ORIGINAL ARTICLE—STUDENT AWARD WINNER 2015*

Inappropriate pattern of nutrient consumption and coexistent cardiometabolic disorders in elderly people from Poland

Agnieszka R. Guligowska, Małgorzata Pigłowska, Janusz Śmigielski, Tomasz Kostka

Department of Geriatrics, Medical University of Lodz, Łódź, Poland

KEYWORDS

cardiovascular disease, deficiency, diabetes mellitus, nutrition, recommendations

ABSTRACT

INTRODUCTION Nutritional recommendations are aimed at, among others, reducing morbidity and mortality from cardiovascular diseases and metabolic disorders, which are common in the aging population. Adherence to these recommendations allows not only to stop the progression of a disease but also to improve the overall health of elderly patients.

OBJECTIVES The aim of this study was to analyze differences in nutrition of elderly patients, with emphasis on the implementation of nutritional recommendations both for healthy people and for patients with cardiometabolic disorders.

PATIENTS AND METHODS Based on a 24-hour recall questionnaire of 239 volunteers (mean age, 72 ±9.34 years) and using the Diet 5.0 software, we analyzed in detail the pattern of consumption of various nutrients.

RESULTS Compared with the recommendations of the World Health Organization and cardiology associations, more than 90% of the population did not cover the demand for calcium, potassium, vitamin D, folic acid, and α-linolenic acid. The intake of polyunsaturated fatty acids, sodium, magnesium, fiber, water, and vitamin C was slightly higher. The appropriate intake was observed only in a diet of 15% to 40% of the subjects. The most significant differences were demonstrated for the coexisting diseases and the intake level of sodium, polyunsaturated fatty acids (particularly docosahexaenoic acid) vitamin C, iron, fiber, lauric acid, and sucrose. The diet of patients with hypercholesterolemia was the least deficient, while deficiencies were the most common in patients with a history of myocardial infarction, ischemic heart disease, and heart failure.

CONCLUSIONS Nutrition of geriatric patients is inadequate. Their diet is profoundly deficient in nutrients, and these deficiencies further deteriorate in the presence of cardiovascular or metabolic diseases. Our results indicate the need for education among elderly patients in terms of proper eating habits and, possibly, individual supplementation.

Correspondence to:
Agnieszka Guligowska, MSc, Klinika Geriatrii, Uniwersytet Medyczny w Łodzi, ul. Żeromskiego 113, 90-549 Łódź, Poland, phone/fax: +48 42 639 36 09, e-mail: agnieszka.guligowska@stud.umed.lodz.pl
Received: April 15, 2015.
Revision accepted: April 20, 2015.
Published online: June 3, 2015.
Conflict of interest: none declared.
Pol Arch Med Wewn. 2015; 125 (7-8): 521-531

* The authors won the second award of the Editor-in-Chief for the best student paper in 2015. For more information, go to www.pamw.pl.

INTRODUCTION Cardiovascular and metabolic diseases are the major cause of disability and mortality among elderly patients in developed countries. Despite a recent decrease in mortality rates in many countries, the diseases are still responsible for over 4 million deaths per year or 46% of all deaths in Europe.[1]

The population of Poland and other Central and Eastern European countries has been aging rapidly. The Eurostat databases show that in 2020, people over 65 years of age will constitute nearly 25% of the Polish society, and the old age dependency ratio (≥65/15–64 years old) will amount to 36%.[2] This is an enormous challenge for social welfare and health care services, which are not adequately prepared to deal with this situation.[3] In the face of hazards posed by cardiometabolic disease in modern society, the role of prevention, including changes in eating habits and nutritional education of patients, becomes an extremely important issue. A proper diet and physical activity play an important preventive function in patients with cardiometabolic diseases. A report from the World Health Organization (WHO) showed that health awareness has increased in many countries and the eating habits of the Europeans have changed, which has significantly decreased mortality from cardiovascular disease (CVD).[1]

The WHO,[4] European Society of Cardiology,[5] and the American Heart Association[6] recommend healthy diet as the cornerstone of CVD prevention.

Surprisingly, very little is known about the dietary habits of older patients from Central and Eastern European countries. Therefore, the aim of this paper was to analyze the pattern of consumption of various nutrients among elderly patients from Poland in relation to coexistent cardiometabolic diseases.

PATIENTS AND METHODS

Patients

The study was conducted from April 2012 to February 2015 with the participation of patients treated in the Outpatient Geriatric Clinic of the Medical University of Lodz, Łódź, Poland, who volunteered to undergo a detailed dietary assessment. The inclusion criteria were as follows: oral feeding, ability to communicate verbally, and consent to participate in the study. Patients with severe dementia and those receiving enteral nutrition were excluded from the study. Similarly, patients using any dietary supplements of vitamins and minerals were excluded from the study.

A total of 239 patients (173 women and 66 men) who met the inclusion criteria participated in the study. They were diagnosed with the following concomitant diseases: hypertension (146 patients), chronic heart failure (CHF; 93 patients), ischemic heart disease (IHD; 85 patients), previous myocardial infarction (MI; 19 patients), previous stroke (26 patients), diabetes (51 patients), and hypercholesterolemia (123 patients). The study was approved by the Ethics Committee of the Medical University of Lodz, and written informed consent was obtained from all subjects.

Methods

Subjects were interviewed during medical appointments. Interviewers (a nutritionist and dietician) used a 24-hour recall questionnaire to register and then encode the intake of food, beverages, and supplements during the preceding day. Every interview lasted approximately 30 minutes. The intake of energy and nutrients was calculated using the Dieta 5.0 software (developed by the National Food and Nutrition Institute in Warsaw, Poland).[7,8] The program analyzes the consumption levels of 84 nutrients as well as the energy intake (the total amount expressed as the percentage of energy coming from proteins, fats, and carbohydrates).

All participants had their height, weight, and waist circumference measured, and the results were used for the assessment of body mass index (BMI) and waist-to-height ratio (WHtR).[9] The WHtR was used to avoid the need for age- and sex-specific values. This parameter is considered to be a particularly reliable predictor of CVD, diabetes, and related risk factors.[10]

Statistical analysis

Data were verified for normality of distribution and equality of variances. Correlations between the intake of nutrients and age, educational level, BMI, and WHtR were analyzed with the Spearman's rank correlation coefficient. The Mann–Whitney test was used to compare the mean values. A statistical analysis was performed using the Statistica 10th CSS program. The results of the quantitative variables were presented as a mean ± standard deviation and median. The limit of statistical significance was set at a P value of less than 0.05 for all analyses.

RESULTS

The mean age was 72.0 ±9.34 years, and there was no difference in age between men and women (72.0 ±9.0 years vs 72.0 ±9.4 years, respectively). The mean level of education expressed as the years of schooling was 11.5 ±3.6; and there was no difference in the level of education between men and women (11.6 ±3.5 vs 11.5 ±3.7, respectively). Men and women had a comparable BMI (27.1 ±4.3 kg/m^2 and 28.6 ±5.3 kg/m^2, respectively). The BMI of the whole study group was 28.2 ±5.1 kg/m^2. WHtR was 0.59 ±0.07 for the whole study population, 0.58 ±0.07 for men, and 0.59 ±0.08 for women.

The intake of selected nutrients and associations between the intake and age, educational level, BMI, and WHtR are presented in TABLE 1.

The mean energy intake showed a significant negative correlation with age with a simultaneous increase of energy from both total fat and saturated fat. Although there was no significant correlation between age and total protein intake, a significant negative correlation was observed with the consumption of vegetable protein, cystine, arginine, and aspartic acid. Age negatively correlated with the intake of long-chain polyunsaturated fatty acids (LCPUFAs), fatty acids 18:3 and 22:6, digestible carbohydrates, starch, fiber, several vitamins and minerals (vitamin B_1, niacin, vitamin B_6, folic acid, vitamin C, sodium , potassium, phosphorus, magnesium, iron, zinc, and copper), and with average water consumption.

The educational level did not differentiate the total energy intake but showed a strong positive correlation with the percentage of energy intake from proteins and a strong negative correlation with the percentage of energy intake from total carbohydrates and sucrose. There was a positive correlation between the educational level and the intake of animal proteins and all analyzed amino acids, LCPUFAs (22:5, 22:6), fatty acids 20:4, 20:5, 20:1, 18:3, and cholesterol, and a negative correlation with the intake of lauric acid (12:0). The intake of digestible carbohydrates, starch, and sucrose negatively correlated with the educational level, while the level of fiber in diet increased with the educational level. The intake of the majority of vitamins and minerals as well as water consumption showed a positive correlation with the educational level.

The average intake of protein per 1 kg of body mass showed a strong negative correlation with

BMI and WHtR. BMI positively correlated with the consumption of aspartic acid and proline. There was a negative correlation between WHtR and polyunsaturated fatty acids (PUFAs). The level of fiber in diet increased with an increase in WHtR. The intake of individual vitamins and minerals showed a negative correlation with WHtR (β-carotene, vitamin B_1, folic acid, magnesium, iron, copper, and manganese).

Associations between the intake of selected nutrients and sex and concomitant cardiometabolic diseases are shown in **TABLE 2**. The energy intake was lower in women than in men (1569 ±459 kcal vs 1976 ±636 kcal) and in patients with hypercholesterolemia than in healthy subjects (1598 ±486 kcal vs 1762 ±590 kcal). In addition, patients with hypercholesterolemia had a higher level of energy intake from protein and lower from sucrose. A smaller percentage of energy intake from protein was observed in patients with IHD and CHF. In patients with a history of stroke, the percentage of energy intake from carbohydrates and sucrose was significantly higher compared with their healthy peers (57.2 ±6.2 vs 53.7 ±9.6 for carbohydrates; 17.5 ±6.6 vs 13.8 ±7.7 for sucrose).

The intake of proteins and individual amino acids was significantly lower in women (63 ±23 g) than in men (76 ±25 g), patients with IHD (63 ±25 g), and patients with CHF (63 ± 23 g). In comparison with patients with normal cholesterol levels, patients with hypercholesterolemia showed a lower intake of vegetable protein (22 ±7 g vs 25 ±8 g). A lower consumption of selected amino acids (isoleucine, cystine, phenylalanine, threonine, tryptophan, arginine, alanine, aspartic acid, glycine, and serine) was observed in patients with a history of MI compared with their healthy peers.

The intake of fat was lower in women than in men. A higher consumption of lauric acid (12:0) was reported for patients with hypertension, IHD, CHF, and stroke. Patients with diabetes showed a lower intake of total PUFAs (18:2, 18:3) than their healthy peers (8.26 ±7 g and 8.62 ±5 g, respectively). In comparison with patients with normal cholesterol levels and without IHD, patients with hypercholesterolemia consumed significantly more LCPUFAs (0.32 ±0.7 g vs 0.16 ±0.5 g), while patients with IHD significantly less LCPUFAs (0.14 ±0.5 g vs 0.3 ±0.7 g). A lower intake of fatty acids 20:5 and 22:5 was reported in patients with stroke. The cholesterol intake was significantly lower in patients with MI than in their healthy peers (188 ±122 mg vs 260 ±154 mg).

The carbohydrate intake was significantly lower in women than in men (224 ±73 g vs 293 ±109 g). In patients with hypercholesterolemia, the intake of carbohydrates (226 ±80 g vs 261 ±97 g), including starch (112 ±41 g vs 129 ±48 g), was also lower compared with patients with normal cholesterol levels. An important finding was a high consumption of sucrose (mean, 62 ±46 g; 14% ±7% of energy from sucrose) in the whole study population. Only patients with hypercholesterolemia and patients with diabetes consumed less sucrose (53 ±39 g; 13% ±7% of the energy from sucrose and 50 ±34 g; 12% ±7% of the energy from sucrose, respectively). In contrast, patients with stroke consumed significantly more sucrose (71 ±29 g; 18% ±7% of the energy from sucrose).

A lower fiber intake was found in patients with stroke (16.5 ±8 g vs 18.9 ±8 g), IHD (16.9 ±8 g vs 19.6 ±8 g), and CHF (16.5 ±8 g vs 20 ±9 g). For IHD (118 ±61 kcal/g vs 97 ±42 kcal/g) and CHF (117 ±5 kcal/g vs 96 ±43 kcal/g), a significant difference in the supply of kilocalories per 1 gram of fiber was also found. Patients with hypercholesterolemia did not show significant differences in fiber intake compared with their healthy peers, but the number of kilocalories per 1 gram of fiber was significantly lower (99 ±51 kcal/g vs 110 ±49 kcal/g).

The vitamin D intake was lower in men compared with women (3.49 ±4.9 μg vs 3.52 ±5.42 μg). In contrast, the intake of several minerals (sodium, potassium, phosphorus, magnesium, iron, zinc, copper, and iodine) and vitamins (retinol, vitamins E, B_1, B_2, B_6, and B_{12}) was significantly lower in women.

A lower intake of vitamins and minerals was observed in patients with a history of MI, IHD, and CHF, as compared with healthy peers. Subjects with hypercholesterolemia had a higher intake of vitamin C (103 ±141 mg vs 81 ±121 mg) and vitamin D (4.14 ±6 μg vs 2.78 ±3 μg). A lower intake of vitamin C was found in patients with hypertension (90 ±157 mg vs 95 ±77 mg), MI (48 ±42 mg vs 96 ±136 mg), IHD (75 ±150 mg vs 102 ±119 mg), and CHF (73 ±143 mg vs 104 ±123 mg). The intake of vitamin B_6 was significantly lower in patients with MI (1.29 ±0.7 mg vs 1.77 ±0.9 mg). Patients with CHF consumed less folic acid (206 ±74 μg vs 259 ±146 μg). The iron intake was also lower in patients with CHF (9.7 ±5.3 mg vs 11.7 ±9.6 mg), IHD (10 ±5.6 mg vs 11.5 ±9.3 mg), MI (8.3 ±3.3 mg vs 11.2 ±9 mg), and diabetes (9.9 ±6 mg vs 11.2 ±8.7 mg). The sodium intake was lower in patients with a history of MI (2680 ±1019 mg vs 3471 ±1242 mg). Also, in this group, the intake of iodine was significantly lower (96.1 ±59 μg vs 146.8 ±66 μg).

DISCUSSION This is the first study showing in detail the pattern of consumption in older adults including those with coexistent cardiometabolic diseases. Our data indicate that the intake of nutrients generally does not follow the current recommendations and is usually worse in the presence of common cardiometabolic disorders. The results also indicate the directions for future management of this population of patients in terms of eating habits, education, and use of potential supplements.

Our study population showed a significant deficiency of vitamin D, folic acid, calcium, and potassium in diet. Less than 10% of the patients met the daily intake set by the Adequate Intake and Recommended Daily Intake (RDA) for those vitamins and minerals.[11,12] Owing to a widespread

TABLE 1 Daily intake of selected nutrients and associations between the intake and age, educational level, body mass index, and waist-to-height ratio in the study group (n = 239)

Nutrients	Mean ± SD	Median	Age	Educational level	BMI	WHtR
energy, kcal	1681 ±545	1625	–0.136[a]	NS	NS	NS
percentage of energy from proteins, %	16.4 ±4.8	15.7	NS	0.333[c]	NS	NS
percentage of energy from fat, %	29.5 ±7.96	28.6	0.132[a]	NS	NS	NS
percentage of energy from saturated fatty acids, %	11.64 ±4.25	11.0	0.146[a]	NS	NS	NS
percentage of energy from carbohydrates, %	54.06 ±9.35	54.2	NS	–0.215[c]	NS	NS
percentage of energy from sucrose, %	14.2 ±7.7	13.1	NS	–0.258[c]	NS	NS
percentage of energy from alcohol, %	0.11 ±0.74	0.00	NS	NS	NS	NS
alcohol, g	0.30 ±2.13	0.00	NS	NS	NS	NS
total protein, g	67.01 ±24	63.4	NS	0.229[c]	NS	NS
protein per 1 kg of body mass, g/kg	0.96 ±0.36	0.93	NS	0.138[a]	–0.330[c]	–0.375[c]
animal protein, g	43.42 ±21	39.9	NS	0.274[c]	NS	NS
vegetable protein, g	23.48 ±7.56	22.6	–0.256[c]	NS	NS	NS
isoleucine, mg	3178 ±1216	2977	NS	0.244[c]	NS	NS
leucine, mg	4976 ±1859	4699	NS	0.242[c]	NS	NS
lysine, mg	4462 ±1957	4154	NS	0.262[c]	NS	NS
methionine, mg	1563 ±621	1456	NS	0.261[c]	NS	NS
cystine, mg	987 ±328	955	–0.187[b]	0.166[a]	NS	NS
phenylalanine, mg	2899 ±1024	2766	NS	0.221[c]	NS	NS
tyrosine, mg	2303 ±879	2183	NS	0.249[c]	NS	NS
threonine, mg	2691 ±1040	2518	NS	0.248[c]	NS	NS
tryptophan, mg	849 ±326	807	NS	0.226[c]	NS	NS
valine, mg	3738 ±1384	3549	NS	0.240[c]	NS	NS
arginine, mg	3438 ±1384	3148	–0.140[a]	0.217[c]	NS	NS
histidine, mg	1888 ±802	1723	NS	0.234[c]	NS	NS
alanine, mg	3244 ±1340	2936	–0.136[a]	0.258[c]	NS	NS
aspartic acid, mg	5996 ±2287	5618	–0.140[a]	0.251[c]	NS	NS
glutamic acid, mg	12912 ±4368	12627	NS	0.181[b]	0.133[a]	NS
glycine, mg	2937 ±1303	2726	–0.162[a]	0.204[b]	NS	NS
proline, mg	4641 ±1595	4561	NS	0.154[a]	0.143[a]	NS
serine, mg	3163 ±1129	3018	NS	0.236[c]	NS	NS
total fat, g	56.33 ±25	52.1	NS	NS	NS	NS
total SF, g	21.9 ±11.3	19.8	NS	NS	NS	NS
total MUFAs, g	21.5 ±10.5	19.98	NS	NS	NS	NS
total PUFAs, g	8.57 ±5.03	7.09	NS	NS	NS	–0.130[a]
LCPUFAs, g	0.24 ±0.61	0.03	–0.159[a]	0.282[c]	NS	NS
cholesterol, mg	254 ±153	221	NS	0.208[b]	NS	NS
fatty acid: 4:0, g	0.28 ±0.22	0.25	NS	NS	NS	NS
fatty acid: 6:0, g	0.20 ±0.15	0.17	NS	NS	NS	NS
fatty acid: 8:0, g	0.17 ±0.12	0.15	NS	NS	NS	NS
fatty acid: 10:0, g	0.40 ±0.34	0.32	NS	NS	NS	NS
fatty acid: 12:0, g	0.72 ±0.48	0.63	NS	–0.265[c]	NS	NS
fatty acid: 14:0, g	2.34 ±1.64	2.04	NS	NS	NS	NS
fatty acid: 15:0, g	0.28 ±0.22	0.23	NS	NS	NS	NS
fatty acid: 16:0, g	11.79 ±6.03	10.8	NS	NS	NS	NS
fatty acid: 17:0, g	0.19 ±0.14	0.17	NS	NS	NS	NS
fatty acid: 18:0, g	5.38 ±2.98	4.79	NS	NS	NS	NS
fatty acid: 20:0, g	0.07 ±0.06	0.05	NS	NS	NS	NS
fatty acid: 14:1, g	0.21 ±0.16	0.17	NS	NS	NS	NS
fatty acid: 15:1, g	0.06 ±0.06	0.05	NS	NS	NS	NS
fatty acid: 16:1, g	1.33 ±0.80	1.12	NS	NS	NS	NS
fatty acid: 17:1, g	0.12 ±0.09	0.10	NS	NS	NS	NS

fatty acid: 18:1, g	19.3 ±9.49	17.9	NS	NS	NS	NS
fatty acid: 20:1, g	0.28 ±0.36	0.18	NS	0.132[a]	NS	NS
fatty acid: 22:1, g	0.19 ±0.50	0.03	NS	NS	NS	NS
fatty acid: 18:2, g	7.15 ±4.43	6.06	NS	NS	NS	NS
fatty acid: 18:3, g	1.03 ±0.98	0.82	–0.143[a]	0.129[a]	NS	NS
fatty acid: 18:4, g	0.01 ±0.05	0.00	NS	NS	NS	NS
fatty acid: 20:3, g	0.00 ±0.01	0.00	NS	NS	NS	NS
fatty acid: 20:4, g	0.13 ±0.13	0.09	NS	0.128[a]	NS	NS
fatty acid: 20:5, g	0.08 ±0.24	0.00	NS	0.230[c]	NS	NS
fatty acid: 22:5, g	0.02 ±0.05	0.00	NS	0.194[b]	NS	NS
fatty acid: 22:6, g	0.14 ±0.34	0.02	–0.155[a]	0.283[c]	NS	NS
total carbohydrates, g	243 ±90	232	–0.154[a]	NS	NS	NS
available carbohydrates, g	224 ±86	213	–0.138[a]	–0.138[a]	NS	NS
sucrose, g	62.1 ±46.2	52.4	NS	–0.238[c]	NS	NS
lactose, g	9.19 ±7.94	7.68	NS	NS	NS	NS
starch, g	121 ±45.9	115	–0.152[a]	–0.182[b]	NS	NS
dietary fiber, g	18.66 ±8.3	17.4	–0.234[c]	0.265[c]	NS	–0.140[a]
calories to dietary fiber ratio, kcal/g	104 ±50.4	93.9	0.149[a]	–0.305[c]	NS	0.142[a]
retinol, µg	1266 ±2203	841	NS	NS	NS	NS
retinol, µg	661 ±2105	283	NS	–0.186[b]	–0.14[a]	NS
β-carotene, µg	3600 ±3516	2623	NS	0.213[c]	NS	–0.134[a]
α-tocopherol, mg	8.50 ±11	7.19	NS	0.163[a]	NS	NS
vitamin D, µg	3.49 ±4.92	2.25	NS	0.128[a]	NS	NS
thiamin, B_1, mg	1.14 ±0.71	1.02	–0.196[b]	0.206[b]	NS	–0.150[a]
riboflavin, B_2, mg	1.50 ±0.85	1.33	NS	0.268[c]	NS	NS
niacin, mg	16.85 ±9.27	14.4	–0.162[a]	0.235[c]	NS	NS
vitamin B_6, mg	1.73 ±0.88	1.62	–0.174[b]	0.249[c]	NS	NS
folate / folic acid, µg	239 ±126	218	–0.18[b]	0.256[c]	NS	–0.137[a]
vitamin B_{12}, µg	4.29 ±7.17	2.43	NS	0.185[b]	NS	NS
vitamin C, mg	91.85 ±132	55.3	–0.138[a]	0.334[c]	NS	NS
minerals, g	15.62 ±5.39	15.1	–0.193[b]	0.187[b]	NS	NS
sodium, mg	3413 ±1245	3220	–0.158[a]	NS	NS	NS
potassium, mg	2977 ±1259	2856	–0.225[c]	0.246[c]	NS	NS
calcium, mg	516 ±274	474	NS	0.200[b]	NS	NS
phosphorus, mg	1084 ±434	1029	–0.166[b]	0.278[c]	NS	NS
magnesium, mg	272 ±99	262	–0.216[c]	0.222[c]	NS	–0.136[a]
iron, mg	10.9 ±8.2	9.62	–0.195[b]	0.231[c]	NS	–0.194[b]
zinc, mg	9.02 ±3.47	8.31	–0.171[b]	0.219[c]	NS	–0.131[a]
copper, mg	1.07 ±0.43	1.03	–0.254[c]	0.240[c]	NS	–0.154[a]
manganese, mg	4.89 ±2.03	4.54	NS	NS	NS	–0.156[a]
iodine, µg	143 ±66.5	134	NS	NS	NS	NS
water, g	1960 ±625	1843	–0.133[a]	0.211[b]	NS	NS

Data are presented as means with standard deviations and medians.

a $P < 0.05$; b $P < 0.01$, c $P < 0.001$

Abbreviations: eq, equivalent; LCPUFAs, long-chain polyunsaturated fatty acids; MUFAs, monounsaturated fatty acids; NS, nonsignificant; PUFAs, polyunsaturated fatty acids; SD, standard deviation; SF, saturated fatty acid; WHtR, waist-to-height ratio

excess of salt in diet (approximately 8 g), only 16% of the respondents had an adequate sodium intake. Also, only 16% of the population reached the recommended level of 6% to 11% of energy from PUFAs and a minimum of 250 mg of energy from LCPUFAs. The data for α-linolenic acid (ALA, 18:3) are even less optimistic because only 5.4% of the population obtained the recommended energy level form ALA of 1% to 2%.[13] The consumption of saturated fatty acids exceeded the recommended maximum of 10% of the energy intake among more than 60% of the respondents. We observed more positive results in terms of the recommendation to limit the energy intake from total fat

TABLE 2 Associations between the intake of selected nutrients and sex and concomitant cardiometabolic disease in the study group (n = 239)

Nutrients	Sex	Hyper-tension, n = 146	Hypercholes-terolemia, n = 123	Diabetes mellitus, n = 51	Ischemic heart disease, n = 85	History of MI, n = 19	History of stroke, n = 26	Chronic heart failure, n = 93
energy, kcal	0.000[b]	NS	0.031[b]	NS	NS	NS	NS	NS
percentage of energy from proteins, %	NS	NS	0.022[a]	NS	0.005[b]	NS	NS	0.020[b]
percentage of energy from fat, %	NS	NS	NS	NS	NS	NS	NS	NS
percentage of energy from saturated fatty acid, %	0.038[a]	NS	NS	NS	NS	NS	NS	NS
percentage of energy from carbohydrates, %	NS	NS	NS	NS	NS	NS	0.043[a]	NS
percentage of energy from sucrose, %	NS	NS	0.012[b]	NS	NS	NS	0.007[a]	NS
percentage of energy from alcohol, %	NS	NS	NS	NS	NS	NS	NS	NS
alcohol, g	NS	NS	NS	NS	NS	NS	NS	NS
total protein, g	0.000[b]	NS	NS	NS	0.011[b]	NS	NS	0.017[b]
protein per 1 kg of body mass, g/kg	NS	NS	NS	NS	0.038[b]	NS	NS	NS
animal protein, g	0.019[b]	NS	NS	NS	0.005[b]	NS	NS	0.032[b]
vegetable protein, g	0.000[b]	NS	0.005[b]	NS	NS	NS	NS	NS
isoleucine, mg	0.000[b]	NS	NS	NS	0.008[b]	0.049[b]	NS	0.020[b]
leucine, mg	0.001[b]	NS	NS	NS	0.007[b]	NS	NS	0.018[b]
lysine, mg	0.003[b]	NS	NS	NS	0.008[b]	NS	NS	0.032[b]
methionine, mg	0.001[b]	NS	NS	NS	0.005[b]	NS	NS	0.017[b]
cystine, mg	0.000[b]	NS	NS	NS	0.038[b]	0.024[b]	NS	0.016[b]
phenylalanine, mg	0.000[b]	NS	NS	NS	0.009[b]	0.044[b]	NS	0.017[b]
tyrosine, mg	0.001[b]	NS	NS	NS	0.004[b]	NS	NS	0.009[b]
threonine, mg	0.001[b]	NS	NS	NS	0.003[b]	0.039[b]	NS	0.015[b]
tryptophan, mg	0.000[b]	NS	NS	NS	0.018[b]	0.040[b]	NS	0.044[b]
valine, mg	0.000[b]	NS	NS	NS	0.008[b]	NS	NS	0.014[b]
arginine, mg	0.001[b]	NS	NS	NS	0.005[b]	0.011[b]	NS	0.023[b]
histidine, mg	0.002[b]	NS	NS	NS	0.012[b]	NS	NS	0.032[b]
alanine, mg	0.002[b]	NS	NS	NS	0.004[b]	0.029[b]	NS	0.032[b]
aspartic acid, mg	0.000[b]	NS	NS	NS	0.005[b]	0.027[b]	NS	0.021[b]
glutamic acid, mg	0.000[b]	NS	NS	NS	0.033[b]	NS	NS	0.013[b]
glycine, mg	0.002[b]	NS	NS	NS	0.013[b]	0.020[b]	NS	0.032[b]
proline, mg	0.000[b]	NS	NS	NS	NS	NS	NS	0.021[b]
serine, mg	0.001[b]	NS	NS	NS	0.004[b]	0.039[b]	NS	0.010[b]
total fat, g	0.002[b]	NS	NS	NS	NS	NS	NS	NS
total SF, g	0.043[b]	NS	NS	NS	NS	NS	NS	NS
total MUFAs, g	0.001[b]	NS	NS	NS	NS	NS	NS	NS
total PUFAs, g	0.000[b]	NS	NS	0.025[b]	NS	NS	NS	NS
LCPUFAs, g	NS	NS	0.021[a]	NS	0.017[b]	NS	NS	0.039[b]
cholesterol, mg	NS	NS	NS	NS	NS	0.010[b]	NS	NS
fatty acid: 4:0, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 6:0, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 8:0, g	NS	NS	NS	NS	0.038[a]	NS	NS	NS
fatty acid: 10:0, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 12:0, g	0.009[b]	0.038[a]	NS	NS	0.000[a]	NS	0.021[a]	0.001[a]
fatty acid: 14:0, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 15:0, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 16:0, g	NS	NS	NS	NS	NS	NS	NS	NS

fatty acid: 17:0, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 18:0, g	0.000[b]	NS	NS	NS	NS	NS	NS	NS
fatty acid: 20:0, g	0.002[b]	NS	NS	0.006[b]	NS	NS	NS	NS
fatty acid: 14:1, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 15:1, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 16:1, g	NS	NS	NS	NS	NS	0.010[b]	NS	NS
fatty acid: 17:1, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 18:1, g	0.001[b]	NS	NS	NS	NS	NS	NS	NS
fatty acid: 20:1, g	0.015[a]	NS	NS	0.021[b]	NS	NS	NS	NS
fatty acid: 22:1, g	NS	NS	0.012[a]	0.023[b]	NS	NS	NS	NS
fatty acid: 18:2, g	0.000[b]	NS	NS	0.024[b]	NS	NS	NS	NS
fatty acid: 18:3, g	0.000[b]	NS	NS	0.006[b]	NS	NS	NS	NS
fatty acid: 18:4, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 20:3, g	NS	NS	NS	NS	NS	NS	NS	NS
fatty acid: 20:4, g	0.013[b]	NS	NS	NS	0.025[b]	NS	NS	NS
fatty acid: 20:5, g	NS	NS	NS	NS	NS	NS	0.034[b]	NS
fatty acid: 22:5, g	NS	NS	0.042[a]	NS	NS	NS	0.036[b]	NS
fatty acid: 22:6, g	NS	NS	0.012[a]	NS	0.015[b]	NS	NS	0.032[b]
carbohydrates, g	0.000[b]	NS	0.002[b]	NS	NS	NS	NS	NS
available carbohydrates, g	0.000[b]	NS	0.001[b]	NS	NS	NS	NS	NS
sucrose, g	0.017[b]	NS	0.003[b]	0.026[b]	NS	NS	0.019[a]	NS
lactose, g	0.003[b]	NS	NS	NS	NS	NS	NS	NS
starch, g	0.000[b]	NS	0.005[b]	NS	NS	NS	NS	NS
dietary fiber, g	NS	NS	NS	NS	0.005[b]	0.037[b]	NS	0.000[b]
calories to dietary fiber ratio, kcal/g	NS	NS	0.035[b]	NS	0.005[a]	NS	NS	0.003[a]
vitamin A - eq retinol, μg	NS	NS	NS	NS	NS	0.022[b]	NS	NS
retinol, μg	0.039[b]	NS	NS	NS	0.001[a]	NS	NS	0.004[a]
β-carotene, μg	NS	NS	NS	NS	NS	NS	NS	NS
α-tocopherol, mg	0.020[b]	NS	NS	0.005[b]	NS	NS	NS	NS
vitamin D, μg	0.031[a]	NS	0.008[a]	NS	NS	0.019[b]	NS	NS
thiamin, B_1, mg	0.000[b]	NS	NS	NS	0.019[b]	0.001[b]	NS	0.019[b]
riboflavin, B_2, mg	0.001[b]	NS	NS	NS	0.032[b]	0.046[b]	NS	0.005[b]
niacin mg	0.000[b]	NS	NS	NS	NS	0.016[b]	NS	NS
vitamin B_6, mg	0.007[b]	NS	NS	NS	NS	0.005[b]	NS	NS
folate / folic acid, μg	NS	NS	NS	NS	0.010[b]	0.032[b]	NS	0.000[b]
vitamin B_{12}, μg	0.014[b]	NS	NS	NS	NS	0.016[b]	NS	NS
vitamin C, mg	NS	0.019[b]	0.041[a]	NS	0.002[b]	0.015[b]	NS	0.003[b]
minerals, g	0.000[b]	NS	NS	NS	NS	0.005[b]	NS	NS
sodium, mg	0.000[b]	NS	NS	NS	NS	0.010[b]	NS	NS
potassium, mg	0.003[b]	NS	NS	NS	NS	NS	NS	0.031[b]
calcium, mg	NS	NS	NS	NS	NS	NS	NS	NS
phosphorus, mg	0.001[b]	NS	NS	NS	0.013[b]	NS	NS	0.002[b]
magnesium, mg	0.001[b]	NS	NS	NS	NS	NS	NS	0.010[b]
iron, mg	0.022[b]	NS	NS	0.036[b]	0.007[b]	0.007[b]	NS	0.001[b]
zinc, mg	0.001[b]	NS	NS	NS	0.009[b]	NS	NS	0.002[b]
copper, mg	0.021[b]	NS	NS	NS	0.003[b]	NS	NS	0.001[b]
manganese, mg	NS	NS	NS	NS	0.044[b]	NS	0.015[b]	0.003[b]
iodine, μg	0.025[b]	NS	NS	NS	NS	0.001[b]	NS	NS
water, g	NS	NS	NS	NS	NS	NS	NS	NS

a higher intake in women or in the presence of the disease, **b** lower intake in women or in the presence of the disease

Abbreviations: MI, myocardial infarction; others, see **TABLE 1** below 30% and from MUFAs to a level of 8% to 13%. More than half of the subjects showed such a dietary pattern. Another positive result was the intake of cholesterol below 300 mg in more than two-thirds of the total population. Apart from calcium and potassium, the third most deficient mineral component was magnesium. Only 28% of the study population covered the demand for magnesium at a level of the RDA (320 mg). Iodine and iron deficiency occurred in more than half of the subjects. The intake of phosphorous, copper, and zinc in relation to the RDA was relatively satisfactory. Over 80% of the population consumed manganese at a level above 3 mg. The Adequate Intake for adult men and women is 2.3 mg/d and 1.8 mg/d, respectively. A Tolerable Upper Intake Level of 11 mg/d was set for adults based on a no-observed-adverse-effect level for Western diets.[14]

Over 60% of the population consumed more than 10% of energy from sucrose and less than 20 g of fiber per day. In one-third of the patients, it was more than the recommended 108.5 kcal per 1 g of fiber.[15] The recommended intake level of vitamins C (75 mg), E (8 mg), and B_1 (1.1 mg) was observed in 41% of the population. The intake of vitamins B_2, B_6, A, B_{12}, and niacin was relatively satisfactory. One-third of the subjects consumed protein at a recommended level for elderly people (1–1.5 g protein per kg body weight),[15] with animal protein constituting at least 35 g of protein. Therefore, it is reasonable to say that about 60% of the population is at risk for quantitative or qualitative deficiency of protein. If the intake of protein is too low, it may contribute to protein malnutrition and disorders typical for older age, such as sarcopenia and frailty. Only 40% of the population consumed an appropriate amount of water (minimum 2000 mg), while there were only 4 subjects who consumed more than the recommended maximum daily amount of alcohol (20 g for men and 10 g for women).[16]

An age-related decrease in the intake of energy and some amino acids (arginine and histidine) may further contribute to malnutrition and poor prognosis especially in the case of new cardiovascular incidents.[17] Our population did not show anthropometric features of malnutrition: three-quarters of the patients had a BMI above 25 kg/m^2, and 88% had a WHtR of 0.5 or higher. Nevertheless, it is necessary to monitor the nutritional status and to implement preventive measures for both obesity and malnutrition (sarcopenic obesity) in this population. This is particularly important because with an increase in WHtR our subjects consumed less vitamins and minerals and less fiber with the same calorie intake. The pattern of fat intake also deteriorated with age. An increase in the percentage of energy from saturated fatty acids is particularly alarming—one of the most important nutritional factors elevating low-density lipoprotein cholesterol levels.[16] The intake of LCPUFAs, which decreases with age, should be also considered as potentially detrimental to the cardiovascular system. An age-related decrease in the fiber intake may contribute to changes in blood glucose and, through increased reabsorption of bile salts, it may cause an increase in low-density lipoprotein cholesterol levels. Also, constipation, which is common in elderly patients, is enhanced by dietary fiber deficiency. Fiber should be consumed from whole grain cereals, legumes, vegetables, fruits, and berries.[18]

The educational level has been shown to have a positive effect on nutritional choices. The more educated the patients, the higher the intake of minerals, water, and vitamins. A reduction in sodium and sucrose consumption and an increased fiber intake have been observed with a higher educational level. However, an age-related increase in the consumption of animal protein and cholesterol was found. This should be monitored as it can overload the digestive system and kidneys as well as affect calcium balance. The level of protein intake should not exceed 1.5 g/kg.[15]

Despite the recommendations concerning sodium[19] and potassium intake in patients with hypertension, less than 9% of hypertensive subjects in our study showed an appropriate potassium intake and only 17% subjects—appropriate sodium intake. The average consumption was more than 8 grams of salt per day and the maximum intake was 24 g of salt per day. Another disturbing finding was an extremely low intake of vitamin C (only 34% of the population adhered to the RDA level). This indicates that there is an insufficient amount of vegetables and fruits in the diet of patients with hypertension. The recommended level is at least 400 g of vegetables and fruit per day[16] divided into 5 servings. As an antioxidant, vitamin C affects the level of oxidative stress, thereby improving endothelial function.[20] Owing to poorer tolerance of raw vegetables and fruits by elderly patients, it is important to serve them in an easily digestible form rich in vitamin C. Patients with hypertension consumed also higher amounts of lauric acid (12:0), which is considered to be hypercholesterolemic.[21] Therefore, they should consider limiting the intake of high-fat dairy products, butter, and coconut oil.

Also patients with hypercholesterolemia showed a significantly deficient diet. The demand for vitamin D was covered only by 5% of the subjects and for LCPUFAs—by 22% of the subjects; 37% patients with hypercholesterolemia consumed less than 10% of energy from sucrose, and as much as 50% of the patients followed the recommendations for vitamin C intake. Almost 70% of the subjects consumed a satisfactory amount of calories per 1 g of fiber. Although patients with diabetes generally have a reduced dietary intake of sucrose, still almost 60% of the subjects consumed more than the recommended 10% of energy from sucrose. Meanwhile, the European Heart Network suggested to set a longer-term goal of a reduction in the sugar intake at a level of 5% of energy, which was reached by less than 12% of the patients with diabetes.[16] In addition, only 24% of these patients covered the demand for vitamin E and 30%—for iron.

In patients with IHD, the demand for folic acid was covered only by 3.5% of the subjects and for LCPUFAs—by slightly more than 8%. Less than 30% of the patients with IHD covered the demand for protein, fiber, and vitamin C. One-third of the subjects covered the demand for vitamin B_1 and iron. In addition, we observed that more than 50% did not cover the demand for zinc and copper. Similarly, the diet of patients with CHF was significantly deficient in nutrients. Among those patients, only 1.1% covered the demand for folic acid; 6.5%, for potassium; and 20%, for magnesium. Similarly to patients with IHD, two-thirds of the population did not cover the need for fiber, vitamin C, vitamin B_1, iron, zinc, and half of them—for copper. Patients with IHD and CHF did not consume enough whole-grain products, vegetables, and fruit. In contrast, a high intake of high-fat milk products was observed, which is not beneficial for health.

The demand for nutrients was also poorly covered in the group of patients with previous MI. None of them reached the recommended levels for folic acid and vitamin D. Also, adherence to the intake of protein (21% of the subjects), vitamin C (21% of the subjects), vitamin B_1 (10% of the subjects), iron (26% of the subjects), vitamin B_{12} (16% of the subjects), niacin (21% of the subjects), and vitamin B_6 (32% of the subjects) was very low. In contrast, these patients showed a reduced sodium intake (as many as one-thirds of the patients met the recommendations—the largest group in the whole studied population). Unfortunately, a possible side effect of dietary sodium restriction was a reduction in the consumption of iodine. Only 16% of the patients with previous MI covered the demand for iodine. In Poland, there has been obligatory iodization of salt since 1996 (30 ±0 mg KJ / 1 kg NaCl).[22] A reduced salt intake directly affects the intake of iodine, and alternative sources of iodine should be suggested (eg, sea fish, iodized water, iodized low-sodium salt). Similarly to patients with previous MI, patients with previous stroke failed to reach the recommended levels for numerous nutrients. In addition, almost all patients (99%) consumed an excessive amount of energy from sucrose (over 10%).

The present study has several limitations. We examined a convenient sample of volunteers. Usually, subjects with a relatively good physical and cognitive functional status are able to participate in such studies. The intake of nutrients may change depending on the season and may be different in other environments and settings.

We conclude that elderly Polish people use a typical Western-culture diet that does not follow the current nutritional recommendations. Patients consumed excessive amounts of saturated fatty acids, sucrose, and sodium, and insufficient amounts of LCPUFAs, dietary fiber, potassium, magnesium, vitamin C, vitamin D, and folic acid. Nutrient intake is usually worse in the presence of common cardiometabolic disorders. The results indicate the directions for future work in terms of the eating habits and patients' education by promoting healthy diets rich in fruits, vegetables, and fish and with limited intake of sweets.

Contribution statement Each author certifies that he or she has participated sufficiently in the intellectual content, analysis of data, if applicable, and the writing of the manuscript to take public responsibility for it. Each author has reviewed the final version of the manuscript, believes it represents valid work, and approves it for publication.

Acknowledgments This study was supported by grant 503/6-077-01/503-01 from the Medical University of Lodz. The authors were partially supported by the Healthy Ageing Research Centre project (REGPOT-2012-2013-1, 7FP).

REFERENCES

1 Nichols M, Townsend N, Scarborough P, Rayner M. Cardiovascular disease in Europe 2014: epidemiological update. Eur Heart J. 2014; 35: 2950-2959.

2 European Commission (2011) Demography report 2010. Older, more numerous and diverse Europeans. SEC 2011; 431.

3 Borowiak E, Kostka T. Comparative characteristics of the home care nursing services used by community-dwelling older people from urban and rural environments. J Adv Nurs. 2013; 69: 1259-1268.

4 World Health Organization (WHO). Prevention of cardiovascular disease: guidelines for assessment and management of cardiovascular risk. Geneva, WHO, 2007.

5 Perk J, De Backer G, Gohlke H, et al. European Association for Cardiovascular Prevention & Rehabilitation (EACPR); ESC Committee for Practice Guidelines (CPG). European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts). Eur Heart J. 2012; 33: 1635-1701.

6 Lichtenstein AH, Appel LJ, Brands M, et al. Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association Nutrition Committee. Circulation. 2006; 114: 82-96.

7 Kunachowicz H, Nadolna I, Przygoda B, Iwanow K. [Food Composition Tables]. Warszawa, PZWL; 2005. Polish.

8 Zujko ME, Witkowska AM, Górska M, et al. Reduced intake of dietary antioxidants can impair antioxidant status in type 2 diabetes patients. Pol Arch Med Wewn. 2014; 124: 599-607.

9 Cox BD, Whichelow MJ, Prevost AT. The development of cardiovascular disease in relation to anthropometric indices and hypertension in British adults. Int J Obes Relat Metab Disord. 1998; 22: 966-973.

10 Browning LM, Hsieh SD, Ashwell M. A systematic review of waist-to-height ratio as a screening tool for the prediction of cardiovascular disease and diabetes: 0·5 could be a suitable global boundary value. Nutr Res Rev. 2010; 23: 247-269.

11 Jarosz M, Bułhak-Jachymczyk B. [Standards of Human Nutrition. Principles of prevention for obesity and noncommunicable diseases]. Warszawa, PZWL, IŻŻ; 2008. Polish.

12 Jarosz M. [Nutrition Standards for the Polish population - amendment]. Instytut Żywności i Żywienia, Warszawa; 2012. Polish.

13 Elmadfa I, Kornsteiner M. Fats and fatty acid requirements for adults. Ann Nutr Metab. 2009; 55: 56-75.

14 Trumbo P, Yates AA, Schlicker S, Poos M. Dietary reference intakes: vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. J Am Diet Assoc. 2001; 101: 294-301.

15 Bauer J, Biolo G, Cederholm T, et al. Evidence-based recommendations for optimal dietary protein intake in older people: a position paper from the PROT-AGE Study Group. J Am Med Dir Assoc. 2013; 14: 542-559.

16 European Heart Network. Diet, Physical activity and Cardiovascular Disease Prevention in Europe. 2011.

17 Farid K, Zhang Y, Bachelier D, et al. Cognitive impairment and malnutrition, predictors of all-cause mortality in hospitalized elderly subjects with cardiovascular disease. Arch Cardiovasc Dis. 2013; 106: 188-195.

18 European Food Safety Authority. 2010 Scientific Opinion on Dietary Reference Values for carbohydrates and dietary fibre. EFSA Journal. 2010; 8: 1462.

19 World Health Organization. Diet, Nutrition and the Prevention of Chronic Diseases. Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series No. 916. Geneva: WHO; 2003.

20 Ashor AW, Lara J, Mathers JC, Siervo M. Effect of vitamin C on endothelial function in health and disease: a systematic review and meta-analysis of randomised controlled trials. Atherosclerosis. 2014; 235: 9-20.

21 Fernandez ML, West KL. Mechanisms by which dietary fatty acids modulate plasma lipids. J Nutr. 2005; 135: 2075-2078.

22 [Minister of Health Resolution, July 24, 1996]. Monitor Polski. 1996; 48: 462. Polish.

ARTYKUŁ ORYGINALNY – KONKURS STUDENCKI 2015*

Niewłaściwa struktura spożycia składników odżywczych w kontekście współistniejących zaburzeń kardiometabolicznych wśród osób starszych w Polsce

Agnieszka R. Guligowska, Małgorzata Pigłowska, Janusz Śmigielski, Tomasz Kostka

Klinika Geriatrii, Uniwersytet Medyczny w Łodzi

SŁOWA KLUCZOWE

choroby kardiologiczne, cukrzyca, niedobory pokarmowe, zalecane spożycie, żywienie

STRESZCZENIE

WPROWADZENIE Rekomendacje żywieniowe mają na celu m.in. zmniejszenie liczby zachorowań i śmiertelności z powodu powszechnych w starzejącym się społeczeństwie chorób układu krążenia i metabolicznych. Stosowanie się do nich pozwala nie tylko zatrzymać rozwój choroby, ale także poprawić ogólny stan zdrowia osób starszych.

CELE Celem prowadzonych badań była analiza różnic w sposobie odżywiania osób starszych, ze szczególnym uwzględnieniem realizacji zaleceń żywieniowych zarówno dla osób zdrowych, jak i dla osób z zaburzeniami kardiometabolicznymi.

PACJENCI I METODY W oparciu o kwestionariusz 24-godzinnego spożycia wśród 239 wolontariuszy (średnia wieku 72 ±9,34 roku) dokonano przy użyciu programu Dieta 5.0 szczegółowej analizy struktury spożycia poszczególnych składników odżywczych.

WYNIKI W porównaniu z zaleceniami Światowej Organizacji Zdrowia oraz towarzystw kardiologicznych, ponad 90% populacji nie pokrywało zapotrzebowania na wapń, potas, witaminę D, kwas foliowy i kwas α-linolenowy. Nieznacznie lepiej kształtował się poziom spożycia wielonienasyconych kwasów tłuszczowych, sodu, magnezu, błonnika, wody i witaminy C. Odpowiednia ich ilość występowała jedynie w diecie 15–40% badanych. Najwięcej istotnych różnic wykazano między współistniejącą chorobą a poziomem spożycia sodu, wielonienasyconych kwasów tłuszczowych (szczególnie kwas dokozaheksaenowy), witaminy C, żelaza, błonnika, kwasu laurynowego i sacharozy. Najmniej niedoborowa była dieta pacjentów z hipercholesterolemią, a najczęściej niedobory występowały u pacjentów po przebytym zawale, z chorobą niedokrwienną serca i niewydolnością serca.

WNIOSKI Pacjenci geriatryczni odżywiają się niewłaściwie. Ich dieta jest głęboko niedoborowa, a współistniejąca choroba układu krążenia lub metaboliczna jeszcze pogłębia te niedobory. Uzyskane wyniki wskazują na potrzebę prowadzenia wśród osób starszych edukacji w zakresie właściwych nawyków żywieniowych i ewentualnej indywidualnie wdrażanej suplementacji.

Adres do korespondencji:
mgr inż. Agnieszka Guligowska, Klinika Geriatrii, Uniwersytet Medyczny w Łodzi, ul. Żeromskiego 113, 90-549 Łódź, tel./fax: 42 639 36 09, e-mail: agnieszka.guligowska@stud.umed.lodz.pl
Praca wpłynęła: 15.04.2015.
Przyjęta do druku: 20.04.2015.
Publikacja *online*: 03.06.2015.
Nie zgłoszono sprzeczności interesów.
Pol Arch Med Wewn. 2015; 125 (7-8): 521-531

*Autorzy pracy otrzymali II nagrodę Redaktor Naczelnej w konkursie na najlepszą studencką pracę oryginalną w 2015 r. Regulamin konkursu jest dostępny na stronie www.pamw.pl.