Determinants of nutritional status of older people in long-term care settings on the example of the nursing home in Białystok

Wojszel ZB*

Department of Geriatrics, Medical University of Białystok, Poland

Abstract

Purpose: The aim of the study was the assessment of the nutritional status of older people living in the chosen long-term care setting in Poland as well as the determinants having an effect on the nutritional status of the examined subjects.

Materials and methods: The subjects included older residents (aged 65 years and older) of the nursing home for the somatically ill adults in Bialystok. The MNA-Mini Nutritional Assessment test was used as an assessment tool to detect nutritional risk. The assessment included elements of clinical and functional evaluation (Katz Index, Instrumental Activities of Daily Living (ADL) scale, Geriatric Depression Scale, Abbreviated Mental Test Score, Norton scale and mobility scale).

Results: One hundred out of the 109 persons fulfilling the age criterion were examined. We found that 12% of them were malnourished, 61% were at risk of malnutrition and 27% were well nourished according to the MNA test. Malnutrition affected more often persons having difficulties with chewing, ADL dependent, with limited mobility, suspected of dementia, having suffered from cerebral stroke and who lived with other people coming to the nursing home. The risk of malnutrition was observed significantly more often in individuals suspected of depression and living in urban area before nursing home placement. The significant determinants of lower scores of MNA in the regression analysis were: suspected depression, IADL dependency, limited mobility, female gender and higher number of drugs.

Conclusions: The study has confirmed that malnutrition remains a common problem among older people living in nursing homes. Malnutrition is an increasing hazard especially for women, for people taking higher number of drugs and for those with different mental and physical disabilities.

Key words: malnutrition; older people in nursing home; Mini Nutritional Assessment.

Introduction

Aging does place individuals at a greater nutritional risk [1,2] but the prevalence of malnutrition reaches significant levels first of all in elderly patients who are in hospitals or who live in nursing homes [3]. The prevalence of protein-energy malnutrition in nursing home residents ranges from 23 to 85% [4]. Poor nutritional status is related to increased morbidity, and malnutrition is associated with an increased incidence of morbidity and mortality [5].

The diagnosis of protein-energy malnutrition in elderly populations is difficult. There is no generally accepted "gold standard" for diagnosis and precise nutritional assessment is difficult in everyday clinical practice [6,7]. A brief nutritional assessment test such as the Mini Nutritional Assessment (MNA) could be an effective way of screening patients who are undernourished. The aim of the MNA is to evaluate an individual's risk of malnutrition so as to permit early nutritional intervention when necessary [8].

The aim of the study was the assessment of the nutritional status of older people living in the chosen long-term care setting in Poland as well as the determinants having an effect on the nutritional status of the examined subjects. The paper attempts also to find determinants of nutritional status of older people living in nursing home assessed with Mini Nutritional Assessment scale.

* CORRESPONDING AUTHOR:
Department of Geriatrics
Medical University of Białystok
ul. Fabryczna 27, 15-471 Białystok, Poland
Tel: +48 85 8694982; Fax: +48 85 8694974
e-mail: wojszel@amb.edu.pl (Beata Wojszel)

Material and methods

The subjects included older residents (aged 65 years and older) of the nursing home for the somatically ill adults in Białystok. One hundred out of the 109 persons fulfilling the age criterion were examined. The response rate was 91.7%. 9 individuals did not want to participate or were not able to participate because of their serious health status.

A questionnaire taking into account the following: 1) the social-demographic evaluation, 2) the experiences connected with living in nursing home, 3) health status with elements of clinical judgment, the occurrence of chronic illnesses, and medication, 4) the functional evaluation of the respondent with functional ability scales, and 5) nutritional status assessment with Mini Nutritional Assessment Scale (MNA) – was used.

The following instruments were used to rate the respondent's functional ability:

• The Katz Index [9] – used to evaluate functional ability in the range of basic ADL (P-ADL – personal activities of daily living) – being able to take care of oneself (eating, incontinence, using the toilet, bathtub/shower, dressing, moving). It placed individuals into one of three groups: functionally able – 5-6 points; moderately ADL dependent – 3-4 points, and severely ADL dependent- 1-2 points.

• Instrumental Activities of Daily Living scale (I-ADL) [10]. This took into account instrumental activities of daily living, such as cleaning, meals preparation, shopping, using the telephone, taking medication, moving outside the home etc. If the respondent was able to perform the activity without any help he or she was given 3 points, with some help – 2 points, and not able at all – 1 points (the answers can give maximum 27 points).

• The scale of mobility according to Piotrowski [11] – placed the respondents into one of four groups. Group I – persons able to walk freely at home and outside the home; group II – persons walking freely around the home but having difficulties moving outside the home; group III – persons able to walk around the home but who can not move outside the home; group IV – persons who are bedridden, in a wheelchair, or confined to an armchair.

• A questionnaire rating cognitive functions – Abbreviated Mental Test Score (AMTS) [12] – the test results were on the following scale: from 0 to 3 points showed a serious cognitive impairment, from 4 to 6 points showed a moderate cognitive impairment, above 6 points (maximum 10 points) normal state of cognitive functions in the respondent.

• The Geriatric Depression Scale (GDS) [13] – graded the emotional state of the respondent in two stages: from 0 to 5 points as a normal emotional state and a suspected state of depression with a rising tendency from 6 to 15 points.

• Norton scale assessing risk of developing pressure sores [14] – 14 points or above pointed to the normal status and less then 14 points – to the risk of pressure sores.

The Mini Nutritional Assessment (MNA) test [15] was used as an assessment tool to detect nutritional risk. The instrument consists of 18 point weighted questions in four categories (*Tab. 1*). The first category consists of four anthropometric measurements such as body mass index (BMI), mid upper arm and calf circumferences and weight loss during the past 3

Table 1. Elements of MINI NUTRITIONAL ASSESSMENT (MNA) [15]

I.	**Anthropometric assessment**	• BMI – body mass index • mid upper arm and calf circumferences • weight loss during the past 3 months
II.	**Global evaluation**	• accommodation type – living independently or in nursing home, • taking more then 3 prescription drugs, • psychological stress or acute disease in the past 3 months, • mobility, • neuropsychological problems, • pressure sores or skin ulcers
III.	**Dietetic assessment**	• quantity and quality of eating meals, • loss of appetite, • digestive problems, chewing or swallowing difficulties causing decline in patient food intake, • beverages consumed per day, • mode of feeding
IV.	**Subjective assessment**	• Does patient consider to have any nutritional problems? • How would the patient consider his health status in comparison with other people of the same age?

months. Six global questions regarding accommodation type, pharmaceutical consumption, acute diseases (including psychological stress), mobility, neuropsychological problem, and pressure sores/skin ulcers constitute the second category. The third part consists of six questions assessing dietary intake and the final part of two self-assessments of whether food intake is sufficient and of the own health status. The answers can give maximum 30 points. Less than 17 points is regarded as indicated malnutrition, 17-23.5 points indicate a risk of malnutrition, and ≥24 points indicate that the person is well nourished.

Two experienced and trained in geriatric assessment nurses, not employed in the studied nursing home, were interviewers.

The STATISTICA 7.0 [16] program was used to analyze the collected data. In case the Chi square Pearson test was used a p-value of 0.05 or lower was considered to be statistically significant.

Multivariate regression analysis (standard, stepwise backward and forward) was used to find independent variables influencing nutritional status of the group studied. The total score of MNA was used as the dependent variable for multiple regression analysis. The multivariate regression model was constructed with independent variables presented in *Tab. 2*, describing both the general situation of the older person as well as his or her functional abilities. The variables previously associated with the risk of malnutrition from the literature were chosen. Some of the variables were constituted of the total scores on different scales as described above. First of all the variables correlating significantly with the total score of MNA were chosen. The analysis was done in stages. Standard regression was used to assess the relationships among variables in the model. To eliminate independent variables those do not provide additional prediction to the variables already in the equation stepwise backward regression was used. The stepwise forward regression was used to check the proportion of variance attributable to

Table 2. **Variables included in the multivariate regression models analyzing chosen determinants of the Mini Nutritional Assessment score**

Variable	Label/Value (in case of scales scores – min-max; mean in the group studied)
I. Socio-demographic characteristics	
Age	number of years (66-102; 79.1)
Gender	female=0 male=1
Living alone before nursing home placement	yes=0 no=1
II. Functional abilities	
Katz Index (ADL) score	total score on the scale (0-6; 3.97)
IADL score	total score on the scale (9-27; 14.6)
GDS score	total score on the scale (0-14; 7.66)
AMTS score	total score on the scale (0-10; 7.0)
Norton scale score	total score on the scale (10-20; 15.8)
Piotrowski mobility scale score	I/ II group of mobility =0 III/IV group of mobility =1
III. Other characteristics	
Number of drugs taken every day	total number of drugs (0-13; 4.4)
Stroke in the past	without =0 yes =1
Difficulties in chewing	no =0 yes =1
Place of having meals	a resident's room =0 a dinner room =1

ADL – Activities of Daily Living; IADL – Instrumental Activities of Daily Living; GDS – Geriatric Depression Scale; AMTS – Abbreviated Mental Test Score

some independent variables after variance due to variables in equation is accounted for.

The study was approved by the Ethics Committee of the Medical University of Białystok.

Results

Age and gender of the examined groups is presented in *Tab. 3*. Most of the respondents were women, belonging to the older subgroup. The average age was 80.4 years (±7.79) in women and 75.9 (±6.86) in men. Differences in age structure between male and female group were statistically significant (p=0.007 in Chi square Pearson test).

We found that 12% of the group members were malnourished (<17 points), 61% were at risk of malnutrition (17-23.5 points) and 27% were well nourished (≥24 points) according to the MNA test (*Fig. 1*). The distribution of malnutrition and risk of malnutrition in different subgroups of the studied individuals are presented in *Tab. 4*, and *Tab. 5*.

Well nourished individuals were observed significantly more frequently in men (p<0.05), people with good psycho-physical abilities – good mobility (p<0.001), without signs of depression (p<0.001) or cognitive impairment (p<0.001), ADL independency (p<0.01), no risk of pressure sores (p<0.05), with good teeth status (p<0.01), having meals in a dinning room, and not in the resident's room (p<0.001). The risk of malnutrition was

Table 3. **Age and gender structure of examined group**

Gender	Males		Females		Total
	n	%	n	%	n=%
Age*					
65-74 years old	14	48.3	15	21.1	29
+75 years old	15	51.7	56	78.9	71
Total	29	100.0	71	100.0	100
Average age [n years; ±SD]	75.9 (±6.86)		80.4 (±7.79)		79.1 (±7.78)

SD – standard deviation

Figure 1. **The prevalence of malnutrition, and risk of malnutrition in older residents of studied nursing home (N=100)**
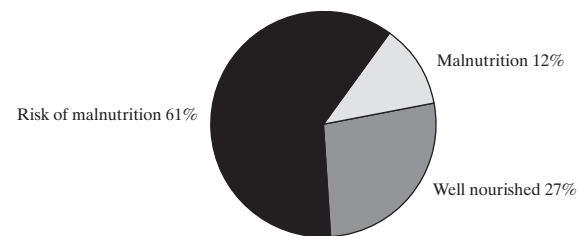

Risk of malnutrition 61%   Malnutrition 12%   Well nourished 27%

Table 4. **Nutritional status according to Mini Nutritional Assessment (MNA) and age, gender and living arrangements (N=100)**

Nutritional status according to MNA	Well nourished [%]	Risk of malnutrition [%]	Malnutrition [%]
Gender			
Female (n=71)	21.1	63.4	15.5
Male (n=29)	41.4	55.2	3.4
p*	<0.05	NS	NS
Age Group			
65-74 years old (n=29)	31.0	62.1	6.9
+75 years old (n=71)	25.3	60.6	14.1
p*	NS	NS	NS
Place of living before nursing home placement			
Urban (n=83)	11.8	82.3	5.9
Rural (n=17)	30.1	56.6	13.3
p*	NS	<0.05	NS
Alone living before nursing home placement			
Yes (n=41)	29.3	68.3	2.4
No (n=59)	25.4	55.9	18.7
p*	NS	NS	<0.05
The length of stay in nursing home			
<12 months (n=24)	25.0	58.3	16.7
+1 year (n=76)	27.6	61.9	10.5
p*	NS	NS	NS
Place of having meals in nursing home			
Resident's room (n=64)	15.6	65.6	18.8
Dinning room (n=36)	47.2	52.8	0.0
p*	<0.001	NS	<0.01

* – two tailed U test for two frequencies

observed significantly more frequently in the group of older people living in urban area before nursing home placement (p<0.05), with suspected depression (p<0.01). Malnutrition affected significantly more frequently subjects living with other people before nursing home placement (p<0.05), having meals

Table 5. **Nutritional status according to Mini Nutritional Assessment (MNA) and functional/health status (N=100)**

Nutritional status according to MNA		Well nourished [%]	Risk of malnutrition [%]	Malnutrition [%]
Mobility (Piotrowski scale)				
Group I/II (n=53)		43.4	52.8	3.8
Group III/IV (n=47)		8.5	70.2	21.3
	p*	<0.001	NS	<0.01
Cognitive functions				
Normal state (n=55)		41.8	54.6	3.6
Suspected dementia (n=44)		8.9	68.9	22.2
	p*	<0.001	NS	<0.01
Emotional status				
Normal state (n=28)		57.1	39.3	3.6
Suspected depression (n=72)		15.3	69.4	15.3
	p*	<0.001	<0.01	NS
ADL functional ability				
Functionally able (n=58)		37.9	60.4	1.7
ADL dependent (n=42)		11.9	61.9	26.2
	p*	<0.01	NS	<0.001
Risk of pressure sores (Norton scale)				
Risk (n=27)		11.1	51.9	37.0
No risk (n=73)		32.9	64.4	2.7
	p*	<0.05	NS	<0.0001
Self-rating of the health status				
Good (n=25)		40.0	52.0	8.0
Average/poor (n=75)		22.7	64.0	13.3
	p*	NS	NS	NS
Chewing difficulties				
No/little (n=87)		29.9	63.2	6.9
Yes, big difficulties (n=13)		7.7	46.2	46.1
	p*	NS	NS	<0.001
Status of teeth				
Good status (n=24)		50.0	45.8	4.2
Poor dentition (n=76)		19.7	65.8	14.5
	p*	<0.01	NS	NS
Stroke in the past				
No (n=88)		29.5	61.4	9.1
Yes (n=12)		8.3	58.3	33.4
	p*	NS	NS	<0.05
Number of drugs taken				
0-3 drugs (n=40)		32.5	65.0	2.5
+4 drugs (n=56)		25.0	57.1	17.9
	p*	NS	NS	<0.05

ADL – Activities of Daily Living; * – two tailed U test for two frequencies

in resident's room at nursing home (p<0.01), with different psycho-physical dysfunctions – pore mobility (p<0.01), suspected dementia (p<0.01), ADL dependency (p<0.001), risk of pressure sores (p<0.0001), with chewing difficulties (p<0.001), having suffered from cerebral stroke in the past (p<0.05) and taking 4 or more drugs every day since 3 months (p<0.05). There were no significant differences observed between individuals in different age groups, with different lengths of stay at nursing home, rating differently their health status.

The average value of MNA in the whole group was 21.2 [standard deviation ±3.7; minimum – 12.5; maximum – 28.5;

Table 6. **Standard multivariate regression analysis of independent factors associated with the total score on Mini Nutritional Assessment Scale** (N=96; adjusted R^2=0.6121; SE=2.3; F=12.530; p<0.00001)

Independent variable	B	S.E.	β	p
Constant*	20.21	3.9		<0.00001
I. Socio-demographic characteristics				
Age	0.013	0.04	0.03	NS
Gender*	1.53	0.59	0.19	<0.05
Living alone before nursing home placement	-0.71	0.52	-0.09	NS
II. Functional abilities				
Katz Index score	-0.034	0.25	-0.02	NS
IADL score *	0.15	0.08	0.21	NS
GDS score *	-0.38	0.08	-0.36	<0.0001
AMTS score	0.08	0.11	0.07	NS
Mobility scale*	-1.59	0.66	-0.21	<0.05
Norton scale score	0.15	0.16	0.12	NS
III. Other characteristics				
Number of drugs taken every day	-0.20	0.08	-0.17	<0.05
Stroke in the past	0.34	0.87	0.03	NS
Difficulties in chewing	-1.02	0.78	-0.09	NS
Having meals in resident's room	-0.47	0.67	-0.06	NS

IADL – Instrumental Activities of Daily Living; GDS – Geriatric Depression Scale; AMTS – Abbreviated Mental Test Score; adjusted R^2 – the adjusted squared multiple correlation; B – denotes the unstandardized coefficient; SE – the standard error of B; β – the standardized coefficient beta; p – the probability value; NS – not significant; * – variables significant in stepwise backward regression of the model

kurtosis – (-).066; skeweness – 0.01]. The distribution of MNA scores in our group was normal according to the Lilliefors and Kolmogorov-Smirnov tests of normality.

As the distribution of MNA scores in the studied group was normal the multivariate regression analysis was used to find determinants of MNA in nursing home inhabitants. The total score of MNA was used as the dependent variable and the variables described in *Tab. 2* were included in the model as the independent ones. The results of the standard multivariate regression analysis of the model are presented in *Tab. 6*. Together the independent variables included in the model accounted for 61.2% of the total variance of MNA (N=96, adjusted R^2=0.6121, SE 2.33, F=12.53, p<0.00001). Variables significant in stepwise backward regression of the model are marked with asterisk – together they accounted for 59.8% of the total variance of dependent variable (adjusted R^2=0.5979). Lower score on MNA was independently associated with lower IADL scores, higher GDS scores, female gender and difficulties in mobility (III/IV group according to Piotrowski scale).

The stepwise forward regression was used to check the proportion of variance attributable to independent variables after variance due to variables in equation is accounted for. *Tab. 7* presents the consecutive steps of this analysis. Five of the variables have added the significant proportion of variance explanation (together in the analysis – 62.9%). Above the variables essential in stepwise backward regression analysis another important variable has emerged here. It was the number of drugs taken every day – the higher the number the lower MNA score.

Table 7. **Stepwise forward multivariate regression analysis of independent factors associated with the total score on Mini Nutritional Assessment Scale** (N=96; adjusted R^2=0.6287; SE=2.28; F=21.107; p<0.00001)

Independent variable	Step	B	S.E.	β	p	Adjusted R^2
Constant		20.83	2.26		<0.000001	
Norton scale score	1	0.15	0.13	0.12	NS	0.3959
GDS score *	2	-0.40	0.08	-0.38	<0.00001	0.4743
IADL score *	3	0.19	0.07	0.26	<0.01	0.5249
Gender *	4	1.53	0.55	0.19	<0.01	0.5657
Mobility scale *	5	-1.51	0.60	-0.20	<0.05	0.6022
Number of drugs taken every day	6	-0.21	0.08	-0.17	<0.01	0.6212
Living alone before nursing home placement	8	-0.69	0.49	-0.09	NS	0.6263
Difficulties in chewing	9	-0.95	0.76	-0.08	NS	0.6381

IADL – Instrumental Activities of Daily Living; GDS – Geriatric Depression Scale; B – denotes the unstandardized coefficient; SE – the standard error of B; β – the standardized coefficient beta; p – the probability value; adjusted R^2 – the adjusted squared multiple correlation; * – variables significant in stepwise backward regression of the model; NS – not significant

Discussion

The study has confirmed that malnutrition remains a common problem among older people living in nursing homes – 12% of the group studied was malnourished and 61% were at risk of malnutrition. In the study performed in all nursing homes in Helsinki one-third (29%) of the studied residents suffered for malnutrition (Mini Nutritional Assessment – MNA – score <17), and 60% were at risk (MNA 17-23.5)[17]. In these terms the study replicates also the findings of other studies [18,19].

The lower scores of Mini Nutritional Assessment were independently associated in our study with female gender, lower scores on Instrumental Activities of Daily Living scale (grater IADL dependency), higher scores on GDS (emotional disturbances), worse mobility and higher numbers of drugs taken every day since three months. In previously mentioned study, performed in Helsinki, malnutrition was associated with female gender, a longer stay in the nursing home, functional impairment, dementia, stroke, constipation and difficulties in swallowing as well as eating less than half of the offered food portion, not eating snacks and resident's weight control at long intervals, but in logistic regression analysis mainly patient--related factors predicted malnutrition (impaired functioning, swallowing difficulties, dementia, constipation) [17]. In another study performed in nursing homes the number of drugs and the mental health score were the only parameters which remained significant in the final multivariate regression model explaining the Mini Nutritional Assessment score as a dependent variable [21]. Some other researches also indicate that higher levels of nutritional disturbances in nursing homes are associated with older person ADL dependency, depression and polypharmacy [20,18].

Malnutrition in the studied group affected more frequently persons living with other people before nursing home placement, having meals in resident's room at nursing home, with the suspected dementia, personal ADL disability and with risk of pressure sores or having stroke in the past. These variables were not independently associated with the nutritional status of the older person measured as the MNA score in the regression analysis. A thorough analysis of correlations between variables revealed that these variables correlated significantly with IADL score.

As expected, the disturbances in nutrition in the present study were substantially higher in those respondents who showed to be in worse mental and physical condition. The risk of developing malnutrition in the group studied could be in a large proportion the consequence of the morbidity and frailty that has resulted in them living in long term care institution. The correlation between MNA results and age was week in the studied group. Findings of other studies were similar [21]. The frequency of malnutrition increases with age but our results suggest that it seems to be rather the function of the frailty and different chronic diseases and not the ageing per se. In case of older people living in long term care institutions a lot of disabilities and chronic diseases coexist, and health status may become more important than age in explaining malnutrition of elderly person.

Psychosocial factors such as social support and depression are related to nutritional risk in the elderly [22]. The relationship between malnutrition and depression is complex. Depression leads to reduced appetite, but, on the other hand, malnutrition may induce depression and apathy [23,24]. Insufficient dietary routines may also contribute to the risk of nutritional disturbances in nursing homes [25].

The programs that are to help prevent malnutrition in nursing home residents should encompass screening of the persons at risk, and then an intervention. Surveillance of risk factors – before full-blown malnutrition is detected – can lead to early intervention [26]. This type of intervention could decrease the risk of nutritional disturbances significantly as well as limit the negative effects of them on the morbidity and mortality of older subjects, if they should arise [27,28]. Future studies are necessary to assess to what extent these nutritional disturbances are reversible.

Conclusions

1. The study has confirmed that malnutrition remains a common problem among older people living in nursing homes.

Based on MNA one-tenth of the study subjects living in nursing home appeared to be malnourished and more then half of them appeared to be at risk of malnutrition.

2. Malnutrition is an increasing hazard especially for older women, for people with emotional disturbances and IADL dependent as well as for subjects taking greater number of drugs.

3. Introducing the periodic assessment of the nutritional status among older residents in nursing homes with simple measures such as, for example, the MNA tool, could allow for the implementation of an appropriate nutritional intervention in specific cases.

Acknowledgements

References

1. Lipschitz DA. Nutrition and aging. In: Evans JG, Wiliams TF, Beattie BL, Michel JP, Wilcock GK: Oxford Textbook of Geriatric Medicine. 2nd edition. Oxford: University Press; 2000, p. 139-58.

2. Rolls BJ, Drewnowski A. Diet and nutrition. In: Birren JE, editor. Encyclopedia of Gerontology Vol 1. San Diego: Academic Press; 1966, p. 429-40.

3. Rudman D, Feler AG. Protein – calorie undernutrition in nursing home. J Am Geriatr Soc, 1989; 37: 173-83.

4. Silver AJ, Morley JE, Stome LS, Jones D, Vickers L. Nutritional status in an academic nursing home. J Am Geriatr Soc, 1988; 36: 487-91.

5. Beck AM, Ovesen L, Osler M. The 'Mini Nutritional Assessment' (MNA) and the 'Determine Your Nutritional Health Checklist' (NSI Checklist) as predictors of morbidity and mortality in an elderly Danish population. Br J Nutr, 1999; 81: 31-6.

6. Morley JE. Nutrition assessment is a key component of geriatric assessment. In: Vellas BJ, Guigoz Y, Garry PJ, Albarede JL, editors. Facts and Research in Gerontology 1994. Supplement 2: The Mini Nutritional Assessment: MNA. Nutrition In the Elderly. Paris: Serdi Publishing Company; 1994, p. 5-9.

7. Vellas B, Guigoz Y. Nutritional assessment as part of the geriatric evaluation. In: Rubenstein LZ, Wieland D, Bernabei R, editors. Geriatric assessment technology: the state of the art. Milano: Editrice Kurtis; 1995, p. 179-94.

8. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: the Mini Nutritional Assessment as part of the geriatric evaluation. Nutr Rev, 1996; 54: S59-65.

9. Katz S, Ford AB, and Moskowitz RW. Studies of illness in the aged: the index of ADL: a standardized measure of biological and psychosocial function. JAMA, 1963; 185, 914-9.

10. Lowton MP, and Brody EM. Assessment of elderly people: self maintaining and instrumental activities of daily living. Gerontologist, 1969; 9, 179-86.

11. Piotrowski J. Miejsce człowieka starego w rodzinie i w społeczeństwie. [The place of older people in the family and in the society.] Warszawa: PWN; 1973.

12. Royal College of Physicians of London: Standardised Assessment Scales for Elderly People. London: Royal College of London; 1992, p. 6-22.

13. Yesavage JA. Geriatric Depression Scale. Psychopharmacol Bull, 1988; 24: 709-10.

14. Norton D, McLaren R, Exton-Smith AN. An Investigation of Geriatric Problems in Hospital, 3rd ed. Churchill Livingstone, London 1979.

15. Guigoz Y, Vellas B, Garry PJ. Mini Nutritional Assessment: A practical assessment tool for grading the nutritional state of elderly patients. In: Vellas BJ, Guigoz Y, Garry PJ, Albarede JL, editors. Facts and Research in Gerontology 1994. Supplement 2: The Mini Nutritional Assessment: MNA. Nutrition In the Elderly. Paris: Serdi Publishing Company; 1994, p. 15-59.

16. Stanisz A. Przystępny kurs statystyki w oparciu o program STATISTICA PL na przykładach z medycyny. [An approachable statistics course based on the STATISTICA PL program.] Vol. 1 and 2. Kraków: StatSoft Polska; 2001.

17. Suominen M, Muurinen S, Routasalo P, Soini H et al. Malnutrition and associated factors among aged residents in all nursing homes in Helsinki. Eur J Clin Nutr, 2005; 59 (4): 578.

18. Saletti A, Lindgren EY, Johansson L, Cederholm T. Nutritional status according to Mini Nutritional Assessment in an institutionalized Elderly population in Sweden. Gerontology Clin Sec, 2000; 46: 139-45.

19. Rudman D, Feler AG. Protein – calorie undernutrition in the nursing home. J Am Geriatr Soc, 1989; 37: 173-83.

20. Unosson M, Ek AC, Bjurulf P, Larsson J. Demographical, sociomedical and physical characteristics in relation to malnutrition in geriatric patients. J Adv Nurs, 1991; 16: 1406-12.

21. Griep MI, Mets TF, Collys K, Ponjaert-Kristoffersen I, Massart DL. Risk of malnutrition in retirement homes elderly persons measured by the "Mini-Nutritional Assessment". J Gerontology, 2000; 2: M57-M63.

22. Johnson CSJ. Psychosocial correlates of nutritional risk in older adults. Can J Diet Prac Res, 2005; 66: 95-7.

23. Brozek J. Effects of generalized malnutrition on personality. Nutrition, 1990; 6: 389-95.

24. Cederholm T, Jagren C, Hellstrom K. Nutritional status and performance capacity in internal medical patients. Clin Nutr, 1993; 12: 8-14.

25. Gilmor S.A., Robinson G, Posthauer E, Raymond J. Clinical indicators associated with unintentional weight loss and pressure ulcers in elderly residents of nursing facilities. J Am Diet Assoc, 1995; 95: 984-92.

26. Wilson M-MG, Morley JE: Nutritional assessment and support in chronic disease management. In: Bales CW, Ritchie CS, Russell RM, editors. Handbook of clinical nutrition and aging. Totowa, New Jersey: Humana Press; 2004, p. 77-101.

27. Johanson LE, Dooley PA, Gleick JB. Oral nutritional supplement use in elderly nursing home patients. J Am Geriatr Soc, 1993; 41: 947-52.

28. Thomas DR. Outcome from protein-energy malnutrition in nursing home residents. In: Vellas BJ, Guigoz Y, Garry PJ, Albarede JL, editors. Facts and Research in Gerontology 1994. Supplement 2: The Mini Nutritional Assessment: MNA. Nutrition in the Elderly. Paris: Serdi Publishing Company; 1994, p. 87-95.