Comparison of three screening tools for nutritional status assessment of the elderly in their homes

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Background. The prevailing recommendation for the elderly is to live in their own homes as long as conditions allow. With this emphasis on the natural living environment, it is imperative to closely monitor both the general health and nutritional needs of the elderly in community settings.
Aim. The aim of the study was to compare three nutritional status screening and evaluation tools of the elderly in their homes.
Methods. Testing of measuring instruments, MNA, SGA, and MUST took place in the homes of 120 seniors in selected areas of the Czech and Slovak Republics. The study included 120 seniors. For testing of the relationships and dependencies, Pearson's correlation coefficient, t and Fisher tests were used. The level of statistical significance was $\alpha = 0.05$.
Results. All tests were to a large degree correlated ($p_{MNA} = 0.0049$; $p_{MUST} = -0.537$; $p_{SGA} = -0.578$) with the body mass index of the seniors. Simultaneously, it was confirmed that the tools for assessing nutritional status in the study showed significant differences regarding the classification of patients at risk of malnutrition and/or malnourished patients.
Conclusions. Based on the findings, we conclude that MNA appeared to be a more appropriate tool for nutritional assessment of the elderly living in their homes. SGA and MUST provided rather subjective evaluation of the nutritional status and did not furnish an in-depth categorization of malnutrition.

Key words: nutrition, home care, elderly over 65 years of age, Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), Malnutrition Universal Screening Tool (MUST)

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INTRODUCTION

The quality of nutrition in the elderly exerts significant influence on their overall functional status. Advanced age is associated with increased incidence of impaired nutrition, especially undernourishment. Population study results aimed at the elderly show an elevated risk of nutritional impairment in as many as 65 percent of the elderly in their homes and 90 percent of hospitalised inpatients/care facility residents in the same age group[1,2]. The European SENECA study involving a cohort of independently living elderly citizens has shown that nutrition-related weight loss is associated with a significantly higher mortality rate than persons with stable or mildly increasing weight[3]. Decreased food intake may be the result of a multitude of factors. In some cases, physical illness is the factor; however, causes may also include disability, age-related physiological changes, and psychological as well as psychosocial variables[3,4]. These factors may result in inadequate nutrition and subsequently impaired functional status[5,6], together with increased morbidity and mortality[7,8]. The functional consequences of malnutrition often lead to social isolation and higher levels of dependence which decrease the overall quality of life[8,9].

Currently, the prevailing recommendation for the elderly is to live in their own homes as long as conditions allow. With this emphasis on the natural living environment, it is imperative to closely monitor both the general health and nutritional needs of the elderly in community settings. The best-known and most widely recommended[10,11] tools for nutritional status assessment include the MNA (Mini Nutritional Assessment[12]), SGA (Subjective Global Assessment[13]) and MUST (Malnutrition Universal Screening Tool[14]) In the Czech Republic, the knowledge necessary for the implementation of such assessment tools is limited. Hence, the data on nutritional status of the elderly living in their homes is scarce. The goal of the study was to compare three screening and evaluation tools of the nutritional status of the elderly in their homes.

MATERIALS AND METHODS

Sample and Setting

Of 160 elderly people (from two Czech home care agencies and two Slovak home care agencies) addressed by the researcher, a total of 120 agreed to participation in the study, equalling a 75% return rate. Czech (n=60) and Slovak (n=60) elderly individuals aged 65 and over were assessed from May 2009 to January 2010. The main inclusion criteria were age (≥65 years), informed consent, living on their own in their own homes and ability to

cooperate. The main exclusion criterion was severe cognitive impairment.

Design

The study was conducted under the ethical standards of the Declaration of Helsinki. Written informed consent was obtained for each subject. All members of staff in home care agencies were informed of the study. The study focussed on three measuring tools targeting nutritional status of persons aged 65 and over who live by themselves in their own homes. The instrument was composed of two parts. Part one of the measuring instrument elicited the following characteristics: age, sex, nationality. Part two comprised three assessment tools: MNA, SGA, MUST. **Mini nutritional assessment (MNA)** is a measuring tool specifically created for seniors[15]. It consists of questions and measurements grouped into four areas: (1) anthropometric assessment (weight, height, mid-arm circumference, calf circumference, weight loss), (2) general assessment and screening (six questions related to mobility, independence level, presence of acute disease, pressure sores/skin ulcers, neuropsychological impairment, psychological stress and medication/multiple prescription drug use), (3) items related to dietary habits and food intake (eight questions regarding food and fluid intake as well as eating capacity), (4) self-assessment of health and nutritional status (two questions). A weighted score is assigned to each question/item. The total score is the sum of screening and assessment scores and ranges from 0 to 29 points. Results exceeding 23.5 points correspond to a normal, adequate state of nutrition in healthy individuals. Scores ranging 17 to 23.5 points are indicative of persons at risk of nutritional impairment, and values below 17 points strongly suggest a state of malnutrition[12]. MNA considers domains that are not directly connected to food intake, yet are fundamental for older feeble seniors in terms of mobility, depression and dementia. However, the disadvantage of this tool is the inability of patients with dementia to answer some questions on their own. Further, MNA cannot be used with patients receiving enteral nutrition, for example percutaneous endoscopic gastrostomy[16,17]. **Subjective global assessment (SGA)** yields three rating scores – medical history, physical examination and overall SGA rating. The medical history sub-section investigates weight change, change in dietary intake, gastrointestinal symptoms and functional capacity. The physical examination sub-section focuses on subcutaneous fat, muscle wasting, ankle oedema/sacral area oedema, and ascites. SGA questionnaire items are not numerically scored as they are based on subjective observations. Following the medical history and physical examination sections, the overall rating (Subjective Global Assessment) categorizes patients into Group A (adequate nutrition), Group B (actual or suspected borderline/ mildly impaired nutrition) or Group C (inadequate nutrition, malnutrition[13]). The advantage of SGA is its easy applicability and ability to grade malnutrition. On the other hand, disadvantages include the required theoretical and practical skills for patient assessment as well as the fact that it was not specifically designed for seniors[19]. Short-term training is recommended for examiners before they routinely apply this test because the final evaluation is affected by the amount and depth of examiner's clinical experience. Provided that the examiner is well experienced and patients furnish true data on their recent physiological status, then such nutritional status of a patient can be viewed as accurate[19].

Table 1. Characteristics of sample population and results of assessment tool data.

Sex (n)	females	59 (49.2%)
	males	61 (50.8%)
Mean age (years)	complete set	73.24
	females	71.06
	males	73.67
Nationality	Slovak	60 (50%)
	Czech	60 (50%)
Mean BMI (kg/m^2)	complete set	24.32
	females	23.56
	males	25.36
MNA	adequate nutrition	38 (32%)
	risk of malnutrition	40 (33%)
	malnutrition	42 (35%)
SGA	A	74 (62%)
	B	35 (29%)
	C	11 (9%)
MUST	low risk	83 (69%)
	moderate risk	16 (13%)
	high risk	21 (18%)

n = number of patients/absolute frequency

Malnutrition universal screening tool (MUST) is composed of three clinical parameters rated 0, 1 and 2. The first parameter is BMI with the following rating scores: BMI ≥ 20.0 = 0 points, BMI 18.5 – 20.0 = 1 point, BMI <18.5 = 2 points. The second parameter is weight loss within the last 3 to 6 months. If weight loss is less than 5 percent, the score is 0. For weight loss ranging 5-10 percent the score is 1, and a weight loss exceeding 10 percent of baseline carries the score of 2. The third parameter scores acute disease effect. 2 points are added in the case of acutely ill patients with no nutritional intake or likelihood of no nutritional intake for more than 5 days. A total patient score of 0 indicates a low risk of undernutrition. In a hospital care setting it is recommended to re-assess low-risk patients on a weekly basis. According to the guidelines, low-risk home residents should be re-assessed monthly and community residents annually. 1 point is indicative of a moderate risk of undernutrition and patients should be monitored for dietary and fluid intake for at least three days. The same measure should be applied

Table 2. Comparison of BMI with assessment test results (Pearson's correlation test).

Tool	malnutrition	mild nutritional	normal weight	overweight	obesity	r
BMI	<18 points	18–20 points	20–25 points	25.5–30 points	over 30 points	
MNA	15	26	36	30	13	0.5502
SGA	10	4	63	30	13	-0.578
MUST	11	24	42	30	13	-0.537

r = Pearson's correlation coefficient

Table 3. Mutual comparison of MNA, SGA and MUST.

MNA	adequate nutrition	risk of malnutrition	malnutrition	Total	
MUST	n	n	n	n	r
Low risk	36	34	13	83	
Moderate risk	1	4	11	16	**0.5954**
High risk	0	2	19	21	
Total	37	40	43	120	

MNA	adequate nutrition	risk of malnutrition	malnutrition	Total	
SGA	n	n	n	n	r
A	36	28	10	74	
B	1	12	22	35	**0.6241**
C	0	0	11	11	
Total	37	40	43	120	

MUST	low risk	moderate risk	high risk	Total	
SGA	n	n	n	n	r
A	68	6	0	74	
B	15	10	10	35	**0.7598**
C	0	0	11	11	
Total	83	16	21	120	

n = absolute frequency, r = Pearson´s correlation coefficient

to home and community care with re-assessment every month (home care) and every 2-3 months (community care), respectively. Scores of 2+ points strongly suggest an increased risk of undernutrition. Dieticians and nutritional specialists should be consulted in hospitals as well as home care[14], and the re-assessment intervals should be shortened. This test is easy to perform, but it does not include items for the seniors' functional level assessment. It overly focuses on acute illnesses and therefore it is less applicable in long-term care[19].

The MNA test was translated into the Czech language by Topinkova and published in 2003 (ref.[22]). Permission for the use of the Czech version of MNA test was obtained for the purpose of this study. The other two tests SGA and

MUST were translated by two independent translators. A second interpretator provided the back-translation to ensure accuracy. One of the researchers obtained permission for the use of the SGA and MUST tests from the authors. The latter recruitment was preceded by a request for permission submitted to the institution management.

Data collection

The tests were carried out during regular home visits by researcher nurses who were trained beforehand to properly administer the tests to guarantee the validity of all results. During the first home visit participants were informed about the purpose of the study. The researcher nurse explained to all participants that measuring was painless, not unpleasant; it was completely voluntary and anonymous. The participant content was obtained and his/her questions were answered. During the second visit, the researcher obtained the data and conducted the measurement. For weighing, the patient wore light indoor clothes and no shoes. BMI was calculated later by the research group. The safety of the elderly was ensured during measuring and weighing, especially those, who had problems with instability. All measurements used the same calibrating weight and meter. Weight and height measurements were taken wherever clinically applicable. As bed-ridden patients could not be weighed, the BMI was calculated according to Tomíška[16] where appropriate. Height measurements were taken of all participants except for individuals confined to bed. In the latter case, the estimated height formula was applied to patients who did not know how tall they were[17]. Completing an instrument including measurements lasted approximately 30 min. The information and data were immediately recorded into instruments.

Data Analysis

Statistical analysis was performed using the SPSS software Version 17.0. The Pearson correlation coefficient, t-test and Fisher´s test were applied as correlation, association and significance measures. The data were evaluated at a significance level of $\alpha = 0.05$.

RESULTS

Population characteristics

The sample of 120 seniors consisted of 61 males (51%) and 59 females (49%) with a mean age of 73.40 years (73.67 for males, 71.06 for females). Mean BMI value for the whole sample was 24.32. 51 seniors had an BMI within the normal range, 30 were overweight, 13 were obese and 26 showed signs of malnutrition. The BMI stratification categories applied were in compliance with WHO recommendations[15].

Nutritional assessment scores by nationality

The results suggest that the only measure indicating better nutritional status of the Czech seniors compared to the Slovak ones was SGA. The SGA test showed a statistically significant difference at the significance level of 0.05 ($P = \mathbf{0.0471}$*). In order to render it more accurate, it is necessary to increase the sample size. The results may be influenced by subjectivity of nutrition status evaluation. No statistically significant relationships were identified for the MNA and MUST tests. Since no significant differences between the Czech and Slovak data subsets were found. Further relationships were tested for the undivided data set of n = 120.

MNA, MUST, SGA test results

Comparison of MNA, MUST and SGA test results showed the following differences. The MNA placed 38 seniors in the adequate nutrition range, 40 seniors at risk of malnutrition and 42 in the malnutrition range. The SGA put a majority (74 clients) in the A class (SGA A, adequate nutrition), 35 seniors in the B class (SGA B, moderate malnutrition) and 11 seniors in the C lass (SGA C, severe malnutrition). Corresponding results for the MUST test assigned a majority of 83 seniors to the low-risk group, 16 seniors to the moderate risk group and 21 seniors to the high risk for malnutrition group.

Comparison of MNA, MUST, SGA with BMI values

Results for all three assessment tools used in the study yielded significant relationships toward the BMI.

There was a significant correlation between BMI and the assessment tool results (r = -0.537 for MUST and r = -0.578 for SGA). The association values as expressed by correlation coefficients are of medium range for all tests used.

Mutual comparison of MNA, SGA and MUST

Statistically significant relationships were demonstrated by mutual comparison of the nutritional status assessment tools. The results are based on the Pearson´s correlation coefficient and were statistically significant in all cases.

All the assessment tools used were mutually correlated in direct proportion. Correlation values for the MNA/MUST tests (r = 0.5954) and MNA/SGA tests (r = 0.6241**)** reached medium level while the correlation value for the MUST/SGA tests (r = 0.7598**)** was very high.

DISCUSSION

The objective of this study was to compare three screening and evaluation tools for the nutritional status of seniors – MNA, SGA and MUST. 120 senior citizens living in their homes participated in the study. All three tools had been established by the authors as reliable methods for easy evaluation of patient nutritional status. Unlike the SGA and MUST tests, MNA primarily targets seniors[10]. It showed more patients at risk of malnutrition or already malnutritioned than the SGA test[16]. Our data show that the results are valid when the MNA test is compared with MUST.

Another interesting finding is that of Langiago et al.[22]. These authors assessed patient nutritional status by comparing the BMI and MNA scores. The prevalence rates of

malnutrition and normal weight, respectively, were established at 6.3% and 30.8% with the BMI count. In contrast, the MNA test results led to classifying 13% of respondents as malnourished and 66% at risk of malnutrition. These figures strongly suggest that nutritional assessment in the elderly should not be based solely on BMI. The MNA scale appears to be a more appropriate tool for complex evaluation of nutritional status.

Further evidence supports this finding. Suominema et al.[23] in a study of 1 043 seniors using the standardized MNA test, identified malnutrition in 56.7% of the elderly population, whereas the one based on nurse visual inspection estimates and BMI count determined a malnutrition rate as low as 15.2%. In reality, nurse estimates limited the malnutrition diagnosis to anorexic patients only with a BMI below 17.2 kg/m^2. Beck[24] reports that in hospitalized patients with non-cancer conditions and a BMI less than 20 there is an increased mortality rate within one year. In contrast, the lowest mortality rate in the elderly was reported for those with a BMI exceeding 25. This study indicates that an ideal body weight range for the elderly is a BMI from 24 to 29, not 21 to 25.

Some authors point out that MNA is not a proper tool for patients who are unable to reliably assess their status such as people suffering from dizziness, advanced dementia, serious after-stroke symptoms or acute illnesses[26]. Such patients have frequently been excluded from previous studies which examined clinical levels of MNA (ref.[16,17]). MNA thus appears to be a more appropriate method in the case of patients in outpatient care. Correct evaluation of MNA tests can become increasingly difficult with patients in institutionalized facilities due to decreased level of patient's own evaluation skills and of caretakers' willingness to participate in these tests[27].

The tools used in our study to evaluate nutritional status showed statistically significant discrepancies when it comes to classification of patients at risk of malnutrition or already malnourished. This most likely occurred due to application of different criteria for such classification in respective tests, and also because of changing emphasis on specific criteria. From the clinical point of view, these discrepancies are of significant importance because treatments based on different categorization of patients at risk of malnutrition or apparently already malnourished can result in different conclusions in the case of the same patients[10]. For instance, the VA study in 1991 showed that the SGA test yielded unfavourable results compared to the ones of the NRI (Nutritional Risk Index) test[28].

Ozturk et al.[26] conducted a study which focused on detection of malnutrition levels using the SGA questionnaire. The study involved a total of 603 inpatients of whom 91% were identified as adequately nourished, 8.3% as moderately undernourished and only 0.4% as severely undernourished. Compared to the NRS 2002 questionnaire the results showed statistically significant differences. Another study[10] evaluated undernutrition using the SGA and NRS (Nutrition Risk Screening) tests. The discrepancies between the two tests were minimal – the SGA test detected undernutrition in 40.7% of patients, the NRS in 45.1%. The Swiss population study[20] aimed at sensitivity and specificity of NRI, MUST and NRS 2002 compared to SGA in 995 inpatients revealed some interesting findings. The NRI showed medium to high nutritional risk in 25% of patients, the NRS 2002 in 28% of patients and the MUST test in 37% of patients. The SGA test classed 39% of patients as moderately to severely undernourished. The sensitivity and specificity values of the NRI test equalled 43.1% and 89.3%, the corresponding values for MUST were 62.1% and 78.6%, and for NRS 2002 were 62.0% and 93.1% (ref.[10]). Validation of the MNA questionnaire provided proof of high sensitivity (98.9%), specificity (94.3%) and diagnostic precision (97.2%) in patients at risk of malnutrition[25].

In view of the proven results of the MNA test, this test should be the best for geriatric patients. The test is valid for the elderly in community, long-term and acute care in cases when needed information for test evaluation can be retrieved in a reliable way.

CONCLUSIONS

The prevalence of nutritional impairments in the geriatric population is relatively high. According to available guidelines[17], the recommendation is to screen for impaired nutritional status using assessment tools in the general elderly population during regular preventive check-ups, as well as in all elderly inpatients hospitalized for acute illness and before their transfer to long-term care facilities. Appropriate hydration and nutrition should constitute an integral part of quality care both with inpatients and independently living seniors.

Our measurements confirm that the Mini Nutritional Assessment (MNA) is the most valuable instrument for nutritional assessment of the elderly in their homes due to its ability to provide dynamic data on this population. The Subjective Global Assessment (SGA) and Malnutrition Universal Screening Tool (MUST) tests tend to be more subjective and less sensitive toward categorization of malnutrition. This study is rare and unique from the point of evaluating levels of nutrition in the Czech Republic. The study is limited by the small sample size and the use of the selected regions for data collection. With those limitations in mind, the following recommendations for further research are made. It is highly recommended that further research with more respondents be undertaken to verify our results and to determine tools for the best possible assessment of nutrition levels of seniors.

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