ORIGINAL PAPER

NUTRITIONAL STATUS ASSESSMENT OF PATIENTS IN A GENERAL PRACTITIONER'S OFFICE

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Abstract

Aim: The study aimed at determining the nutritional status of senior citizens in a general practitioner's office. **Design:** A cross-sectional study. **Methods:** Nutritional status was assessed with the Mini Nutritional Assessment (MNA), Malnutrition Universal Screening Tool (MUST), Mini Nutritional Assessment – Short Form (MNA-SF) and laboratory parameters (prealbumin, transferrin and CRP). The study comprised 241 participants. The significance of differences in selected nutritional markers for various groups was determined using a chi-squared test, Spearman's correlation coefficient and Fisher's test at a critical statistical significance level of 0.05. **Results:** Malnutrition was detected in a relatively high proportion of the elderly, ranging from 13% to 90% depending on the tools used. There were significant differences between the tools when identifying patients as malnourished or being at risk of malnutrition. The MNA revealed more patients at risk of or with malnutrition (90%) than the MNA-SF (58%) or MUST (13%). No statistically significant correlations were found either between nutritional status and biochemical markers of nutrition or between nutritional status and age of the elderly. **Conclusion:** In the general practice setting, nutrition of the elderly must not be neglected as adequate nutrition is a prerequisite for faster convalescence and return to a normal life.

Keywords: assessment, biochemical markers, Malnutrition Universal Screening Tool (MUST), Mini Nutritional Assessment (MNA), Mini Nutritional Assessment – Short Form (MNA-SF), nutrition, patients over 65 years of age.

Introduction

Nutrition plays an important role in all areas of health care. Obesity, malnutrition and an unbalanced diet contributed to the development of numerous conditions; conversely, many diseases are linked to considerable nutritional and metabolic problems. At an older age, the quality of nutrition fundamentally affects the overall state of the organism and major deficiencies may contribute to multimorbidity. Nutritional disorders of the elderly are a serious issue. An older age is associated with a higher prevalence of nutritional disorders, in particular with malnutrition. The prevalence of malnutrition in senior citizens receiving community care ranges from 13% to 20% (Skinner et al., 2010). Early detection of malnutrition at an older age may aid in avoiding a low quality of life (Stratton et al., 2006), increased morbidity (Norman et al., 2008) and mortality of the elderly (Sorensen et al., 2008). Inadequate assessment and of senior

citizens' nutritional status by health professionals in a general practitioner's office may have a major impact on the development of malnutrition after their admission to institutional care or hospital. Despite the high prevalence of malnutrition in elderly inpatients, its recognition and subsequent monitoring are often inadequate (Adams et al., 2008). Some authors point to the fact that the situation in community care is similar to that in hospitals, as manifested by poor detection of malnutrition and organization of care. For example, a Dutch study of outpatients (n = 2,288) showed that only 17% of severely malnourished persons and 4% of those at a moderate risk for malnutrition received adequate nutritional therapy and care (Meijers et al., 2009).

Nutritional status is a complex concept that may be assessed with various methods involving deficiency signs and symptoms or manifestations of excessive nutrition. In order to adequately plan nutritional support in a patient, their nutritional status must be correctly assessed. Volkert et al. (2006) stress that nutritional screening must be routinely performed in all patients, with the aim of early detection of the risk for malnutrition. Early recognition of malnutrition allows for timely interventions (Stanga, 2009).

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Nutritional screening is a rapid and simple tool for assessing patients at risk for malnutrition. Kondrup et al. (2003) and Meier (2006) claim that nutritional status must be identified in all patients. Therefore, recommendations have been developed to perform nutritional screening. All patients must be screened to identify their potential nutritional risk so that unnecessary depletion is avoided. Ideally, screening should be initiated in a community care facility and repeated upon admission to an institution. Screening tools detect malnutrition and/or predict whether it is likely to develop or worsen (Kondrup et al., 2003).

Routine screening of patients identified to be at risk for malnutrition was recommended by many national, international and professional organizations (British Dietetic Association, 1999; British Association for Parenteral and Enteral Nutrition, Department of Health, 2001; Council of Europe, 2002; Royal College of Physicians, 2002; European Society of Parenteral and Enteral Nutrition, NHS Duality Improvement Scotland, 2003).

Many validated tools have been successfully used to detect malnutrition in clinical practice (Meier, 2006), including the Mini Nutritional Assessment (Guigoz, Vellas, Garry, 1996), Malnutrition Universal Screening Tool (Elia, 2003) and Mini Nutritional Assessment – Short Form (Rubenstein et al., 2001).

Aim

The study aimed at determining the nutritional status of senior citizens in a general practitioner's office.

Methods

Design

A cross-sectional study.

Sample

The study comprised 241 responders (78 males and 163 females). The sample was characterized by the following data: gender, age, medical diagnosis and body mass index (BMI). The main criteria for purposive sampling of the elderly were age (≥ 65 years), informed consent, good cognitive status (a MMSE score of 21 or more points) and being registered with a general practitioner.

Data collection

The study was carried out between October 2013 and October 2014. All nutrition assessment tools were tested during patients' visits to their general practitioners' offices in the city of Ostrava. When obtaining anthropometric data, the rule (Jurášková et al., 2007) was followed that outside a laboratory, measurements may be taken with subjects wearing

minimal clothing. When measuring weight and height, precautions were taken to ensure the safety of participants, in particular those having problems with stability and mobility.

Nutritional assessment of seniors older than 65 years of age was carried out using the following tools:

The *Mini Nutritional Assessment* (MNA) consists of 18 items in 4 domains:

1. *anthropometric measurements* – four items including weight, height, mid-arm circumference and calf circumference;
2. *diet information* – six questions on the number of full meals per day, types of foods eaten, fluid consumption or need for assistance with feeding;
3. *general status* – six questions on independence, number of prescription drugs, mobility, mental status, skin sores and the presence of serious illness in the last three months; and
4. *subjective assessment* – questions on the person's own perception of health and nutrition.

Each item is assigned a weighted score. The total score ranges from 0 to 29 points. A score of 24 or more points indicates that the person is well nourished while 17 to 23.5 points indicate a risk for malnutrition. Less than 17 points suggest malnutrition (Guigoz, Vellas, Garry, 1996).

The *Malnutrition Universal Screening Tool* (MUST) is composed of three clinical parameters, each being assigned 0, 1 or 2 points. The first parameter is BMI which is assessed as follows: BMI $> 20 \text{ kg/m}^2 = 0$ points, BMI $18.5\text{--}20.0 \text{ kg/m}^2 = 1$ point, BMI $< 18.5 \text{ kg/m}^2 = 2$ points. Another parameter is weight loss over the last 3–6 months, with 0 points for a loss of less than 5%, 1 point for 5–10% and 2 points for more than 10%. The last parameter is acute disease effect. Two points are added to the total score if there is no nutritional intake or likelihood of no intake for more than 5 days. Patients with a total score of 0 points are at a low risk for malnutrition (Elia et al., 2003).

The *Mini Nutritional Assessment – Short Form* (MNA-SF) comprises only 6 items from the original MNA. Those are concerned with food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and BMI. Specifically, there are questions about the patient's loss of appetite, digestive problems, chewing/swallowing difficulties, weight loss, psychological stress or acute disease in the last 3 months, as well as their mental state and BMI. Each item is scored, with the total score ranging from 0 to 14 points. Twelve or more points indicate normal nutritional status; persons with scores of 11 or less are at risk of malnutrition and need further examinations to assess their nutritional

status. It takes less than 3 minutes to perform the assessment (Rubenstein et al., 2001).

Prealbumin measurement is able to reveal the risk of malnutrition at a time when albumin levels are still normal. Thus, prealbumin is considered a suitable marker for nutritional status monitoring. The biological half-life is 1.5 to 2 days. Prealbumin levels are influenced, for example, by physiological stress due to injury or inflammation. The reference value ranges from 0.25 to 0.45 g/l (Klener et al., 2006).

Transferrin binds iron and controls the release of iron into the circulation. Its biological half-life is 8 to 12 days. The plasma concentration of transferrin is between 2.0 and 3.6 mg/l (Zadák, 2002).

C-reactive protein (CRP) is one of the most important acute-phase reactants. The plasma concentration of this protein is increased as early as 4 hours after the reaction is induced. Peak concentration is reached after 24–48 hours, with the half-life being approximately 24 hours. The normal CRP concentration is 0.0–4.0 mg/l (Klener et al., 2006). Increased CRP concentration (> 10 mg/dl) may suggest the presence of physiological stress and subsequent delay of prealbumin production.

Data analysis

The significance of differences in selected nutritional markers for various groups was determined using a chi-squared test, Spearman's correlation coefficient and Fisher's test at a critical statistical significance level of 0.05. The data were analyzed and processed with MS Excel and Stata v. 13.

Results

The sample comprised 241 senior citizens registered with a general practitioner, of whom 78 were males (32%) and 163 were females (68%), see Table 1.

The participants were distributed into age groups as follows: young seniors (65–69 years of age; 86 persons, 35%), old seniors (70–74 years; 86 persons, 35%) and very old seniors (75 years or more; 69 persons, 30%). The mean age of both males and females was 72 years.

A total of 179 participants (74%) had cardiac disease and 10 persons (4%) had respiratory disease. Another 47 seniors (20%) had metabolic disease and 5 individuals (2%) had cancer.

Based on WHO recommendations and nutritional recommendations for the elderly (Topinková, 2005), the participants were classified into the following groups: underweight (BMI = 18.4 kg/m² or less; no persons, 0%), normal weight (18.5–24.9 kg/m²; 48 persons, 20%), overweight (25.0–29.9 kg/m²; 104

persons, 43%), class I obesity (30.0–34.9 kg/m²; 59 persons, 25%) and class II obesity (35.0 kg/m² or more; 30 persons, 12%).

A total of 119 persons (49%) had lower than normal levels of prealbumin. A half of the sample (121 seniors) had normal prealbumin concentration and only one person had an increased prealbumin level. Transferring levels were normal in 224 persons (93%), low in 13 (5%) and high in 4 (2%) seniors.

The sample comprised 167 individuals (67%) with normal and 80 (33%) with elevated CRP.

Table 1 Demographic characteristics of patients

	n (%)
Gender	
males	78 (32)
females	163 (68)
Mean age (years)	
sample	72
Age	
65–69 years	86 (35)
70–74 years	86 (35)
75 years or more	69 (30)
BMI (kg/m²)	
18.5–24.9	48 (20)
25–29.9	104 (43)
30–34.9	59 (25)
35 or more	30 (12)
Medical diagnosis	
cardiac disease	179 (74)
respiratory disease	10 (4)
cancer	5 (2)
metabolic disease	47 (20)
MNA	
well-nourished	24 (10)
at risk	199 (83)
malnourished	18 (7)
MNA-SF	
well-nourished	102 (42)
malnourished	139 (58)
MUST	
low risk	210 (87)
moderate risk	9 (4)
high risk	22 (9)
Prealbumin	
< 0.25	119 (49)
0.25–0.45 g/l	121 (51)
> 0.45	1 (0)
Transferrin	
< 2.00	13 (5)
2.00–3.60 mg/l	224 (93)
> 3.60	4 (2)
CRP	
0.0–4.0	161 (67)
> 4.0	80 (33)

Nutritional status and age

The study showed no statistically significant differences in the participants' nutritional status with respect to age (Table 2). None of the tools (MUST, MNA and MNA-SF) confirmed differences when comparing the age groups 65–69, 70–74 and 75+.

Comparison of MUST, MNA, MNA-SF, BMI and laboratory markers of nutrition

The results, as presented in Table 3, showed statistically significant correlations between the tools, BMI and biochemical markers of nutrition. Specifically, the higher BMI, the higher MNA score and the better nutritional status. In case of the MUST, however, an inverse relationship was found between

the score and BMI, that is, the lower MUST score, the higher BMI.

As seen from the table, there were statistically significant correlations between all tools used in the study. While there were moderate correlations between the MUST and MNA-SF ($r = -0.4967$) and between the MUST and MNA ($r = -0.4118$), the MNA and MNA-SF were strongly correlated ($r = 0.7819$).

No statistically significant correlations were found between nutritional status determined by the tools and biochemical markers of nutrition.

Table 2 Comparison of MNA, MUST and MNA-SF scores by age (Fisher's test)

Test	Nutritional status	Age			F	p-value
		65–69 years	70–74 years	75 years or more		
		n	n	n		
MNA	well nourished	11	9	4	2.126	0.345
	malnourished	75	77	65		
MUST	well nourished	75	74	61	0.197	0.909
	malnourished	11	12	8		
MNA-SF	well nourished	42	37	23	3.796	0.150
	malnourished	44	49	46		

F – test criterion

Table 3 Correlations between MNA, MUST, MNA-SF, BMI and laboratory markers of nutrition (Spearman's correlation coefficient)

Parameters studied	BMI	MNA	MNA-SF	MUST	Prealbumin	Transferrin
BMI	1.000					
MNA	0.265*	1.000				
MNA-SF	0.118	0.781*	1.000			
MUST	-0.172*	-0.411*	-0.496*	1.000		
Prealbumin	0.055	0.120	0.106	-0.073	1.000	
Transferrin	0.165	0.100	0.069	-0.037	0.124	1.000
CRP	0.366*	0.031	-0.027	0.117	-0.277*	-0.004

Discussion

The present study, aimed at determining the nutritional status of senior citizens in a general practitioner's office, revealed malnutrition in a relatively high proportion of the elderly, ranging from 13% to 90% depending on the tools used. The findings are consistent with those from other studies suggesting prevalence as high as 90% in community care (Ferdous et al., 2007; Kozáková, Jarošová, Zeleníková, 2012; Cereda et al., 2016). Some authors point to the fact that the situation in community care is not very good, as manifested by poor detection of malnutrition and organization of care. For example, a Dutch study of outpatients ($n = 2,288$) showed that only 17% of severely malnourished persons and 4% of those at a moderate

risk for malnutrition received adequate nutritional therapy and care (Meijers et al., 2009). Adequate nutrition of the elderly is a prerequisite for faster convalescence and return to a normal life, as confirmed, for example, by studies by Caccialanza et al. (2010) or Lobo Támer, Ruiz López, Pérez de la Cruz (2009). In the present study, nutrition assessment tools showed significant differences when identifying patients as malnourished or being at risk for malnutrition. The MNA found 10% of well-nourished seniors, 83% at risk of malnutrition and 7% malnourished. The MUST detected malnutrition in 9%, moderate risk in 4% and good nutritional status in 87% of the elderly. The MNA-SF showed no risk of malnutrition in 42% of participants and nutritional disorders in the remaining 58%.

The differences in distribution may be explained by different criteria for classification of malnutrition used by the tools. The three instruments used (MNA, MNA-SF, MUST) were developed for specific populations and care settings (Elia et al., 2003). It means that not all persons identified as being at risk of malnutrition are in the same part of the malnutrition spectrum. The above differences are of considerable clinical significance as assessments carried out with these tools may lead to various results in the same group of subjects. Although malnutrition affects all age groups, older age is considered as one of the main risk factors (Feldblum et al., 2009; Cabella, Conda, Gamera, 2011). However, malnutrition is not an inevitable side effect of ageing as it is influenced by many factors associated with the process of becoming older. This may contribute to loss of appetite or changes in nutritional intake and lead to the development of malnutrition. The present study failed to confirm that the prevalence of malnutrition increases with age as no significant correlation was found between age and malnutrition. In none of the categories, significant differences between the tools (MNA, MNA-SF, MUST) and seniors' age were not observed. Similar results were reported in a study by Russell, Elia (2009) that showed only minimal differences in the prevalence of malnutrition with respect to age. The study found malnutrition in 33% of persons under 70 years of age, 31% of those aged 70 to 84 and 33% in individuals older than 85 years. Similar results were reported by Smoliner et al. (2009) assessing the impact of age, gender, depression and self-caring capacity on the development of malnutrition. The study found that the only risk factor for malnutrition was depression. On the other side, numerous studies (e.g. Pirlich et al., 2005; Luchinn et al., 2009) detected higher prevalence rates of malnutrition in those over 65 years of age than in younger individuals. The differences were twice as large in the elderly (30%) as in younger patients (13%). This is consistent with a study by Lamb et al. (2009) showing the effect of age on the prevalence of malnutrition. The condition was detected in 20.6% of those under 60 years of age, 29.7% in the 60–79 age category and in 39.4% in persons aged 80 or older. According to Buffa et al. (2010), individuals most at risk of the development of malnutrition are those aged 70 to 79 years. Other authors (e.g. Burgos et al., 2012) concluded that the age of 65 or more may be one of the risk factors for malnutrition.

Of all anthropometric measurements, BMI is the simplest and most frequently used parameter of nutritional status. In the present study, BMI values

did not suggest malnutrition in any of the participating seniors. According to Cook et al. (2005), screening tools for nutritional assessment usually include BMI which is considered the golden standard for detecting malnutrition at a younger age; however, the index is not recommended for screening of the elderly. Although BMI may be a suitable tool for nutritional assessment in population studies it may mask significant changes in body weight, leading to a misdiagnosis of a nutritional problem (Cook et al., 2005; Lelovics et al., 2008). An Italian study by Langiano et al. (2009) concluded that nutritional assessment of the elderly should not be based merely on BMI values. This was confirmed by a Finnish study of 1,043 senior citizens assessed with the standardized MNA revealing malnutrition in 56.7% of the subjects while nurses estimated malnutrition in only 15.2% of the elderly based on visual assessment and BMI. Only anorectic patients were visually identified as malnourished (Kubešová, Weber, 2008). The present study found statistically significant correlations between the MNA, MUST and BMI. Specifically, the higher BMI, the higher MNA score and the better nutritional status ($r = 0.440$). In case of the MUST, however, an inverse relationship was found between the score and BMI, that is, the lower MUST score, the higher BMI. This is consistent, for example, with findings reported by Pereira Machado, Santa Cruz Coelho (2011).

Serum albumin and transferrin levels are considered as markers of nutritional status (López-Contreras et al., 2012). Unlike albumin, prealbumin is thought to be a more sensitive marker (Çelik et al., 2011) given its short half-life and the fact that its serum concentration is closely associated with frequent changes in nutrition and its values are changed depending on nutritional support (Devoto et al., 2006). Prealbumin tests are beneficial mainly because they are capable of detecting at least 50% of patients at risk of malnutrition at a time when albumin levels are still normal. The present study comprised 49% of individuals with lower-than-normal levels of prealbumin. The majority of senior patients (51%) had normal albumin concentrations. In the elderly, repeated prealbumin tests are used to evaluate the adequate intake of nutrients over time (Dennis et al., 2008). The present study failed to confirm significant correlations between malnutrition and prealbumin levels. This may be explained by the fact that prealbumin was only measured on a single occasion which may be a limitation as some authors claim (Shenkin, 2006). Nutritional status would be better interpreted using at least two measurement carried out 3 to 5 days apart from each other, allowing

assessment of trends in the development of both prealbumin and CRP levels. Other findings were reported by Sergi et al. (2006) concluding that malnutrition lowers the mean concentrations of both prealbumin and other visceral proteins with the exception of transferrin.

Another point is the role of transferrin in detecting malnutrition in the elderly. The present study revealed normal transferrin levels in 93% of participants and thus failed to show differences in transferrin levels between malnourished and well-nourished seniors. This is consistent with studies by Sergi et al. (2006) and Santosa et al. (2004). According to Huckleberry (2004), transferrin concentrations are considerably lowered in severely malnourished patients but seems to be a less reliable marker in the initial phases of malnutrition, with relatively low specificity and sensitivity. Similar findings were reported by Sergi et al. (2006) who confirmed that visceral proteins other than transferrin may be important markers of nutrition. Other authors prefer prealbumin to transferrin or albumin as a more suitable marker of malnutrition (Chrysostomou et al., 2010).

Conclusion

Senior citizens with malnutrition are relatively frequently encountered in a general practitioner's office. The study showed a high prevalence of malnutrition in patients receiving community care. If not recognized and treated in time, nutritional disorders affect their independence, prolong their hospital stay and considerably increase treatment costs. In the general practice setting, nutrition of the elderly must not be neglected as adequate nutrition is a prerequisite for faster convalescence and return to a normal life.

Ethical aspects and conflict of interest

Each participant was individually informed about the purpose of the study to obtain their consent and any questions were answered. It was also explained to the participants that measurements were painless, not unpleasant, voluntary and anonymous. In those who gave informed consent, measurements and questionnaire survey were carried out. In all cases, health professionals working in the participating facilities were also informed about the study. The study protocol was performed in accordance with The Declaration of Helsinki. The survey was a part of a diploma thesis at the University of Ostrava. The authors are not aware of any conflict of interest.

Author contribution

Concept and design (RK, LH, RZ), data collection (LH), analysis and interpretation of data (RK, LH), the drafting of the manuscript (RK), a critical revision of the manuscript (RK, RZ), the final completion of the article (RK, RZ).

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