Health status correlates of malnutrition in the polish elderly population – Results of the Polsenior Study

R. KRZYMINSKA-SIEMASZKO[1], J. CHUDEK[2,3], A. SUWALSKA[4], M. LEWANDOWICZ[1], M. MOSSAKOWSKA[5], R. KROLL-BALCERZAK[6], B. WIZNER[7], S. TOBIS[8], K. MEHR[9], K. WIECZOROWSKA-TOBIS[1,10]

[1]Laboratory of Geriatric Medicine, Department of Palliative Medicine, Poznan University of Medical Sciences, Poznan, Poland
[2]Department of Pathophysiology, Medical University of Silesia in Katowice, Katowice, Poland
[3]Department of Internal Medicine and Oncological Chemotherapy, Medical Faculty, Medical University of Silesia in Katowice, Katowice, Poland
[4]Laboratory of Neuropsychobiology, Department of Psychiatry, Poznan University of Medical Sciences, Poznan, Poland
[5]International Institute of Molecular and Cell Biology in Warsaw, Warsaw, Poland
[6]Department of Haematology, Poznan University of Medical Sciences, Poznan, Poland
[7]Department of Internal Medicine and Gerontology, Jagiellonian University Medical College, Krakow, Poland
[8]Laboratory of Occupational Therapy, Department of Geriatrics and Gerontology, Poznan University of Medical Sciences, Poznan, Poland
[9]Laboratory of Masticatory System Dysfunctions, Department of Oral Rehabilitation, Poznan University of Medical Sciences, Poznan, Poland
[10]Department of Human Nutrition and Hygiene, Poznan University of Life Sciences, Poznan, Poland

Abstract. – **OBJECTIVE:** The aim of the study was to analyze health-related factors associated with poor nutritional status (PNS) of a representative group of Polish older people, based on data from the PolSenior project (the first nation-wide study of Polish senior citizens).

PATIENTS AND METHODS: Nutritional status was assessed in 3751 community-dwelling older people (1770 females, mean age: 77.4±8.0 years) using the Mini Nutritional Assessment - Short Form. Elements of comprehensive geriatric assessment (cognitive and mood screening), selected medical data were analyzed in relation to the nutritional status. These were: the number of medications, the number of chronic diseases, selected diseases potentially related to malnutrition (anaemia, stroke, peptic ulcer, Parkinson's disease, cancer – past or present), total edentulism, use of dentures, and chronic pain.

RESULTS: PNS was observed in 44.2% of participants. Female sex [OR 1.72, 95% CI (1.45-2.04)], advanced age [OR 2.16 (1.80-2.58)], symptoms of depression [OR 11.52 (9.24-14.38)], cognitive impairment [OR 1.52 (1.20-1.93], multimorbidity [OR 1.27 (1.04-1.57)], anaemia [OR 1.80 (1.41-2.29)] and total edentulism [OR 1.26 (1.06-1.49)] were independently correlated with PNS.

CONCLUSIONS: PNS in Polish elderly population is strongly related to the occurrence of symptoms of depression. People in advanced age with symptoms of depression, cognitive impairment, multimorbidity, anaemia and total edentulism should be screened and monitored for early symptoms of malnutrition.

Key Words:
  Malnutrition, MNA-SF, Health-related correlates, Elderly, Ageing.

Introduction

The imbalance between nutritional needs and nutrients intake is more prevalent in older people than in middle-aged individuals, and malnutrition is a common condition[1]. Poor nutritional status (PNS) not only accelerates the ageing process but may also increase morbidity and negatively impact the course of diseases[2,3]. It may also prolong hospitalization, increase the costs of treatment and increase the mortality rate among older people[4,5]. Malnutrition is thus a significant factor, which affects the functional independence of older people[6,7].

In view of current demographic projections, which indicate a rise in the proportion of older

Corresponding Author: Roma Krzyminska-Siemaszko, Ph.D; e-mail: romakrzyminska@interia.pl

people in most countries worldwide, including Poland[8], it is very important to identify subjects with PNS early in order to implement proper treatment. Therefore, efforts to determine the risk factors that may adversely affect the nutritional status of older people, and which in turn lead to irreversible changes in their independence, seem crucial. However, malnutrition in old age is usually a multifactorial condition and it is often not possible to pinpoint its key cause. Moreover, in cases of coexistence of malnutrition and chronic diseases, it is difficult to delineate the causality.

The socio-demographic correlates of malnutrition in Poland have been presented in a previous paper[9]. The authors pointed out that particular attention should be paid to single, poorly educated females, especially in advanced age, living in rural areas and declaring to be in a bad financial situation. That paper notwithstanding, data on health-related correlates of malnutrition from a representative group of older people are limited [10]. The aim of this paper was to, therefore, analyze the health-related factors associated with PNS in Poland, based on the data from the PolSenior project – the first nation-wide study of a representative group of Polish senior citizens.

Patients and Methods

PolSenior was a multidisciplinary research project, conducted in 2007-2011, in order to assess the medical, psychological, social and economic aspects of ageing in Poland. The aim of the project was to define the status of older people as well as their social and medical needs. The outcomes were expected to facilitate the provision of necessary care in view of the increasing number of older people.

In the PolSenior project 4979 subjects (2412 females and 2567 males), aged 65 years and older, were studied. The sample size was calculated assuming an assessment of traits that occur with the prevalence of at least 5% within the elderly population. Participants were selected through a multi-stage draw, planned so as to obtain a representative group for Poland. The selection was performed independently in six 5-year age cohorts: 65-69 years (n=782), 70-74 years (n=923), 75-79 years (n=844), 80-84 years (n=791), 85-89 years (n=871), 90 years and above (n=768). A detailed description of the study design has already been presented[11].

Informed consent was obtained from each participant or their caregiver prior to the study. The study was conducted in accordance with the Declaration of Helsinki and the protocol was approved by the Bioethics Committee of the Medical University of Silesia in Katowice (Permit Number: KNW-6501-38/08).

Studied group
The studied group was comprised of 3751 community-dwelling respondents of the PolSenior project (1770 females and 1981 males) who met the following inclusion criteria:
- Acquired at least 70% of all possible points in the Mini-Mental State Examination (MMSE); this result was supposed to confirm the ability to understand the questions of the 15-point Geriatric Depression Scale (GDS), used to assess the symptoms of depression,
- Were able to stand upright for height measurement which, in turn, made it possible to calculate Body Mass Index (BMI),
- The data obtained from the respondents enabled the completion of Mini Nutritional Assessment – Short Form scale (MNA-SF).

Study Procedure and Data Analysis
In the analysis an assessment of the nutritional status was made, along with other elements of the comprehensive geriatric assessment (cognitive and mood screening) which are important for the nutritional status. Selected medical history data was also included (number of medications routinely taken by the study participants, number of chronic diseases, selected chronic diseases potentially related to malnutrition).

The nutritional status was assessed with the MNA-SF (the revised MNA-SF of 2009)[12], one of the most valid and frequently used nutritional screening tools for older people[13,14]. MNA-SF is composed of 6 questions and evaluates the decrease in food intake, weight loss, mobility, psychological stress or acute diseases, neuropsychological problems (dementia or depression) and BMI.

Poor nutritional status (PNS) was defined as a MNA-SF result below 12 points (the maximum is 14 points). Following Kaiser et al[15], this included both subjects with malnutrition (≤7 points) and those at risk of malnutrition (8-11 points).

Cognitive status was assessed with the Mini-Mental State Examination (MMSE)[16]. A result of 24-30 points indicated that there was no dementia. Results of 0-23 points were classified as a positive screening for dementia (20-23 points:

mild dementia, 10-19: points: moderate dementia and 0-9 points: severe dementia).

The presence of the symptoms of depression was assessed by means of a short version of Geriatric Depression Scale (GDS), composed of 15 questions[17]. GDS was performed only for those respondents who obtained at least 70% of all possible points in MMSE (n=3984), thus excluding persons with cognitive impairment (who might, therefore, not fully understand the questions). Subjects with at least 6 points on the GDS scale were classified as belonging to the group with symptoms of depression.

The number of medications taken by the respondents came from interviews conducted by trained nurses with the older people or their caregivers (if the respondents were not able to actively participate in the project due to health problems or disability, e.g. hearing loss). They were asked to present all medications being used. The analysis included medications taken at least once a week, both prescribed and over-the-counter (OTC). With regard to the number of medications, the respondents were divided into two groups: without polypharmacy (up to 4 medications taken simultaneously) and with polypharmacy (at least 5 medications).

The data on the number of diseases were also obtained during the interviews. Subjects with fewer than 4 chronic diseases were compared against those with 4 or more diseases (i.e. with multimorbidity). The data on selected chronic diseases potentially related to malnutrition (anaemia - based on WHO definition: haemoglobin below 12 g/dl in females and 13 g/dl in males, the peptic ulcer, stroke – both ischemic and haemorrhagic, Parkinson's disease and cancer – present or past) were also collected. Additionally, chronic pain was evaluated, defined as persisting longer than 3 months.

The respondents were also classified based on their dental status. They were divided into those with total edentulism (no teeth of their own) and those who used dentures. Those who had artificial dentures were analyzed separately.

Statistical Analysis

Statistical analysis was performed with STATISTICA 10.0 software (StatSoft, Poland). For all the analyzed variables the mean and standard deviations were calculated. Data distribution normality was assessed using Shapiro-Wilk's test. Statistical comparisons between the groups were made using Chi-square test. To assess simulta-

neous interdependence between many variables, multiple regression (logistic regression) was used, specifying the odds ratio and the confidence interval with the confidence limit of 95%; $p<0.05$ was considered statistically significant.

The sample was intended to include the same number of men and women in all age cohorts. It thus allowed for the precise assessment of studied factors in the oldest groups. On the other hand, older groups and males were overrepresented compared to the actual population structure. Consequently, post-stratification was necessary in order to make the sample representative of the Polish population and assure that the results reflected the distribution of studied characteristics (including malnutrition and risk of malnutrition) in the entire population of older people in Poland.

Results

Study Participants Characteristics

The mean age of the study participants was 77.4±8.0 years. The female to male ratio was 9:10 (47.2% of subjects studied were females).

Among analyzed individuals 22.8% were diagnosed with at least 4 chronic diseases, 43.8% were treated with at least 5 medications simultaneously and 10.9% with at least 10 medications. Screening for dementia was positive in 17.1% of the individuals studied, and in 29.0% symptoms of depression were present.

Anaemia was present in 14.9% of individuals, peptic ulcer was declared by 10.2%, stroke by 6.4% and Parkinson's disease by 2.1%. 6.7% of the studied population reported being diagnosed with cancer (at present or in the past). Chronic pain was present in 42.6% of the respondents. Total edentulism was found in 47.8%; only 77.6% of participants had dentures and only 83.7% of denture owners used them. Table I presents the demographic and health characteristics of the study participants by gender.

Factors Associated with Poor Nutritional Status

PNS was found in 44.2% of studied subjects, including 6.2% who were malnourished, and 38.0% at risk of malnutrition.

Table II shows the impact of health-related factors (including age and sex) on the prevalence of PNS using univariable analysis. Age and sex had a strong impact on PNS. PNS was detected almost twice as frequently in subjects of the oldest cohort

Table I. Demographics and health characteristics of the participants by gender.

Variable	Males n (%)	Females n (%)	p
Age			
65-69 years	344 (17.4)	378 (21.4)	
70-74 years	429 (21.7)	406 (22.9)	
75-79 years	373 (18.8)	329 (18.6)	p=0.007*
80-84 years	320 (16.2)	272 (15.4)	
85-89 years	326 (16.5)	244 (13.8)	
90 and over	189 (9.5)	141 (8.0)	
Number of chronic diseases			
≥ 4 diseases	358 (18.1)	498 (28.1)	p<0.001
< 4 diseases	1623 (81.9)	1272 (71.9)	
Number of medications			
0-4	970 (49.6)	706 (40.5)	
5-9	810 (41.4)	810 (46.4)	p<0.001*
10 or more	176 (9.0)	228 (13.1)	
Dementia			
Yes	314 (15.8)	328 (18.5)	p<0.05
No	1667 (84.2)	1442 (81.5)	
Depression			
Yes	471 (23.8)	618 (34.9)	p<0.001
No	1510 (76.2)	1152 (65.1)	
Anaemia			
Yes	300 (18.1)	165 (11.3)	p<0.001
No	1358 (81.9)	1291 (88.7)	
Peptic ulcer			
Yes	215 (11.0)	164 (9.3)	ns
No	1746 (89.0)	1593 (90.7)	
Stroke			
Yes	127 (6.4)	111(6.3)	ns
No	1850 (93.6)	1653 (93.7)	
Parkinson's disease			
Yes	49 (2.5)	29 (1.7)	ns
No	1919 (97.5)	1728 (98.3)	
Cancer			
Yes	136 (6.9)	115 (6.5)	ns
No	1835 (93.1)	1642 (93.5)	
Chronic pain (> 3 months)			
Yes	714 (36.1)	880 (49.8)	p<0.001
No	1263 (63.9)	886 (50.2)	
Total edentulism			
Yes	839 (43.9)	895 (52.1)	p<0.001
No	1072 (56.1)	822 (47.9)	
Use of dentures			
Yes	1302 (66.3)	1402 (79.6)	p<0.001*
No	106 (5.4)	79 (4.5)	
Doesn't have any	555 (22.3)	281 (15.9)	
Chronic pain (> 3 months)			
Yes	714 (36.1)	880 (49.8)	p<0.001
No	1263 (63.9)	886 (50.2)	

Notes: *X² for trend

than in the youngest one (*p*<0.001) and was more frequent among females than males (*p*<0.001). Respondents exposed to a higher risk of PNS included those who were diagnosed with at least 4 chronic diseases (*p*<0.001) as well as those with polypharmacy (*p*<0.001).

As far as analyzed clinical conditions are concerned, the factors contributing to PNS included

positive screening for dementia and symptoms of depression ($p<0.001$) as well as reports on chronic pain ($p<0.001$). Moreover, PNS was more frequent in study participants with anaemia ($p<0.001$), peptic ulcer ($p<0.01$), stroke ($p<0.001$), Parkinson's disease ($p<0.001$) and cancer ($p<0.05$).

PNS was more frequently diagnosed in older people with total edentulism ($p<0.001$). In all the studied groups a comparison of subjects who used dentures with those who did not use them (regardless of whether they still had their own teeth or were toothless) revealed no statistical difference in the risk of PNS. However, in the case of subjects with total edentulism, PNS was more frequent in those who did not use dentures (66.2% vs. 53.0%; $p<0.001$).

The multiple regression models including all factors influencing the risk of PNS from the univariable analysis is presented in Table III. The strongest independent correlate of PNS in the population studied was the presence of symptoms of depression (OR 11.52). Female sex, advanced age (80 years or more), positive screening for dementia, multimorbidity (the presence of 4 or more diseases), anaemia, and total edentulism were also found to be independent factors contributing to PNS.

Separately analyzed multiple regression models for females and males showed differences in the correlates of PNS (Table III). For both sexes, the common correlates included: advanced age (80 years or more), the presence of symptoms of depression and positive screening for dementia, as well as

Table II. Poor nutrition status (MNA-SF<12) of the participants by socio-demographic and health characteristics

Variable	Level	Poor nutritional status n (%)	P
Sex	Males [n=1981]	828 (41.8)	$p<0.001$
	Females [n=1770]	1009 (57.0)	
Age	65-69 years [n=722]	272 (37.7)	
	70-74 years [n=835]	313 (37.5)	
	75-79 years [n=702]	328 (46.7)	$p<0.001^*$
	80-84 years [n=592]	328 (55.4)	
	85-89 years [n=570]	356 (62.5)	
	90 and over [n=330]	240 (72.7)	
Number of chronic diseases	≥ 4 diseases [n=856]	507 (59.2)	
	< 4 diseases [n=2895]	1330 (45.9)	$p<0.001$
Number of medications	0-4 [n=1676]	746 (44.5)	
	5-9 [n=1620]	814 (50.2)	$p<0.001^*$
	10 or more [n=404]	248 (61.4)	
Dementia	Yes [n=642]	419 (65.3)	$p<0.001$
	No [n=3109]	1418 (45.6)	
Depression	Yes [n=1089]	938 (86.1)	
	No [n=2662]	899 (33.8)	$p<0.001$
Anaemia	Yes [n=465]	289 (62.2)	
	No [n=2649]	1202 (45.4)	$p<0.001$
Peptic ulcer	Yes [n=379]	210 (55.4)	
	No [n=3339]	1608 (48.2)	$p<0.01$
Stroke			
	Yes [n=238]	150 (63.0)	
	No [n=3503]	1681 (48.0)	$p<0.001$
Parkinson's disease	Yes [n=78]	53 (67.9)	
	No [n=3647]	1767 (48.5)	$p<0.001$
Cancer	Yes [n=251]	138 (55.0)	$p<0.05$
	No [n=3477]	1685 (48.5)	
Chronic pain	Yes [n=1594]	862 (54.1)	
	No [n=2148]	971 (45.2)	$p<0.001$
Total edentulism	Yes [n=1734]	955 (55.1)	
	No [n=1894]	822 (43.4)	
Use of dentures	Yes [n=2704]	1304 (48.2)	$p<0.001$
	No [n=185]	102 (55.1)	ns

Notes: *X^2 for trend.

Table III. Factors associated with poor nutritional status (multiple logistic regression, backward selection model).

Variable	Overall OR (95% CI)	Males p	Females OR (95% CI)	p	OR (95% CI)	p
Female sex	1.72 (1.45-2.04)	<0.001	-		-	
Age[*]	2.16 (1.80-2.58)	<0.001	1.78 (1.40-2.27)	<0.001	2.77 (2.11-3.61)	<0.001
Depression	11.52 (9.24-14.38)	<0.001	12.80 (9.40-17.43)	<0.001	10.80(7.85-14.87)	<0.001
Dementia	1.52 (1.20-1.93)	<0.001	1.58 (1.15-2.18)	0.005	1.41 (0.99-2.02)	0.05
Multimorbidity[**]	1.27 (1.04-1.57)	0.02	-	-	1.35 (1.01-1.79)	0.04
Anaemia	1.80 (1.41-2.29)	<0.001	1.81(1.34-2.44)	<0.001	1.99 (1.30-3.07)	0.002
Total edentulism	1.26 (1.06-1.49)	0.009	1.31(1.04-1.66)	0.02	-	-

Notes: [*]80 years or more; [**]4 or more diagnosed diseases.

anaemia. In males, PNS was also related to edentulism, whereas in females – to multimorbidity.

Discussion

The paper presents health-related correlates of PNS among a representative population of Poland. In addition to advanced age (80 years or more) and female sex, the presence of symptoms of depression, positive screening for dementia, multimorbidity (4 or more chronic diseases), anaemia and total edentulism were independent correlates of PNS in the Polish population.

A shortened version of the MNA (the revised MNA-SF of 2009) was used instead of its full version as it allows prompt and efficient identification of those older people who are malnourished or are at a greater risk of malnutrition. The MNA-SF requires less time to complete than the full version, which is advantageous, especially in studies of the elderly population. The high sensitivity and specificity of the MNA-SF scale, as well as its good correlation with the full version, have been confirmed in many clinical studies[18,19]. The MNA-SF scale has also been validated in research among community-dwelling older people in Poland[20].

In previous investigations[1,10,21-24] of the aspects associated with malnutrition in older people, various health-related factors have been taken into consideration, based on multidimensional analysis. With the exception of Nykanen et al[10], depression was included in all of them. In our work, symptoms of depression were the strongest correlate of PNS. This finding is in agreement with previously published data[1,21,23-24], although Torres et al[22] observed the relationship between PNS and depression only in older people living in urban areas. Among the symptoms of depression apathy, loss of appetite, and loss of interest in self-care were shown to increase the risk of malnutrition[1,21]. On the other hand, vitamin and antioxidant deficiencies have been proven to reduce the risk of depression[25]. Thus, malnutrition and depression may accelerate each other.

Similarly to other studies[1,10,22-24], lower results of MMSE also contributed to PNS in the PolSenior population. It has been stressed that subjects with dementia may be unable to not only go shopping and prepare meals, but even eat properly. Additionally, among individuals with dementia, abnormal food-related behaviours are quite common[26] and may lead to unintentional weight loss [26,27] as well as PNS.

Boulos et al[23] have presented the vicious circle between malnutrition and multimorbidity. In this study, multimorbidity was an important factor contributing to PNS. It has been shown that various chronic diseases are accompanied by decreased food intake and metabolic changes, with a subsequent negative impact on the energy balance[23,31]. Among the diseases included in our report only anaemia (which is itself frequently a symptom of chronic diseases and malnutrition) was found to be a factor for PNS. Mitrache et al[32] have shown that malnutrition may play an important etiologic role in anaemia in older people. Moreover, Ramel et al[33] have found that measures related to malnutrition, e.g. midarm muscle circumference and prealbumin concentration, remained significant predictors of haemoglobin in hospitalised older patients in Ireland. In this context, however, it is worth noticing that anaemia is not included in the list of diseases related to malnutrition presented in the review of Hickson et al[31].

In the present study, peptic ulcer, stroke, Parkinson's disease and cancer were not independent

factors related to PNS. Other scholars[10,22] have not included these parameters. Malnutrition is a common problem in patients with malignancy, but it mainly occurs in advanced stages of cancer[34,35]. Among subjects who had a stroke and Parkinson's disease, malnutrition is related to disability[36,37]. In the entire PolSenior population the number of study participants with advanced stages of analyzed diseases was relatively small. As far as peptic ulcers are concerned, it has been shown that symptoms such as stomach pain (and not the diagnosis itself) were related to malnutrition[24].

Dental status is an integral part of the well-being of older people. Poor dental status in old age, either edentulism or lack of dentures, is a risk factor of malnutrition that is well documented in the literature[28,29]. It is also emphasized that a lack of functional dentition is associated with avoiding foods that must be chewed, such as meat. Raw vegetables, fruit, and high-fibre foods are also avoided[28]. Such a diet alone may result in malnutrition.

Chronic pain was not an independent factor of PNS in the PolSenior population. It has only been included in a multivariable analysis of factors associated with PNS performed in a rural area in Lebanon, by Boulos et al[23], who showed that older people complaining of chronic pain were almost twice as likely to have PNS. It seems possible that chronic pain may cause mood alterations[38] and, subsequently, symptoms of depression (not pain) constitute an independent factor of PNS.

The use of a greater number of medications in the PolSenior population was not related to PNS. This is in agreement with the data published by van Bokhorst et al[1]. On the other hand, Torres et al[22] have reported an association between a higher number of medications used daily and PNS. It seems possible that this is at least partly due to different definitions of polypharmacy used by the cited authors.

When a multiple regression analysis was performed independently for females and males, multimorbidity in the former and edentulism in the latter was found to be independent risk factors for PNS. This is possibly a new observation. It has also been shown that females and males age differently, which most likely also affects the correlates of PNS[39].

Conclusions

PNS in the Polish elderly population is strongly related to the occurrence of symptoms of depres-

sion. In particular, people in advanced age with symptoms of depression, those with a positive screening for dementia, with multimorbidity, anaemia and total edentulism should be screened and monitored for early symptoms of malnutrition. Proper nutritional interventions for older people with early symptoms of malnutrition are a major challenge not only for nutritional specialists, physicians, and nurses but also for all public health practitioners.

Conflicts of interest

The authors declare no conflicts of interest.

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