Use of NSI Determine Checklist to assess the risk of malnutrition in persons of advanced old age living in rural areas

Wojszel ZB.

Department of Geriatrics, Medical University of Białystok, Białystok, Poland

ABSTRACT

Purpose: The study has two aims. One was to assess the prevalence of malnutrition risk factors among persons of advanced old age living in rural areas. The second was to assess an aggregate assessment of malnutrition risk in this group using the NSI Determine Checklist.

Material and methods: Questionnaire surveys were carried out among a random-quota sample of 253 people over 75 years of age (175 women and 78 men), living in the rural part of Sokółka municipality in the Podlaskie Province, Poland.

Results: 78.2% of the study group were at increased risk of malnutrition (50.8% at high risk; 27.4% at moderate). The most common risk factors included multi-drug therapy (63.6%), problems within the oral cavity or problems with teeth interfering with food intake (59.9%), eating alone (45.8%), difficulty doing shopping and preparing meals, and independent consumption (43.5%). Significantly more men than women admitted to drinking three or more glasses of alcohol daily (11.7% *vs.* 0.6%). More women admitted to eating alone (56.6% *vs.* 21.8%) and taking at least three medications daily (68.6% *vs.* 52.6%). Persons over 80 (57.7% of the study group) were significantly more likely than younger respondents to have problems with oral health (65.5% *vs.*52.3%), as well as difficulty doing food shopping, preparing meals, or eating them independently (50.0% *vs.* 34.6%).

Conclusions: The prevalence of malnutrition risk factors among persons of advanced old age in rural areas is high, and as a result, aggregately assessed high risk of malnutrition affects as many as half of them. Introduction of relevant screening methods would help address this underestimated clinical problem and facilitate early nutritional intervention

Key words: risk of malnutrition, assessment, advanced old age, NSI Determine Checklist

***Corresponding author:**
Department of Geriatrics
Medical University of Białystok
27 Fabryczna str.
15-473 Białystok, Poland
Tel: +48 858694982, Fax: +48 858694974
E-mail: wojszel@umb.edu.pl (Z. Beata Wojszel)

Received: 28.12.2012
Accepted: 21.02.2012
Progress in Health Sciences
Vol. 2(1) 2012 pp 68-75.

INTRODUCTION

Malnutrition is classified as a major health problem in old age. It is particularly frequent in the elderly residing in hospitals and nursing homes [1-6]. This is mostly due to multiple co-morbidities along with changes dependent on the physiological process of aging and adverse socio-economic factors [7-8]. Given the prevalence and health consequences for older people (increased: morbidity and mortality, risk of loss of fitness and institutionalization [9-14], malnutrition is considered one of the major geriatric problems. This is continually an underestimated problem in everyday medical practice. Although it should be an important element of a comprehensive geriatric assessment [15], evaluation of the nutritional status and the risk of malnutrition is often overlooked in routine medical and nursing examinations. If this is done at all, it is usually limited to measurement of body weight/ body mass index (BMI). Older people are often unaware of the importance of this issue and whether in their particular case there is a risk of protein or caloric malnutrition and occurrence of nutritional deficiencies, but there is a need of nutrition education also in nurses and other medical staff, who are very inattentive to these problems [16, 17].

Therefore, it would be important to introduce simple assessment tools for risk of malnutrition and assessment of nutritional status in elderly patients into everyday medical practice. Only this would allow for an early nutritional intervention adequately meeting patients' needs. Systematic review of 62 randomized trials on the efficacy of protein and caloric supplementation in geriatrics (excluding research in cancer and intensive health care) has shown that it reduces the risk of death (if used in patients suffering from malnutrition), complications, and improves functional fitness. The advantages however were not noticeable in old people who are not frail [18]. It has been pointed out however, that most included trials were of poor quality. There is an urgent need for additional data from large-scale multi-centre trials.

Nutrition Screening Initiative (*NSI*) DETERMINE *Checklist* is one of the scales introduced to assess the risk of malnutrition among elderly persons [19-21]. It may be particularly helpful for screening [22, 23].

The aims of this study were:

1. to evaluate the prevalence of risk factors for protein and caloric malnutrition among people in advanced old age living in rural areas,
2. and to estimate the aggregate risk of malnutrition in this group using the NSI Determine Checklist.

MATERIAL AND METHODS

The study population

This study forms part of a multidimensional research project on geriatric disability syndromes and nursing services in advanced old age published previously [24]. Questionnaire surveys were carried out among a random-quota sample of 253 people above 75 years of age (175 women and 78 men) living in the rural part of Sokółka municipality in the Podlaskie Province. 62.3% of the population of Sokólski district resides in rural areas.

The survey interviews were conducted with people who agreed to participate in the study. When PESEL national registration number was used to select eligible persons (75 years old and above) the response rate was very low. It was therefore decided that the sample be a random-quota one. The age and gender structure of the studied sample matches exactly the demographic structure of the population living in the studied area, according to the Central Statistical Office [25].

This study was carried out in villages scattered throughout the municipality.

Assessment instruments

Our previous publication contains the full survey questionnaire [24]. In addition to questions concerning social, demographic and health situation of the respondents, it also contained elements of a comprehensive geriatric assessment (assessment of the emotional state using the 15-point Geriatric Depression Scale [26], assessment of cognitive functions on the Katzman's Scale [27], the fitness of sense organs - subjective evaluation of the respondent, fitness within basic ADL- activities-activities of daily living- based on the Barthel Index [28], fitness within the instrumental ADL activities based on the Duke OARS [29], locomotion fitness). Fitness within P-ADL, I-ADL and the aggregate (within the P-ADL, I-ADL and locomotion) are presented as aggregate indicators of disability, meaning the number of activities of a given area for which the respondent requires partial or total assistance from third parties.

The malnutrition risk assessment was conducted with the *NSI Determine Checklist*. Consent of the authors of this tool for its use in

the study had been obtained and a double-back translation was performed (English to Polish and Polish to English). Cross-cultural validation was carried out with the participation of a native English speaker. This checklist consists of 10 questions, the answers to which have a different point value (ranked depending on their weight). It is used to detect people at high risk of problems with nutrition.

Based on the aggregate point result, the studied person can be classified as having normal nutritional status (0-2 points), moderate risk of malnutrition (3-5 points) or high risk of malnutrition (≥ 6 points).

Data collection

Field studies were carried out by the Department of Geriatrics of the Medical University of Białystok in 2007 and 2008 in collaboration with the Research Department of the Polish Sociological Association (ZBN PTS). Interviewers were trained in accordance with the accepted training protocol of ZBN PTS. Some interviews (14.6%) were conducted with significant participation of the guardian of the elderly person (*proxy* interviews) due to the poor health of the respondent. The approval of the Bioethics Committee of the Medical University of Białystok was obtained before starting field studies.

Statistical analysis

The collected data was analyzed using the SPSS v.12.0. PL statistical package. The statistical description of the studied characteristics included their percentage distribution (dual cross-table with calculated interest), in case of quantitative traits measures of central tendencies and measures of dispersion (arithmetic mean, standard deviation; median and inter-quartile range in case of highly skewed data).

Internal consistency of the malnutrition risk assessment scale used in the study was determined by the reliability analysis (Cronbach's alpha) after recoding the answers as 0- risk factor not present or 1- risk factor present, as well as using standardised values of the items. Lilliefors and Shapiro-Wilk tests were used to assess the compliance of distribution of the studied characteristics with the normal distribution. Bilateral nonparametric tests were chosen as most of the quantitative variables had a distribution different from the normal distribution. Pearson's Chi^2 test for independence was used to assess correlations between pairs of qualitative and categorical variables. And U test for two frequencies to compare two indicators of the structure. Finally Mann-Whitney U test was employed to compare differences between two groups. Results were considered statistically significant at $p<0.05$.

RESULTS

The socio-demographic characteristics of the study group are presented in Table 1. The vast majority of respondents were unmarried women (widowed 64.9%, never married 6.4%, divorced 0.4%) usually living with other people. The mean age was 81.1 ± 4.8 years. In about 1 in 3 of cases, respondents assessed their economic situation as bad. The average level of education was low with less than 3% of responders had received a secondary or had received higher education.

Table 1. Social and demographic characteristics of respondents.

	Whole study group N=253 %/ M ± SD
Age, years	81.1± 4.8
80 + year old	57.7 %
Gender (male)	30.8 %
Marital status (married / partner)	28.3 %
Residing alone	28.4 %
Level of education (secondary or higher)	2.9 %
Self-assessed economic situation (bad)	36.9 %

M – mean; SD - standard deviation; N – number of cases

Table 2 shows selected parameters of health condition and fitness of the study group. Half of the respondents assessed their health condition as poor. One-fifth were unable to leave home alone. The average number of ADL activities for which they required assistance was: 2.8 ± 2.3 for I-ADL, 1.5 ± 2.5 for P-ADL and 4.6 ± 4.7 aggregate for the I-ADL, P-ADL and locomotion. Half of the respondents' results on the GDS scale suggested depression. More than 40% had an abnormal result on the scale assessing cognitive function suggesting dementia. A high percentage of the respondents had visual impairment (48.4%), hearing impairment (40.3%), and chewing impairment (69.4%). Respondents were taking an average of 3.7 ± 2.9 medications per day (chronically for at least 3 months) and reported on average of 2.5 ± 1.7 out of 16 listed chronic diseases. Over a quarter of respondents were hospitalized at least once in the preceding 12 months.

The frequency of positive answers to the questions constituting the NSI Determine Checklist assessment in the whole group of study

participants and in subgroups of sex and age is presented in Table 3.

The most common risk factors included multi-drug therapy (63.6%), problems within the

Table 2. Health and fitness status of the respondents.

	Whole study group N=253 %/median (IQR)
Self-assessment of health status (bad)	50.6 %
Average number of failures in I-ADL [0-6]	3.0 (0-5)
Average number of failures in P-ADL [0-10]	0.0 (0-2)
Impaired locomotion (does not leave home on their own)	20.9 %
Functional disability index (P-ADL + I-ADL + locomotion) [0-17]	3.0 (1-7.25)
Cognitive impairment	44.2 %
Average number of points on the Katzman's scale [0-28]	10.0 (4-14)
Depression	51.9%
Average number of points on the GDS [0-15]	6.0 (2-11)
Impaired vision (despite glasses)	48.4 %
Impaired hearing (despite hearing aid)	40.3 %
Difficulty chewing	69.4 %
Average number of medications taken daily [0-15]	4.0 (1-6)
Average number of chronic diseases [0-16]	2.0 (1-4)
Hospitalization in the past 12 months	26.9 %

P-ADL - personal activities of daily living; I-ADL - instrumental activities of daily living; GDS - Geriatric Depression Scale, IQR- inter-quartile range; N- number of cases

Table 3. Gender- and age-dependent frequency of affirmative answers to the NSI Determine Checklist [%]**.**

NSI DETERMINE Checklist questions:	**GENDER**			**AGE**			**Total**
	Males [N=78]	**Females [N=175]**		**75-79 years [N=107]**	**80+ years [N=146]**		**[N=253]**
NSI1- I have an illness or condition that made me change the kind and/or amount of food I eat.	33.3	42.2		36.4	41.7		39.4
NSI2- I eat fewer than two meals per day.	1.3	4.0		1.9	4.1		3.2
NSI3- I eat few fruits or vegetables, or milk products.	32.5	32.0		30.8	33.1		32.1
NSI4- I have three or more drinks of beer, liquor or wine almost every day.	11.7	0.6	***[a]	5.7	2.8		4.0
NSI5- I have tooth or mouth problems that make it hard for me to eat.	61.0	59.4		52.3	65.5	*[a]	59.9
NSI6- I don't always have enough money to buy the food I need.	15.6	21.7		18.7	20.7		19.8
NSI7- I eat alone most of the time.	21.8	56.6	***[a]	39.3	50.7		45.8
NSI8- I take three or more different prescribed or over-the-counter drugs a day.	52.6	68.6	*[a]	69.2	59.6		63.6
NSI9- Without wanting to, I have lost or gained 10 pounds in the last six months.	10.3	8.6		8.4	9.6		9.1
NSI10- I am not always physically able to shop, cook and/or feed myself.	46.2	42.3		34.6	50.0	*[a]	43.5
Aggregate score in the NSI scale [b] [M±SD (N)]	5.3±3.4 (76)	5.9±3.5 (172)		5.2±3.5 (106)	6.1±3.4 (142)		5.7±3.5 (248)

M – mean; SD - standard deviation; N - number of cases; [a]- chi ^{2} test for comparisons between age and gender groups; [b]- Mann-Whitney test for comparisons between age and gender groups; * $p < 0.05$; *** $p < 0.001$ - in the table only statistically significant differences have been indicated

oral cavity or problems with teeth interfering with food intake (59.9%), eating alone (45.8%), difficulty doing shopping and preparing meals, and independent consumption (43.5%). For some questions statistically significant age and gender-related differences were noted. Significantly more men than women admitted to drinking three or more glasses of alcohol daily (11.7% *vs.* 0.6%). More women admitted to eating alone (56.6% *vs.* 21.8%) and taking at least three medications daily (68.6% *vs.* 52.6%). Persons over 80 (57.7% of the study group) were significantly more likely than younger respondents to have problems with oral health (65.5% *vs.*52.3%), as well as difficulty doing food shopping, preparing meals, or eating them independently (50.0% *vs.* 34.6%).

The average risk assessment of malnutrition score was 5.7 ± 3.5 points. In this study group, the prevalence of malnutrition risk assessed with the NSI Determine Checklist was high and equalled to 78.2% (high risk 50.8%, moderate risk 27.4%) – (Fig.1).

No statistically significant differences were observed on age or sex.

Finally, the reliability of the NSI Determine Checklist was assessed using Cronbach's alpha. Internal validity of this tool is not good as Cronbach's alpha was equal to 0.445 (and for standardized values-0.400).

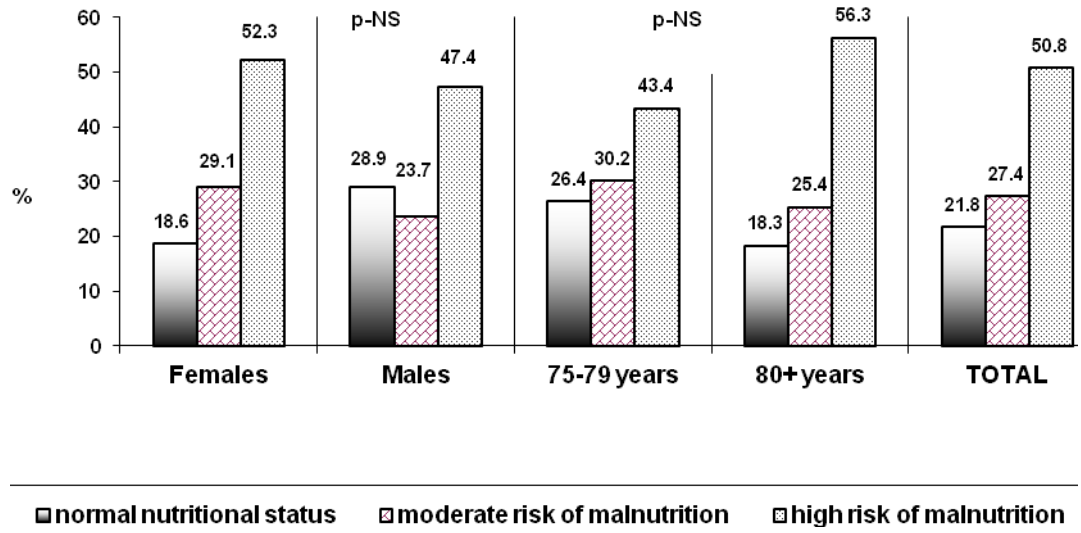

Fig. 1. Risk of malnutrition in persons of advanced old age in rural area (according to the NSI Determine Checklist). NS- not significant

DISCUSSION

This study confirms a high prevalence of important risk factors for malnutrition among community dwelling persons of advanced old age residing in a rural area. The most common factors included multidrug therapy, problems with the oral cavity and dentition, non-self reliance in activities of daily living associated with preparing and eating meals, poor health, and independent consumption.

Although one would expect fruit, vegetables and dairy products to be the staple in rural areas only one-third ate them. They may be not well-tolerated by the elderly due to co-morbidities. One-fifth of the study group, however, also claimed they cannot buy food products due to financial difficulties. Excessive alcohol consumption among older men is a major problem in rural Podlaskie.

Significant changes in body weight in the preceding six months were reported by as many as 9% of respondents. It is recognised that weight loss in the recent period is the most authoritative, single risk factor of malnutrition in old age. Monitoring body weight is a simple and easily available method to assess the imbalance between energy supply and demand.

If it exceeds 5% of the entry body weight, it should trigger appropriate diagnostic procedures to determine the cause and allow for focal intervention [30].

High risk of malnutrition assessed using the *NSI DETERMINE Checklist* occurred in up to 50.8% of the respondents over 75 years of age residing in rural areas. Similarly high rates of malnutrition risk in the elderly assessed using the same scale have been reported by others [31-34]. Detailed comparison with those studies is impossible due to the dissimilarity of populations.

These results are not identical with the prevalence of malnutrition in the study group. In a Polish study by Hryniewiecki, energy shortages were found in as many as 33-36% of the inhabitants of Poznań over 75 years of age, and various nutritional deficiencies were present in 10 to 66% of respondents (depending on the analyzed indicator) [35]. In the opinion of some authors, the *DETERMINE Checklist* is not sufficiently sensitive and specific to recognize malnutrition [32, 34, 36, 38]. The author's own studies also confirmed imperfect psychometric properties of the tool. Assessment of the internal validity of the scale showed that it is not good (Cronbach's alpha= 0.445, and for standardized values-0.400), suggesting that questions form the scale are not really a uniform indicator of latent construct [24]. In case of Mini Nutritional Assessment, the screening tool most established in the elderly, the Cronbach's alpha was found to be only satisfactory (=0.6) [37].

One must be aware that the *DETERMINE Checklist* is not the ultimate diagnostic tool. This instrument was originally designed not as a tool to assess the prevalence of malnutrition, but as an educational tool intended to draw attention of the elderly person or their guardian to the problem and the most common factors for the occurrence of malnutrition in old age. In fact, it is based on research data into the most common risk factors for malnutrition in this period of life [38]. Therefore, many more people from the "at-risk group" are identified. Further accurate assessment of nutritional status, e.g. *Level 1 and Level 2 Screen NSI* or other in-depth assessment method, enable the identification of actual cases of malnutrition [39].

Despite these limitations, the NSI Determine Checklist has been used in several studies on nutritional status of the elderly [12, 14, 31-34]. Its simplicity is a great advantage. The fact that it does not rely on anthropometric or laboratory indicators (difficult to assess with survey field studies, especially in a population of very old people) is also important. In clinical practice, this tool can be used for preliminary screening (as a short questionnaire completed by a member of the geriatric care team, by an elderly person or their guardian) and lead to a more in-depth assessment. It is not an ideal screening tool [40], but it can be used as an educational tool to assist health professionals in evaluating the impact of individual risk factors on nutritional adequacy and overall well being [34]. Even the MNA, a screening tool most established in the elderly, is highly sensitive not only for overt malnutrition but also for being at risk, so it may highlight more people than the given health system can manage. It is therefore, not a gold standard [41].

One of the limitations of the study is the random-quota sample rather than a random one. However, when PESEL national registration was used to select eligible persons (aged 75 and over), the response rate was extremely low. Studies were finally carried out in villages scattered throughout the municipality, and the demographic structure of the studied sample in terms of age and gender matches exactly the demographic structure of the population living in the studied area, in accordance with the Central Statistical Office data [25]. Although the distribution of some variables in the studied sample has also been replicated in other surveys [24, 42], it is unclear how representative the sample is. One should be aware that there could be referential bias. Similar problems affected other nutrition studies performed on people above 60 years old in Polish rural areas. When PESEL number was used for random sampling the response rate was 17% in women and 8% in men [43]. The representativeness of such a sample, despite it being random, is debatable.

CONCLUSIONS

1.The prevalence of the risk factors for malnutrition among persons of advanced old age in rural areas is high and as a result aggregately assessed high risk of malnutrition affects half of them.

2. Screening methods, such as the NSI Determine Checklist, used in everyday practice could facilitate sufficiently early nutritional intervention.

ACKNOWLEDGEMENTS

Work was supported by the Medical University of Bialystok, Poland (grant No. 113-01500 P). The author did not declare any conflict of interest.

Conflicts of interest

I declare that I have no conflict of interest.

REFERENCES

1. Guigoz Y, Vellas B, Garry PJ. Mini nutritional assessment: a practical tool for

grading the nutritional state of elderly patients. Facts Res Gerontol. 1994 (Suppl. 2): 15-59.
2. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of elderly: The Mini Nutritional Assessment as part of geriatric evaluation. Nutr Rev. 1996 Jan; 54: S59-S65.
3. Saletti A, Lindgren EY, Johansson L. Nutritional status according to Mini Nutritional Assessment in an institutionalized elderly population in Sweden. Gerontology. 2000 May-Jun; 46(3): 139-45.
4. Sibai AM, Zard C, Adra N, Baydoun M, Hwalla N. Variations in nutritional status of elderly men and women according to place of residence. Gerontology. 2003 Jul/Aug; 49(4): 215-24.
5. Cowan DT, Roberts JD, Fitzpatrick JM, While AE, Baldwin J. Nutritional status of older people in long term care settings: current status and future directions. Int J Nurs Stud. 2004 Mar; 41(3): 225-37.
6. Wojszel ZB. Determinants of nutritional status of older people in long-term care setting on the example of the nursing home in Białystok. Adv Med Sci. 2006; 51: 168-73.
7. Rolls BJ, Drewnowski A. Diet and nutrition. In: Birren J.E., editor: Encyclopedia of gerontology. San Diego (USA): Academic Press; 1996. Vol 1; p.429-40.
8. Barrocas A, White JV, Gomez C, Smithwick L. Assessing health status in the elderly: the nutrition screening initiative. J Health Care Poor Underserved. 1996 Aug; 7(3): 210-18.
9. Van Nes M-C, Herrmann FR, Gold G, Michel JP, Rizzoli R. Does the Mini Nutritional Assessment predict hospitalization outcomes in older people? Age Ageing. 2001 May; 30: 221-6.
10. Larrieu S, Pérès K, Letenneur L, Berr C, Dartigues JF, Ritchie K, Février B, Alpérovitch A, Barberger-Gateau P. Relationship between body mass index and different domains of disability in older persons: the 3C study. Int J Obes Relat Metab Disord. 2004 Dec; 28: 1555-60.
11. Saletti A, Johansson L, Yifter-Lindgren E, Wissing U, Österberg K, Cederholm T. Nutritional status and a 3-year follow-up in elderly receiving support at home. Gerontology. 2005 May; 51: 192-8.
12. Brunt AR. The ability of the DETERMINE Checklist to predict continued community-dwelling in rural, white women. J Nutr Elder. 2006; 25 (3-4): 41-59.
13. Yap KB, Niti M, Ng TP. Nutrition screening among community-dwelling older adults in Singapore. Singapore Med J. 2007 Oct; 48 (10): 911-6.
14. 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 Jan; 8(1): 31-6.
15. 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.
16. Suominen MH, Sandelin E, Soini H, Pitkala KH: How well do nurses recognize malnutrition in elderly patients? Eur J Clin Nutr. 2009 Feb; 63(2): 292-6
17. Ministry of Health, The European Nutrition for Health Alliance, ESPEN: The fight against malnutrition. Deklaracja. Warszawa; 2011: 2 p.
18. Milne AC, Potter J, Vivanti A, Avenell A. Protein and energy supplementation in elderly people at risk from malnutrition. Cochrane Database Syst Rev. 2009 Apr; 2. Art. No.:CD003288. DOI: 10.1002/ 14651858.CD003288.pub3.
19. Posner BM, Jette AM, Smith KW, Miller DR. Nutritional and health risks in the elderly: The Nutrition Screening Initiative. Am J Public Health. 1993 Jul; 83(7): 972-8.
20. Barrocas A, Bistrian BR, Blackburn GL, Chernoff R, Lipschitz AA, Cohen D, Dwyer J, Rosenberg IH, Ham RJ, Keller GC, Wellman NS, White JV. Appropriate and effective use of the NSI Checklist and Screens. J Am Diet Assoc. 1995 Jun; 95(6): 647-8.
21. Green SM, Watson R. Nutritional screening and assessment tools for older adults: literature review. J Adv Nurs. 2006 May; 54(4): 477-90.
22. Wilson D, Benedict J. Nevada's elderly: nutrition screening, risk, and interventions. Nutr Rev. 1996 Jan; 54(1): S45-7.
23. Azad N, Murphy J, Amos SS, Toppan J. Nutrition survey in an elderly population following admission to a tertiary care hospital. CMAJ.1999 Sept;161(5): 511-5.
24. Wojszel ZB. Geriatryczne zespoły niesprawności i usługi opiekuńcze w późnej starości. Analiza wielowymiarowa na przykładzie wybranych środowisk woje-

wództwa podlaskiego. 1st ed. Białystok: Trans Humana; 2009. 471 p. (Polish)

25. GUS. Rocznik Demograficzny 2008. Warszawa: Główny Urząd Statystyczny; 2008. 530 p. (Polish)
26. Yesavage JA, Brink T, Rose T. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res. 1982-1983, 17(1): 37-49.
27. Katzman R, Brown T, Peck A, Schechter R, Schimmel H. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. Am J Psychiatry. 1983 Jun; 14(6):734-9.
28. Mahoney FI, Barthel DW. Functional evaluation: The Barthel Index. Md State Med J. 1965 Feb; 14: 61-5.
29. Fillenbaum GG, Smyer MA. The development, validity and reliability of the OARS Multidimensional Functional Assessment Questionnaire. J Gerontol. 1981 Jul; 36(4): 428-34.
30. Wallace JI. Malnutrition and enteral/ parenteral alimentation. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S, editors. Hazzard's geriatric medicine and gerontology. 6th ed. New York: McGraw Hill Medical; 2009. p. 469-81.
31. Coulston AM, Craig L, Coble Voss A. Meals on wheels applicants are population at risk for poor nutritional status. J Am Diet Assoc. 1996 Jun;96(6): 570-3.
32. de Groot LCPGM, Beck AM, Schroll M, van Staveren WA. Evaluating the DETERMINE Your Health Checklist and the Mini Nutritional Assessment as tools to identify nutritional problems in elderly Europeans. Eur J Clin Nutr. 1998 Dec; 52(12): 877-83.
33. Yap KB, Niti M, Ng TP. Nutrition screening among community-dwelling older adults in Singapore. Singapore Med J. 2007 Oct; 48(10): 911-6.
34. Brownie S, Myers SP, Stevens J. The value of the Australian Nutrition Screening Initiative for older Australians- results from a national survey. J Nutr Health Aging. 2007 Jan-Feb;11(1): 20-5.
35. Hryniewiecki L. Żywienie ludzi w wieku starczym i podeszłym. Klinika 1998 Dec; 5(12): 1244-5. (Polish)
36. Rush D. Evaluating the Nutrition Screening Initiative. Am J Public Health. 1993 Jul; 83(7): 944-5.
37. Hengstermann S, Nieczaj R, Steinhagen-Thiessen E, Schulz R-J. Which are the most efficient items of Mini Nutritional Assessment in multimorbid patients? J Nutr Health Aging. 2008 Nov; 12 (2): 117-22.
38. Sahyoun NR, Jacques PF, Dallal G, Russell RM. Nutrition Screening Initiative checklist may be a better awareness/educational tool than a screening one. J Am Diet Assoc. 1997 Jul; 97(7): 760-4.
39. Sahyoun NR. Usefulness of nutrition screening of the elderly. Nutr Clin Care. 1999 May-Jun; 2: 155-63.
40. Wilson JM, Junger G. Principles and practice of screening for disease. Genewa: WHO, 1968. p. 163.
41. Bauer JM, Kaiser MJ, Anthony P, Guigoz Y, Sieber CC. The Mini Nutritional Assessment- its history, today's practice, and future perspectives. Nutr Clin Pract. 2008 Aug-Sep; 23(4): 388-96.
42. Synak B. Polska starość. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego, 2002. 346 p. (Polish)
43. Wyka J, Biernat J, Mikołajczak J, Piotrowska E. Assessment of dietary intake and nutritional status (MNA) in Polish free-living elderly people from rural environments. Arch Gerontol Geriatr. 2012 Jan; 54(1): 44-9.