Research Article

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The Analysis of Nutritional Habits of the Third Age Students in Poznań

Abstract: In recent years have seen increasing percentage of the elderly in the overall population. This has driven the attention to the lifestyle factors that influence the health and quality of life of this social group, including their nutrition and physical activity. Universities of the Third Age (U3A) are a valuable platform for the dissemination and broadening of the knowledge related to these topics. The nutritional habits of 61 U3A students in Poznań were evaluated on the basis of a modified KomPAN questionnaire. Their nutritional status was determined using the body mass index (BMI) and waist to hip ratio (WHR) indices. Nearly half of the respondents were overweight and 16% had first degree obesity. The WHR index in women was on average 0.8, while in men it was 1.01. Only 13% of the students declared regular eating, with 60% consuming 4-5 meals a day. Women were found to eat snacks between meals more often than men. It was also found that the majority of the elderly do not add salt to ready meals or sweeten beverages with sugars. Taking into account the observed nutritional problems and the occurrence of improper eating habits of the elderly, it is recommended to continue the education on the prevention of common diet-related diseased.

Keywords: U3A; Older adults; Elderly people in Poland; BMI; Quality of life

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1 Introduction

Demographic data of The World Health Organization is clearly indicating changes in the proportions of individual age groups in most societies. Development of medicine has resulted in prolonged life expectancy and the widespread pursuit of a successful life has resulted in limited birth rates. These factors have driven global population aging (WHO 2011). This trend has also manifested itself in Poland. According to a report of Statistics Poland, people over the age of 65 made up almost 14% of Polish society in 2010. It is estimated that in 2035 elderly people will constitute 23% of the total population of Poland (Ożga and Małgorzewicz 2013).

Seniors are a diverse group in terms of health, physical activity, or knowledge about proper nutrition (Skiba et al. 2015). Also, their socio-economic status is diverse, which makes it difficult to formulate universal recommendations for this social group (Langlley-Evans 2014; Pędich 1998). Analysis of nutritional habits and assessment of the quality of the elderly are crucial for proper arrangement of health programs addressed to them (Krzepota et al. 2015). In addition, aging of the society is associated with growing expenses for medical care. In the case of Poland, the costs of medical care of seniors are even four times higher than for the people aged 15-54 (Ożga and Małgorzewicz 2013). Lifestyle, including physical activity and diet, has a significant impact on health. The most common problems related to the state of nutrition among the elderly are obesity, protein and protein-calorie malnutrition as well as vitamin and mineral deficiencies (Humańska and Kędziora-Kornatowska 2009). Unhealthy eating habits that have started at a young age, health problems and common poor financial condition of the elderly often lead to an unbalanced diet and cause deficits of some nutrients (Niedźwiedzka and Wądołowska 2010).

Noteworthy, Universities of the Third Age (U3A) are becoming more and more popular among seniors. They allow the participants not only to broaden their interests but also to earn knowledge on medical and related topics that are of special importance to this social group. They are also a meeting place which strengthens the awareness

of being still a significant part of society (Zielińska-Więczkowska et al. 2011b). Participation in group activities is known to significantly improve the quality of life by limiting the feeling of loneliness (Konieczna-Wozniak 2005) and by giving a sense of independence (Kaczmarczyk and Trafialek 2007). U3A is therefore a suitable place to provide knowledge about the relation between diet, health and quality of life of the elderly.

To date, only a few U3A surveys have been carried out in Poland. Unfortunately, disproportions in the living standards, income and opportunities in various parts of the country do not allow easy application of the results obtained from other cities to develop an appropriate educational program. Therefore, the aim of this study was to determine eating habits of the U3A students in Poznań and evaluate the impact of diet on body mass index (BMI) and Waist to Hip Ratio (WHR) of this group.

2 Respondents and methods

Initially, 83 respondents from 3 different unpaid U3As participated in the study and completed the questionnaire. Subsequently, the questionnaires were verified and the ones that were incompletely filled were excluded from the study (n=22). Eventually, the study was performed on a population of 61 students of U3A in Poznań.

Evaluation of the nutritional habits was based on data obtained from anonymous questionnaires based on the KomPAN questionnaire provided by Science Committee on Human Nutrition of the Polish Academy of Sciences (Poland) that involved our own modifications (Kowalkowska et al. 2018) including the assessment of indexes developed based on the questionnaire. In total, the study involved 954 subjects aged 15–65 (53.9% females. The questionnaire consisted of 19 questions divided into 2 sections. The first part included questions that concerned eating habits. Respondents were asked to declare the amounts and frequency of meals as well as snacks between the meals. This was followed by questions concerning the frequency of consumption of individual products, i.e. meat and sausages, fish, including their type, vegetables, fruits and dairy products. The questionnaire also included questions about the consumption of ready-made dishes or sweetened hot drinks. The respondents were also asked to evaluate their own health condition. The second part of the questionnaire concerned students' education level and social-economic status (Walczak and Kwiatkowska 2016).

Measurements of body mass, height, waist and hip circumference were also performed in accordance with the rules adopted in anthropometry (*Anthropometry procedures manual* 2007; Sánchez-García et al. 2007). According to the WHO STEPS protocol for measuring waist circumference, the measurement was made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest (World Health Organization 2011). The hip circumference was measured around the widest portion of the buttocks (waist circumference and waist–hip ratio). Measurements of waist and hip circumferences were made using a tape measure. Data on body mass and height were declared by respondents. Values of weight and body height, waist and hip circumference allowed to calculate BMI and WHR index. BMI was calculated as the ratio of body mass [kg] to height squared [m^2], while WHR was defined as a ratio of waist circumference to hip circumference according to the method described by Czernichow et al. (2011).

3 Results

3.1 Characteristics of analyzed group

Of the investigated population (n=61), 50 were women and 11 men. The results of anthropometric measurements (height, body weight, waist and hip circumference) as well as age are presented in Table 1. The analysis of the age of U3A students indicates a significant variation in the study group. The average age was 65 years, with the youngest student less than 40 years old. Anthropometric studies also showed significant differences between students. The average height was 165 cm, with men having a higher average height than women (174 and 163 cm, respectively). The average body weight of U3A students was 72 kg (minimum 44 kg, maximum 112 kg). Women were characterized by a lower waist circumference (85 cm), while a higher average hip circumference (106 cm), compared to men (103 and 101 cm, respectively). The results of the height and weight measurements of the respondents were used to calculate WHR index (Ashwell and Gibson 2016), which was 0.8 in women, and 1.01 in men.

Detailed BMI values for individual groups of respondents are presented in Table 2. Nearly half of the surveyed people were overweight, and 16% manifested 1st degree obesity. Extreme values that suggest 2nd degree obesity or underweight were observed only in women, and accounted for less than 5% of the subjects. Only 1/3 of the respondents were characterized by a correct BMI value.

Table 1: Basic characteristic of the students

Parameter	Total (n=61)			Women (n=50)			Men (n=11)		
	Mean ± SD	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD	Min.	Max.
Age [years]	65 ± 10	39	87	64 ± 9	39	87	67 ± 12	44	80
Height [cm]	165 ± 9	142	186	163 ± 8	142	183	174 ± 5	168	186
Weight [kg]	72 ± 13	44	112	70 ± 13	44	112	83 ± 10	71	103
Waist circumference [cm]	87 ± 12	69	114	85 ± 11	69	114	103 ± 4	98	107
Hip circumference [cm]	106 ± 10	88	130	106 ± 10	88	130	101 ± 1	100	102
BMI [kg/m²]	26 ± 4	18	40	26 ± 4	18	40	27 ± 3	24	32
WHR [-]	0.81 ± 0.09	0.65	1.07	0.80 ± 0.07	0.65	0.96	1.01 ± 0.06	0.96	1.07

Table 2: The details of BMI of the students

BMI	Total (n=61)		Women (n=50)		Men (n=11)	
	n	%T	n	%W	n	%M
< 18.5	2	3.28	2	4.00	-	-
18.5 - 24.9	20	32.79	18	36.00	2	18.18
25 - 29.9	28	45.90	20	40.00	8	72.73
30 - 34.9	10	16.39	9	18.00	1	9.09
35 - 39.9	1	1.64	1	2.00	-	-
> 40	-	-	-	-	-	-

The respondents also answered questions about their socio-economic status (Table 3). It was found that half of U3A students (47.55%) are people with higher education, and 36.06% were people with secondary education. Students with lower education constituted only 16.39% of the population. The economic situation of older people in Poland is difficult and may affect the choices of food products and eating habits. Only slightly more than half of the respondents had an income higher than the minimum salary (above PLN 1500 net). Nearly 41% of the respondents indicated incomes close to the minimum retirement income in Poland and 5% had an income even below the threshold of 1000 PLN. Most women perceived their health as good (56%) or very good (20%), while men rated their health as middling (45%) and good (36%).

3.2 Characteristics of nutritional habits

Analysis of the general eating habits of the U3A students revealed that the majority of respondents consumed between 4 to 5 meals a day (Table 4). Only 14 women and 2 men did not eat adequate number of meals per day. It is noteworthy that half (31 respondents) admitted to regular consumption of only some of their daily meals. Based on

the conducted research, it was found that women consumed snacks between meals more often than men (20 female respondents declared that they consume snacks every day). Only 11% of the students stated the lack of snacks in their daily diet.

The frequency of consumption of selected groups of food products is presented in Table 5. About 75% of the respondents declared that they do not add salt to dishes at all, while 23% of respondents stated that they add salt to some dishes. It was found that about 57% of the respondents did not sweeten hot beverages, such as coffee and tea. Less than 20% of the respondents sweetened beverages by adding one spoon of sugar or honey, while 8% used sweeteners.

The majority of respondents consumed meat and meat products (such as cured meats, vienna sausages or other sausages) several times a week (about 44% of respondents), while complete avoidance of such products was declared by 13%. 69% of the respondents consumed fish once a week. Marine fishes such as salmon, tuna or herring were most commonly consumed among the respondents (about 82% declared eating marine fish). Moreover, about 23% of respondents consumed fruit few times a day, and 21% of respondents consumed vegetables few times a day. About 10% of the respondents declared

Table 3: Socio-economic status and subjective assessment of the health of the students

Question	Total (n=61)		Women (n=50)		Men (n=11)	
	n	%T	n	%W	n	%M
Education						
Basic	2	3.28	2	4.00	-	-
Vocational	8	13.11	6	12.00	2	18.18
Secondary	22	36.07	17	34.00	5	45.46
Higher	29	47.54	25	50.00	4	36.36
Income (per person)						
< 1000 PLN	3	4.92	3	6.00	-	-
1000 - 1500 PLN	25	40.98	19	38.00	6	54.54
> 1500 PLN	33	54.10	28	56.00	5	45.46
Subjective assessment of the health						
Very good	11	18.03	10	20.00	1	9.09
Good	32	52.46	28	56.00	4	36.36
Middling	16	26.23	11	22.00	5	45.46
Bad	2	3.28	1	2.00	1	9.09

Table 4: General eating habits of the U3A students

Question	Total (n=61)		Women (n=50)		Men (n=11)	
	n	%T	n	%W	n	%M
Meals amount						
Less than 2	1	1.64	1	2.00	-	-
2-3	15	24.59	13	26.00	2	18.18
4-5	39	63.93	33	66.00	6	54.55
More than 5	6	9.84	3	6.00	3	27.27
Meals regularity						
No	17	27.87	15	30.00	2	18.18
Yes, but only some	31	50.82	25	50.00	6	54.55
Yes, all	13	21.31	10	20.00	3	27.27
Snacking						
Never	7	11.48	5	10.00	2	18.18
Once a week	12	19.67	10	20.00	2	18.18
A few times per week	13	21.31	9	18.00	4	36.36
Once a day	22	36.06	20	40.00	2	18.18
A few times per day	7	11.48	6	12.00	1	9.10

consumption of fruit only once a week, and 5% of the students declared consumption of vegetables once a week. About 30% of the respondents consumed dairy products several times a week or even daily while about 13% of the respondents pointed that they consume dairy products more often – a few times a day.

Table 5: Frequency of consumption of specific product groups of the respondents

Question	Total (n=61)		Women (n=50)		Men (n=11)	
	n	%T	n	%W	n	%M
Adding extra salt to dishes						
No	46	75.41	36	72.00	10	90.91
Yes, but only sometimes	14	22.95	14	28.00	-	-
Yes, most of the times	1	1.64	-	-	1	9.09
Adding sugar or honey to hot drinks						
No	35	57.38	33	66.00	2	18.18
Yes, 1 teaspoon	12	19.67	7	14.00	5	45.46
Yes, 2 or more teaspoons	9	14.75	7	14.00	2	18.18
Yes, I use sweeteners	5	8.20	3	6.00	2	18.18
Frequency of eating sausages and cold meat						
Never	8	13.12	8	16.00	-	-
Once a week	9	14.75	6	12.00	3	27.27
A few times per week	27	44.26	24	48.00	3	27.27
Once a day	15	24.59	11	22.00	4	36.37
A few times per day	2	3.28	1	2.00	1	9.09
Frequency of eating fish						
Never	5	8.20	5	10.00	-	-
Once a week	42	68.85	33	66.00	9	81.82
A few times per week	12	19.67	11	22.00	1	9.09
Once a day	2	3.28	1	2.00	1	9.09
Type of fish consumed						
Sea	50	81.97	44	88.00	6	54.54
Freshwater	11	18.03	6	12.00	5	45.46
Frequency of eating fruits						
Never	1	1.64	1	2.00	-	-
Once a week	6	9.84	4	8.00	2	18.18
A few times per week	13	21.31	11	22.00	2	18.18
Once a day	27	44.26	22	44.00	5	45.46
A few times per day	14	22.95	12	24.00	2	18.18
Frequency of eating vegetables						
Never	1	1.64	-	-	1	9.09
Once a week	3	4.92	1	2.00	2	18.18
A few times per week	17	27.87	15	30.00	2	18.18
Once a day	27	44.26	22	44.00	5	45.46
A few times per day	13	21.31	12	24.00	1	9.09
Frequency of eating dairy products						
Never	3	4.92	3	6.00	-	-
Once a week	14	22.95	11	22.00	3	27.27
A few times per week	18	29.51	15	30.00	3	27.27
Once a day	18	29.51	14	28.00	4	36.37
A few times per day	8	13.11	7	14.00	1	9.09

4 Discussion

High BMI is associated with increased risk of cardiovascular diseases, decline in quality of life and shorter lifetime (Anandavadivelan et al. 2016; Murray et al. 2017; Xu et al. 2015). Excessive body mass has been observed in over 60% of U3A students in Poznan. Similar observations were made by Walczak and Kwiatkowska (2016) in their study conducted on U3A students in Koszalin. In Perissinotto's et al. study (2002) the average BMI for women was 27.6 kg/m^2, and 26.4 kg/m^2 for men, which indicates overweight. Whereas among elderly people from Spain, 40% of woman were overweight or obese, and 49% and 31.5% of men were overweight or obese, respectively (Gutiérrez-Fisac et al. 2004). Excess of fat tissue and increased waist circumference among seniors is associated with several diseases such as arterial hypertension and type II diabetes (Kvamme et al. 2012).

As a result of the loss of height, BMI as an index of adiposity is likely to be overestimated in older adults. The height lost with aging drives an increase in BMI because the denominator in the equation used to calculate its value (weight/height^2) is decreased. As a result, BMI could have different interpretations for adults at different ages without any significant changes in adiposity (Onwudiwe et al. 2011). Lack of physical activity (Ogonowska-Słodownik et al. 2016) and not following healthy eating guidelines may result in increased waist circumference (over 80 cm in women and above 94 cm in men) (Han et al. 2017). Abdominal obesity is common in men as well as in perimenopausal women (Bogl et al. 2016; Larsson et al. 2017; Ross et al. 2015). Based on the WHR index, about 47% of respondents were classified as abdominally obese. Abdominal obesity can lead to metabolic complications. Among women, the average value of WHR was 0.8, while in men – 1.01. In the study of Perissinotto et al. (2002), the average WHR index value was 0.94 among women and 0.97 among men, which indicates android fat distribution.

In addition to health condition, assessment of elderly people's well-being is also crucial. 70% of the respondents defined their health as good or very good. In a study among auditors from Bydgoszcz, almost 55% defined their well-being as good and did not point to any issues (Zielińska-Więczkowska et al. 2011b). Higher values (70% and 86%) were noted among respondents in other studies (Kozieł and Trafiałek 2007; Zielińska-Więczkowska et al. 2011a).

According to the National Food and Nutrition Institute in Warsaw (Jarosz 2017), people should consume between 5 to 6 meals per day. Frequent consumption of small portions is advised. Based on conducted research, only about

10% of respondents declared such an answer. In previously published studies, the majority of the respondents consumed 3-4 meals per day (43%) or 4-5 meals (36%) (Tańska et al. 2013). Elderly women from Szczecin consumed 3-4 meals a day in over 50% of cases, while 40% consumed 5-6 meals (Krajewska-Pędzik et al. 2014).

Regularity of eating is an important element of the daily diet. Intervals of 2-3 hours between meals are preferred as indicated by the Pyramid of Healthy Eating and Physical Activity (Jarosz 2017). The aim of regularity is to prevent fluctuations in blood glucose levels and help regulate hunger and satiety to prevent the need to search for food to be consumed (Ciampolini and Bianchi 2006). Lack of regularity of meals may contribute to increased consumption of snacks between meals to temporarily satisfy hunger. The phenomenon of snacking was observed among the majority of respondents. Only 11% of them never consumed any additional products during the day. 36% of the respondents admitted to snacking once a day. In the case of auditors from Szczecin, 43% did not consume food between main meals. Among almost 17% of women, the issue of regular daily snacking was identified (Krajewska-Pędzik et al. 2014).

Because of the fact that salivary secretion is impaired and number of taste buds is reduced at an older age, the perception of flavors is diminished (Jabłoński and Kaźmierczak 2005). Therefore, the respondents were asked about the addition of salt to dishes. 23% of respondents added salt to dishes only occasionally, while the vast majority (75%) did not use sodium chloride. Based on literature data, it was found that high content of salt in daily diet has adverse effects on health and is connected with arterial hypertension (Feng et al. 2017; Mazloomy Mahmoodabad et al. 2016). According to current dietary recommendations (Jarosz 2017), the content of salt in the daily food intake should be limited because of the associated risk of arterial hypertension and cardiovascular diseases (Rust and Ekmekcioglu 2016). Therefore, it is recommended to use herbs to enrich the taste of dishes.

Consuming excessive amounts of sugar may contribute to adverse blood glucose level and can supply unnecessary amounts of calories to the body. The use of simple sugars in the daily diet is not recommended because it is known to increase the risk of obesity and type II diabetes (Jurczak et al. 2011). Over 50% of the respondents stated that they do not add sugar or honey to hot beverages. However, 35% of the respondents declared that they add simple sugars to coffee or tea.

Regular and significant consumption of red meat can lead to increased intake of saturated fatty acids. According to the Pyramid of Healthy Eating and Physical

Activity (Jarosz 2017) the intake of red meat in the daily diet of elders should be reduced. This recommendation includes processed meat product such as vienna sausages and pâtés. 25% of the respondents consumed this kind of products once a day and 3% several times during a day.

Marine fishes are rich source of polyunsaturated fatty acids from the n-3 group (Smith et al. 2015). Polyunsaturated n-3 acids facilitate the delivery of vitamin D to the body and affect cognitive functions (e.g., memory and attention) (Barrea et al. 2017; Cui et al. 2015; Lawrence and Sharma 2016). Almost 70% of the respondents consumed fish once a week. Interestingly, in the studies of Krajewska-Pędzik et al. (2014) only 22% of respondents declared the same.

Fruit and vegetables can provide energy to the body, but they are also a rich source of vitamins and minerals. Therefore, they are important ingredients in the daily diet of elderly. It is recommended that they account for at least half of the products consumed during the day (Jarosz 2017). 44% of respondents consumed fruit and vegetables once a day. The consumption of these products several times a day was declared by 23% and 21% of respondents, respectively. In the study of Krajewska-Pędzik et al. (2014), the authors observed daily consumption of fruit and vegetables in over 70% of respondents.

Dairy products such as curd cheese, yoghurt and cheeses are rich sources of calcium, which is an important element in the diet of elderly. Seniors are a group that is prone to diseases of the musculoskeletal system and osteoporosis. Studies show that a diet rich in calcium contributes to a slower rate of bone loss by 1-2% a year in comparison to diets poor in calcium (Bolland et al. 2015; de França et al. 2016). Intake of this element is crucial for postmenopausal women whose risk of osteoporosis is increased several times compared to men (Mahdavi-Roshan 2015; Yun et al. 2016). Among the subjects, 29% declared consumption of dairy products on a once-a-day basis. The same number of respondents stated they consume such products several times a week. For comparison, a third of the surveyed women declared consumption of dairy products several times a week while almost half of the women stated that they eat these products every day.

5 Conclusions

Only about 1/3 of respondents among the U3A students surveyed in Poznań showed a correct BMI value, and almost half were overweight. About 47% of seniors had abdominal obesity, which is associated with a higher risk of diseases such as hypertension, atherosclerosis and type II diabetes. Based on the study of eating habits, it is recommended to increase the consumption of vegetables and fruit, fish and dairy products in order to supplement the diet of older people with valuable nutrients. At the same time, the consumption of red and highly processed meat products should be limited to prevent cardiovascular disease. When asked about unhealthy eating habits, such as addition of salt to already prepared dishes and sugar to hot beverages, the majority of the respondents declared that they abstain from these practices. Nutritional habits among the elderly should be constantly monitored in order to control their health, improve their quality of life and prevent the occurrence of chronic diseases. It is also important to promote education on proper nutrition among seniors which should include programs focused on the practical aspects of composing healthy meals. Such programs should take into consideration the financial capabilities and often improper habits of this group of people.

Conflicts of Interest: The authors declare that they have no conflict of interest for publishing this research.

References

[1] Anandavadivelan P, Brismar TB, Nilsson M, Johar AM, Martin L. Sarcopenic obesity: A probable risk factor for dose limiting toxicity during neo-adjuvant chemotherapy in oesophageal cancer patients. Clin Nutr. 2016;35:724–30. https://doi.org/10.1016/j.clnu.2015.05.011.

[2] Anthropometry procedures manual. National Center for Health Statistics, Hyattsville, MD; 2007.

[3] Ashwell M, Gibson S. Waist-to-height ratio as an indicator of 'early health risk': simpler and more predictive than using a 'matrix' based on BMI and waist circumference. BMJ Open. 2016;6:e010159. https://doi.org/10.1136/bmjopen-2015-010159.

[4] Barrea L, Savanelli MC, Di Somma C, Napolitano M, Megna M, Colao A. Savastano S. Vitamin D and its role in psoriasis: An overview of the dermatologist and nutritionist. Rev Endocr Metab Disord. 2017;18:195–205. https://doi.org/10.1007/s11154-017-9411-6.

[5] Bogl LH, Kaye SM, Rämö JT, Kangas AJ, Soininen P, Hakkarainen A, Lundbom J, Lundbom N, Ortega-Alonso A, Rissanen A, Ala-Korpela M, Kaprio J, Pietiläinen KH. Abdominal obesity and circulating metabolites: A twin study approach. Metabolism. 2016;65:111–21. https://doi.org/10.1016/j.metabol.2015.10.027.

[6] Bolland MJ, Leung W, Tai V, Bastin S, Gamble GD, Grey A, Reid IR. Calcium intake and risk of fracture: systematic review. BMJ. 2015;h4580. https://doi.org/10.1136/bmj.h4580.

[7] Ciampolini M, Bianchi R. Training to estimate blood glucose and to form associations with initial hunger. Nutr. Metab. (Lond). 2006;3:42. https://doi.org/10.1186/1743-7075-3-42.

[8] Cui X, Gooch H, Groves NJ, Sah P, Burne TH, Eyles DW, McGrath JJ. Vitamin D and the brain: Key questions for future research. J. Steroid Biochem. Mol Biol. 2015;148:305–9. https://doi.org/10.1016/j.jsbmb.2014.11.004.

[9] Czernichow S, Kengne A-P, Huxley RR, Batty GD, de Galan B, Grobbee D, Pillai A, Zoungas S, Marre M, Woodward M, Neal B, Chalmers J. Comparison of waist-to-hip ratio and other obesity indices as predictors of cardiovascular disease risk in people with type-2 diabetes: a prospective cohort study from ADVANCE. Eur J Cardiovasc Prev Rehabil. 2011;18:312–9. https://doi.org/10.1097/HJR.0b013e32833c1aa3.

[10] de França NAG, Camargo MBR, Lazaretti-Castro M, Peters BSE, Martini LA. Dietary patterns and bone mineral density in Brazilian postmenopausal women with osteoporosis: a cross-sectional study. Eur J Clin Nutr. 2016;70:85–90. https://doi.org/10.1038/ejcn.2015.27.

[11] Feng W, Dell'Italia LJ, Sanders PW. Novel Paradigms of Salt and Hypertension. J Am Soc Nephrol. 2017;28:1362–9. https://doi.org/10.1681/ASN.2016080927.

[12] Gutiérrez-Fisac JL, López E, Banegas JR, Graciani A, Rodríguez-Artalejo F. Prevalence of Overweight and Obesity in Elderly People in Spain. Obes Res. 2004;12:710–5. https://doi.org/10.1038/oby.2004.83.

[13] Han TS, Correa E, Lean MEJ, Lee DM, O'Neill TW, Bartfai G, Forti G, Giwercman A, Kula K, Pendleton N, Punab M, Rutter MK, Vanderschueren D, Huhtaniemi IT, Wu FCW, Casanueva FF. Changes in prevalence of obesity and high waist circumference over four years across European regions: the European male ageing study (EMAS). Endocrine. 2017;55:456–69. https://doi.org/10.1007/s12020-016-1135-y.

[14] Humańska MA, Kędziora-Kornatowska K. Influence of place of residence on nutrition in the elderly. Gerontol Pol. 2009;17:126–8.

[15] Jabłoński E, Kaźmierczak U. Nutrition in the elderly. Gerontol Pol. 2005;13:48–54.

[16] Jarosz M. Nutritional standards for the population of Poland. Instytut Żywności i Żywienia, Warsaw, Poland; 2017.

[17] Jurczak I, Barylski M, Irzmański R. The importance of diet in the elderly - an important aspect of preventive health care or irrelevant daily regine? Geriatria. 2011;5:127–33.

[18] Kaczmarczyk M, Trafialek E. Activating elderly people - a chance for better and more satisfying aging. Gerontol Pol. 2007;4:116–8.

[19] Konieczna-Wozniak R. Education of seniors as a way to aid loneliness (in Polish). In: Twardowska-Rajewska, J. (Ed.), Against Loneliness. Adam Mickiewicz University, Poznań, Poland; 2015. p. 101–5.

[20] Kowalkowska J, Wadolowska L, Czarnocinska J, Czlapka-Matyasik M, Galinski G, Jezewska-Zychowicz M, Bronkowska M, Dlugosz A, Loboda D, Wyka J. Reproducibility of a Questionnaire for Dietary Habits, Lifestyle and Nutrition Knowledge Assessment (KomPAN) in Polish Adolescents and Adults. Nutrients. 2018;10:1845. https://doi.org/10.3390/nu10121845.

[21] Kozieł D, Trafiałek E. Assessing the influence of the studying at the University of the Third Age on life satisfaction of elderly people. Gerontol Pol. 2007;15:104–8.

[22] Krajewska-Pędzik A, Ratajczak J, Stępień-Słodkowska M. Evaluation of the nutritional habits of female students of the University of the Third Age (in Polish). Akt Ruch Lud Róż Wieku. 2014;21:43–51.

[23] Krzepota J, Biernat E, Florkiewicz B. The Relationship between Levels of Physical Activity and Quality of Life among Students of the University of the Third Age. Cent Eur. J Public Health. 2015;23:335–9. https://doi.org/10.21101/cejph.a4136.

[24] Kvamme J-M, Holmen J, Wilsgaard T, Florholmen J, Midthjell K, Jacobsen BK. Body mass index and mortality in elderly men and women: the Tromsø and HUNT studies. J. Epidemiol. Community Health. 2012;66:611–7. https://doi.org/10.1136/jech.2010.123232.

[25] Langlley-Evans S. Nutrition: a lifespan approach. PZWL, Warsaw, Poland; 2014.

[26] Larsson SC, Wolk A, Håkansson N, Bäck M. Overall and abdominal obesity and incident aortic valve stenosis: two prospective cohort studies. Eur Heart J. 2017;38:2192–7. https://doi.org/10.1093/eurheartj/ehx140.

[27] Lawrence DW, Sharma B. A review of the neuroprotective role of vitamin D in traumatic brain injury with implications for supplementation post-concussion. Brain Inj. 2016;30:960–8. https://doi.org/10.3109/02699052.2016.1147081.

[28] Mahdavi-Roshan M. Copper, magnesium, zinc and calcium status in osteopenic and osteoporotic post-menopausal women. Clin Cases Miner Bone Metab. 2015;12:18–21. https://doi.org/10.11138/ccmbm/2015.12.1.018.

[29] Mazloomy Mahmoodabad SS, Tehrani H, Gholian-aval M, Gholami H, Nematy M. The effect of social class on the amount of salt intake in patients with hypertension. Blood Press. 2016;25:360–3. https://doi.org/10.1080/08037051.2016.1179508.

[30] Murray CJL. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. N Engl J Med. 2017;377:13–27. https://doi.org/10.1056/NEJMoa1614362.

[31] Niedźwiedzka E, Wądołowska L. Analysis of food intake variety in relation to the socio-economic status of elderly Polish citizens. Probl Hig Epidemiol. 2010;91:576–84.

[32] Ogonowska-Słodownik A, Bober EM, Molik B. Functional fitness and body composition of active older women in different age categories. Adv Rehabil. 2016;30:11–7. https://doi.org/10.1515/rehab-2015-0034.

[33] Onwudiwe NC, Stuart B, Zuckerman IH, Sorkin JD. Obesity and Medicare Expenditure: Accounting for Age-Related Height Loss. Obesity. 2011;19:204–11. https://doi.org/10.1038/oby.2010.145.

[34] Ożga E, Małgorzewicz S. Assessment of nutritional status of the elderly. Geriatria. 2013;7:1–6.

[35] Pędich W. Notes on the specifics of the elderly population surveys. Gerontol Pol. 1998;6:3–5.

[36] Perissinotto E, Pisent C, Sergi G, Grigoletto F. ILSA Working Group (Italian Longitudinal Study on Ageing). Anthropometric measurements in the elderly: age and gender differences. Br J Nutr. 2002;87:177–86.

[37] Ross R., Hudson R., Stotz P.J., Lam M. Effects of Exercise Amount and Intensity on Abdominal Obesity and Glucose

Tolerance in Obese Adults. Ann Intern Med. 2015;162:325. https://doi.org/10.7326/M14-1189.

[38] Rust P, Ekmekcioglu C. Impact of Salt Intake on the Pathogenesis and Treatment of Hypertension. In: Islam, M.S. (Ed.), Hypertension: From Basic Research to Clinical Practice. Advances in Experimental Medicine and Biology. Springer International Publishing, Cham; 2016. p. 61–84. https://doi.org/10.1007/5584_2016_147.

[39] Sánchez-García S, García-Peña C, Duque-López MX, Juárez-Cedillo T, Cortés-Núñez AR, Reyes-Beaman S. Anthropometric measures and nutritional status in a healthy elderly population. BMC Public Health. 2007;7:2. https://doi.org/10.1186/1471-2458-7-2.

[40] Skiba M, Kusa-Podkańska M, Wysokińska-Miszczuk J. The influence of the oral condition on the mental and physical well-being of elderly people. Gerontol Pol. 2015;13:250–4.

[41] Smith GI, Julliand S, Reeds DN, Sinacore DR, Klein S, Mittendorfer B. Fish oil–derived n−3 PUFA therapy increases muscle mass and function in healthy older adults1. Am J Clin Nutr. 2015;102:115–22. https://doi.org/10.3945/ajcn.114.105833.

[42] Tańska M, Babicz-Zielińska E, Komorpowska-Szczepańska W. Eating habits of the elderly and their influence on occurrence of overweight and obesity. Fam Med Prim Care Rev. 2013;15:178–80.

[43] Walczak Z, Kwiatkowska M. Evaluation of nutritional habits and the body mass index (bmi) of students of the University of the Third Age at the Koszalin University of Technology.

J. Med. Sci. 2016, 85, 15–21, https://doi.org/10.20883/jms.2016.2.

[44] WHO. Global health and ageing 2011,. World Health Organization.

[45] World Health Organization. Waist circumference and waist-hip ratio: report of a WHO expert consultation. World Health Organization, Geneva, Switzerland; 2011.

[46] Xu W, Tan L, Wang H-F. Jiang T, Tan M-S, Tan L, Zhao Q-F, Li J-Q, Wang J, Yu J-T. Meta-analysis of modifiable risk factors for Alzheimer's disease. J Neurol Neurosurg Psychiatry. 2015;jnnp-2015-310548. https://doi.org/10.1136/jnnp-2015-310548.

[47] Yun BH, Chon SJ, Choi YS, Cho S, Lee BS, Seo SK. The effect of prolonged breast-feeding on the development of postmenopausal osteoporosis in population with insufficient calcium intake and vitamin D level. Osteoporos Int. 2016;27:2745–53. https://doi.org/10.1007/s00198-016-3585-8.

[48] Zielińska-Więczkowska H, Ciemnoczołowski W, Kornatowski T, Kędziora-Kornatowska K. Sense of coherence and life satisfaction in students of the University of the Third Age. Gerontol Pol. 2011a;19:119–25.

[49] Zielińska-Więczkowska H, Kędziora-Kornatowska K, Ciemnoczołowski W. Evaluation of quality of life (QoL) of students of the University of Third Age (U3A) on the basis of socio-demographic factors and health status. Arch Gerontol Geriatr. 2011b;53:e198–e202. https://doi.org/10.1016/j.archger.2010.09.003.