
0 = weight loss greater than 3 kg (6.6 lbs)
1 = does not know
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs)
3 = no weight loss

C Mobility
0 = bed or chair bound
1 = able to get out of bed/chair but does not go out
2 = goes out

D Has suffered psychological stress or acute disease in the past 3 months
0 = yes 2 = no

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems

F Body Mass Index (BMI) (weight in kg) / (height in m²)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater

Screening score (subtotal max. 14 points)
12 points or greater Normal – not at risk – no need to complete assessment
11 points or below Possible malnutrition – continue assessment

Assessment

G Lives independently (not in a nursing home or hospital)
0 = no 1 = yes

H Takes more than 3 prescription drugs per day
0 = yes 1 = no

I Pressure sores or skin ulcers
0 = yes 1 = no

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals

K Selected consumption markers for protein intake
• At least one serving of dairy products (milk, cheese, yogurt) per day yes ☐ no ☐
• Two or more servings of legumes or eggs per week yes ☐ no ☐
• Meat, fish or poultry every day yes ☐ no ☐
0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes

L Consumes two or more servings of fruits or vegetables per day?
0 = no 1 = yes

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem

P In comparison with other people of the same age, how does the patient consider his/her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC 22 or greater

R Calf circumference (CC) in cm
0 = CC less than 31 1 = CC 31 or greater

Assessment (max. 16 points)
Screening score
Total Assessment (max. 30 points)

Malnutrition Indicator Score
17 to 23.5 points at risk of malnutrition
Less than 17 points malnourished

Annex 1

malnutrition being significantly higher among patients living in nursing homes (table II).

BMI correlated linear with the MNA score (r^2 = 0.203, p = 0.037), but BMI £23 as a cutoff point identified only 17 patients (16%) as malnourished or at risk of malnutrition (table III).

The comparison of the MNF-SF and the complete MNA scores, screening phase and assessment phase, is summarized in table IV. Using an MNA-SF score of 11 or lower as a cutoff value suggestive of malnutrition, the MNA-SF score had sensitivity, specificity, positive predictive value, and negative predictive value for

Table I
Nutritional status (MNA score) in relation to age in 106 hospitalized patients over 65 years old

	Malnutrition MNA < 17	*Risk of malnutrition MNA 17-23.5*	*Absence of malnutrition MNA ≥ 24*
≤ 74 years	2 (8.7%)	13 (65%)	8 (35%)
75-84 years	15 (23%)	33 (52%)	16 (25%)
> 84 years	6 (32%)	12 (63%)	1 (5%)

Chi-square, p < 0.012.

Table II
Nutritional status (MNA score) in relation to place of residence in 106 hospitalized patients over 65 years old

	Malnutrition MNA < 17	*Risk of malnutrition MNA 17-23.5*	*Absence of malnutrition MNA ≥ 24*
Resides at home	17 (18%)	54 (56%)	25 (26%)
Nursing home	6 (60%)	4 (40%)	–

Chi-square, p < 0.002.

Table III
Nutritional status (MNA score) in relation to BMI in 106 hospitalized patients over 65 years old

	Malnutrition MNA < 17	*Risk of malnutrition MNA 17-23.5*	*Absence of malnutrition MNA ≥ 24*
BMI ≤ 20	2 (67%)	1 (33%)	–
BMI 21-23	5 (29%)	9 (53%)	3 (18%)
BMI > 23	16 (22%)	48 (56%)	22 (27%)

BMI: Body Mass Index.
Chi-square, p < 0.052.

Table IV
MNA screening score versus MNA total assessment score

	Malnutrition MNA < 17	*Risk of malnutrition MNA 17-23.5*	*Absence of malnutrition MNA ≥ 24*
≤ 11 points Possible malnutrition	23	54	9
≥ 12 points Absence of malnutrition	–	4	16
Total	23	58	25

defining malnutrition risk or malnutrition of 95%, 64%, and 80%, respectively.

The biochemical and hematologic findings of our study population are given in table V. Low levels of albumin, serum cholesterol, and vitamin A and D showed a statistically significant association with malnutrition status assessed by MNA score. Other analytical parameters had a linear, nonsignificant relation. Zinc deficiency was more frequent in patients with malnutrition or risk of malnutrition that in patients with adequate nutritional status (19 *vs.* 4 patients, p < 0.018).

We found no association between the dermatological variables evaluated and MNA score in our study population.

Discussion

In our study of 106 patients older than 65 years admitted to an internal medicine department of a tertiary hospital, 75% were malnourished or at risk of malnutrition according to the MNA score. This presumably means that malnutrition has a significant impact on morbidity and mortality, as well as costs,[15] not only in terms of economically quantifiable parameters but also in terms of the functionality of older adults.[16] In view of the findings of this and earlier studies,[17] hospitalized older adult patients should receive optimal nutritional care, which often is not the case. Our findings suggest that nutritional screening in

Table V
Nutritional status (MNA score) in relation to hematologic and biochemical parameters

	Malnutrition MNA < 17	*Risk of malnutrition MNA 17-23.5*	*Absence of malnutrition MNA ≥ 24*	**P <*
White blood cell count (n = 106) < 1,200	11 (48%)	23 (40%)	8 (32%)	0.146
Albumin (n = 103) < 3.5g/dL	22 (100%)	43 (77%)	18 (72%)	0.000
Cholesterol (n = 104) 160 mg/dL	17 (77%)	31 (54%)	11 (44%)	0.024
Phosphorus (n = 104) < 2.5 mg/dl	4 (18%)	6 (11%)	1 (4%)	0.117
Magnesium (n = 64) < 1.9 mg/dl	5 (33%)	15 (45%)	3 (19%)	0.381
Transferrin (n = 82) < 200 mg/dl	11 (69%)	27 (62%)	12 (55%)	0.323
Zinc (n = 65) < 55 µ/dL	6 (43%)	13 (37%)	4 (25%)	0.304
Vitamin B12-(n = 71) < 197 pg/mL	1 (6%)	1 (3%)	2 (11%)	0.512
Vitamin A (n = 70) < 0.4 ug/mL	9 (60%)	17 (45%)	2 (12%)	0.005
Vitamin C (n = 63) < 6 ng/mL	3 (27%)	11 (31%)	5 (29%)	0.937
Vitamin D (n = 46) < 20 ng/mL	8 (89%)	23 (88%)	6 (55%)	0.044
Vitamin E (n = 70) < 8 ug/mL	–	1 (3%)	1 (6%)	0.320

**Chi-square* test.

the first 48 hours of hospitalization could be useful. Consequently, we propose the use of the MNA-SF in the nursing assessment made to evaluate patients in the admissions unit. The history of the patient should include weight loss and changes in appetite in the last three months, in addition to BMI (weight/height^2). Simple measures such as documenting the patient's height and weight at admission, examining the patient, and assessing the patient's food intake would help in the early detection of malnutrition in hospitalized older adults.[18] Poor food intake is a factor in the loss of muscle protein.[19] Once muscle loss begins, the development of malnutrition is progressive.

The MNA-SF has been shown to have a high sensitivity, positive predictive value and negative predictive value, which confirms it as a useful tool for screening malnutrition. This is particularly useful in hospitals where malnutrition is a frequent and under-recognized clinical problem in older patients. The MNA screening phase could be used by hospital nurses to detect patients with possible malnutrition (MNA score ≤11 points) who would then undergo complete nutritional assessment by the multidisciplinary team of nutrition units. Nutrition units should develop programs to promote nutritional assessment as a routine hospital diagnostic test.[20]

MNA is recommended by scientific associations and can be administered by healthcare professionals in 10-15 minutes.[21] The MNA score is prognostic and predictive of mortality, and includes items designed to identify nutritional risk situations such as insufficient intake of protein, fruits and liquids. It is a good, easy-to-use, useful and economical tool for identifying patients at risk of malnutrition who might benefit from early nutritional support.[22]

In view of our results, the use of BMI < 23 as a cutoff point for malnutrition[23] has little sensitivity in detecting malnutrition or the risk of malnutrition. BMI alone is not a suitable malnutrition indicator in older adults.[24]

Wallace found in a longitudinal study that 13% of adults over 65 years have more than 4% weight loss over a year and that these people have a less favorable health status.[25]

In our study population, a high rate of malnutrition or risk of malnutrition was observed even in patients who lived at home (75%), which contrasts with previous studies, in which the institutionalization of older adults is a nutritional risk factor.[26] Nonetheless, it is true that all of the institutionalized patients in our study group had malnutrition or were at risk of malnutrition. If our patients had been more regularly distributed with respect to place of residence, these differences might have been more evident. In fact, most of the patients in our study lived at home. A growing proportion of older adults in Spain live at home, with only about 3% of older adults living in nursing homes.[27] Our data confirmed that risk of malnutrition and malnutrition affected patients living at home, not only patients living in nursing homes as had been expected. It is necessary to establish preventive measures for older adults independently of their place of residence.[28]

In relation to laboratory parameters, the high frequency of hypoalbuminemia was noteworthy. Serum albumin has limitations as an indicator of nutritional status, but it is an easy parameter to determine and, regardless of its causes, provides information about the risk of death in hospitalized older adults.[29] Similarly, our data flagged hypocholesterolemia as a risk factor for poor nutritional status in our older adult patients, confirming reports in the literature that hypocholesterolemia is predictive of imminent death[30] or less favorable health status in the elderly population.[31,32]

Deficits of specific nutrients, such as vitamins and minerals, can predispose to, or cause, several more serious clinical syndromes. In our study, we found a low frequency of vitamin B12 and folic acid deficiency, which we attribute to the fact that these two vitamins often are supplemented by primary care physicians and many of our patients may have benefited from this measure. This observation was corroborated by the absence of signs of generalized hyperpigmentation in relation to a possible vitamin B12 deficit. In contrast with the hydrosoluble vitamins, deficits in liposoluble vitamins, such as vitamin A and D, are frequent. Adequate intake of liposoluble vitamins is essential because of the consequences of deficiency, such as night blindness, xerosis and dermatitis in the case of vitamin A deficiency, and osteomalacia and risk of fractures in vitamin D deficiency.[33]

With respect to trace nutrients, zinc deficiency was more frequent in our malnourished and at risk patients (75%) than in our patients without nutritional deficits (25%). Older patients with inadequate dietary habits tend to be at risk for mild to moderate zinc deficiency. Zinc deficiency primarily affects immune function,[34] increasing the risk of infection and blunting the sense of taste,[35] smell and touch. Symptoms of zinc deficiency of particular concern include slow healing of wounds and the pressure sores that are so frequent in older patients. Zinc supplementation is therefore imperative.

Among the intervention studies in the populations of older adults, a study made in Stockholm on a sample of patients with a mean age of 85 years merits attention.[36] This study suggests that adults of advanced age at risk of malnutrition according to the MNA score should receive dietary counseling and dietary supplementation with fluid calorie supplements and trace elements, together with a specific hospital education program in the geriatric service to prevent weight loss and improve daily living activities.

Our results support the routine use of the MNA-SF to assess patients older than 65 years admitted to internal medicine due to the effectiveness of this simple test in detecting malnutrition and risk of malnutrition. In view of the high frequency of malnutrition and risk of malnutrition observed, routine screening for malnutrition in high-risk groups, such as older adults, by health professionals in the healthcare system is justified. Malnutrition screening of older adults should be a priority for governments and healthcare systems because it is a public health problem[37] and the easiest measure to implement against it is prevention.

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