



## ORIGINAL PAPER

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# 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

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### ABSTRACT

**Introduction.** Nutrition plays an important role in the elderly stage of life. A proper proportion of the individual nutritional ingredients in a diet may positively impact the ageing body. This positive influence consists in slowing down the undesired and unfavourable physiological alterations leading inevitably to the general weakness of the body.

**Aim.** The aim of the study was to evaluate the nutritional habits and body mass indexes (BMI) of students of the University of the Third Age at the Koszalin University of Technology.

**Materials and Methods.** A total of 189 people (34 men and 155 women) took part in the study in 2014, which involved a diagnostic survey and an evaluation of the nutritional state based on BMI.

**Results.** Approximately 3/4 of the respondents were found to be overweight or obese. A large majority of them viewed their health status as good. The majority (70%) declared regularly eating 3–4 meals. Half of the respondents admitted eating snacks between meals. The majority of the respondents did not control the amount of calories consumed, but they reduced the consumption of cholesterol. About 3/4 of the respondents ate wholemeal bread and spread butter over it. They mainly used all-purpose oil for frying. About half of the respondents ate unprocessed fruit and vegetables every day and only 1/3 of them consumed milk and dairy products every day. About 3/4 of the respondents ate fish once a week. About 1/3 of the males and nearly half of the females ate vitamin and/or mineral supplements. About 3/4 of the respondents performed some physical exercise several times a week. Male and female respondents reported eating snacks between meals to a different extent. It was also found that the educational background significantly differentiated the amount of fruit and vegetables consumed as well as the time of the last meal of the day. The place of residence also significantly differentiates the number of meals and the extent to which the consumption of cholesterol is reduced. The respondents' financial situation was also found to differentiate the form in which fruit are eaten.

**Conclusions.** The findings suggest increased control of the amount of calories consumed, increased consumption of fruit and vegetables, dairy products and fish as well as the need for nutritional education.

**Keywords:** evaluation of nutritional habits; elderly people; BMI.

## Introduction

The disadvantageous demographic situation which was caused by a smaller number of births and a longer average life expectancy is the reason for the inevitable age-

ing of society [1]. As a result, health care providers are showing an increased interest in that population group [2]. The elderly are a heterogeneous group due to their health status [3, 4]. Some of them, with good physical and intellectual capacities, prevent their own social

exclusion by creating associations for seniors. These persons undertake social, cultural or intellectual activities in such groups. The Universities of the Third Age are one of such organizations providing educational services and satisfying the psychosocial and health needs of students [5]. However, the advancing physiological changes as a person becomes older are the reason for physical and mental problems [6–8, 3]. The physical problems include, for instance, a decreasing resistance of the body to chronic diseases. The mental problems are mainly advancing neurodegenerative diseases leading to isolation and social exclusion of persons suffering from them. The lifestyle has a significant impact on health. It includes, for instance, physical activity and nutrition [9, 10]. However, it should be borne in mind that advancing physiological changes modify body's nutritional needs as the person becomes older [11], whereas improper nutrition leads to the occurrence of the so-called diet-related diseases [12]. The frequently coexistent health problems combined with the poor financial condition of the elderly most often lead to an unbalanced diet and result in deficiencies of certain nutrients [13]. The knowledge the elderly possess about nutrition, which is most frequently out of date since it comes from the time they were young or was obtained from not entirely reliable sources such as glossy magazines or TV advertisements, encourages multi-layer activities aimed at nurturing proper nutrition habits [9, 14]. Those activities must be based on proper research in the scope of the nutritional status and diets in order to enable the prevention of irregularities which may occur [7].

### Aim

The aim of the study was to evaluate the nutritional habits and body mass indexes (BMI) of students of the University of the Third Age at the Koszalin University of Technology using a diagnostic survey method and anthropometric measurements.

### Materials and Methods

189 people, including 34 men and 155 women, took part in the study. Evaluation of the eating habits among students of the University of the Third Age of the Koszalin University of Technology was based on data obtained from an anonymous original questionnaire using a diagnostic survey conducted in 2014.

The questionnaire comprised 22 questions divided into 4 parts. The first part concerned an evaluation of the socio-economic and health status. The respondents were asked about their educational level, place of residence and to provide a self-evaluation of their financial

status and health status. The second part of the questionnaire concerned general eating habits. The respondents were asked about the number of meals eaten during the day, eating snacks between meals, the regularity of eating the meals, the time of the last meal and how well they controlled the amount of calories and cholesterol consumed. The third part concerned the frequency of consumption of specific groups of products. The respondents were asked about the type of bread they eat, the type of fat used to spread on bread, the type of fat used for frying, the frequency of eating fruit and vegetables and the form in which they are eaten, the frequency of consuming milk and dairy products and the frequency and form of eating fish. Part Four of the questionnaire concerned dietary supplements and a self-assessment of the level of physical activity. The respondents were asked to declare the type of supplementation used and to self-assess the level of their physical activities. The results were expressed as absolute figures – the number of respondent's specific behaviours, and in relative indexes – the percentage of respondents (%) who declared a specific behaviour. Filling in the questionnaire was preceded by a detailed discussion of the way in which the answers should be given, and the person responsible for the study was present all the time in the room to answer any questions. The body mass index (BMI) of the group of students was determined using the basic anthropometric parameters (body height and weight). The data was used to calculate Quetelet's Body Mass Index:  $[\text{body weight (kg)}]:[\text{body height B-v (m}^2\text{)}]$ . The body height and weight were measured on a certified medical scale with a height meter and the waist circumference measured with a tailor's measuring tape. The anthropometric measurements were conducted in a student outpatient clinic in accordance with the rules adopted in anthropometry [15]. The BMI was interpreted according to the WHO guidelines [16]. The statistical significance of the differences of the anthropometric parameters evaluated in the study was assessed with the U Mann-Whitney test. The relationship between the sex, education level and self-assessment of the financial situation and general nutritional habits of the respondents as well as the frequency and form of eating specific groups of food was determined by an  $\chi^2$  test [17]. The levels of significance of  $\alpha = 0.05$  and  $\alpha = 0.01$  were adopted throughout.

### Results

The data for the average age, waistline circumference, height, body weight and body mass index (BMI) of the students are given in **Table 1**. A detailed analysis of the waistline circumference and the BMI of the students are

presented in **Table 2**. As the data indicates, the average age of the respondents was about 67 years. The average height was 1.63 m, and the average body weight was approx. 70 kg. In analysing the data by gender, it is clear that the men were taller and heavier than the women. When the waistline measurements were analysed in a detailed manner, it was shown that approximately 40% of the assessed students were at risk of metabolic derangements and complications. The statistical analysis revealed that height, weight and waist

circumference significantly distinguished the males from the females ( $p < 0.05$ ). The BMI values, when analysed specifically, demonstrated that the problem of quantitative malnourishment almost did not affect this group of people, although it was found that about 63% of the students were overweight or obese. Considering the gender, it was shown that obesity and overweight were more common among the men than the women.

As **Table 3** shows, the group of men and women under evaluation were mostly well-educated city resi-

**Table 1.** Characteristics of the tested students

Parameters	Men n = 34					Women n = 155					p
	$\bar{X}$	SD	Min.	Max.	Med.	$\bar{X}$	SD	Min.	Max.	Med.	
Age (years)	69.44	6.03	55.00	81.00	70.00	66.70	4.95	56.00	81.00	66.00	$p > 0.05$
Body height (m)	1.72	0.07	1.56	1.88	1.72	1.61	0.05	1.5	1.76	1.61	$p < 0.05$
Body weight (kg)	80.00	9.8	59.00	100.00	81.00	68.15	10.20	43.00	98.00	68.00	$p < 0.05$
Waist circumference (cm)	93.38	9.56	74.00	110.00	92.00	83.35	11.12	60.00	120.00	80.00	$p < 0.05$
BMI ( $\text{kg}/\text{m}^2$ )	26.96	3.32	22.23	35.25	26.15	26.07	3.64	18.13	36.89	25.71	$p > 0.05$

**Table 2.** A detailed analysis of the waistline circumference and the BMI of the students

	Men n = 34		Women n = 155	
	n	%	n	%
Waist circumference $\geq 80^*/ \geq 94^{**}$	14	41.18	58	37.42
BMI ( $< 18.5$ )	-	-	1	0.64
BMI (18.5–24.99)	10	29.52	59	38.06
BMI (25–29.99)	17	50.00	70	45.16
BMI (30–34.99)	6	17.54	22	14.19
BMI (35–39.99)	1	2.94	3	1.95
BMI ( $> 40$ )	-	-	-	-

\* for women; \*\* for men

**Table 3.** Socio-economic and health status

	Men		Women	
	n	%	n	%
Education				
Basic	1	2.94	2	1.29
Vocational	2	5.88	4	2.58
Secondary	14	41.18	92	59.35
Higher	17	50.00	57	36.78
Place of residence				
City	32	94.12	148	95.48
Village	2	5.88	7	4.52
Financial position				
Bad	3	8.82	2	1.29
Average	11	32.36	92	59.35
Good	17	50.00	59	38.07
Very good	3	8.82	2	1.29
The health status by self-assessment				
Bad	11	32.36	19	12.26
Good	21	61.76	130	83.87
Very good	2	5.88	6	3.87

**Table 4.** General feeding behavior

	Men		Women	
	n	%	n	%
Number of meals				
< 3	-	-	5	3.23
3-4	28	82.35	112	72.25
5 >	6	17.65	38	24.52
Eating between the meals				
Yes	10	29.41	84	54.19
No	24	70.59	71	45.81
Regularity of meals				
Yes	27	79.41	113	72.90
No	7	20.59	42	27.10
Time of last meal (hours)				
18-20	27	79.41	125	80.64
20-22	7	20.59	27	17.42
22-24	-	-	3	1.94
Control over energetic value				
Yes	16	47.06	56	36.13
No	18	52.94	98	63.87
Limiting cholesterol				
Yes	31	91.18	122	78.71
No	3	8.82	33	21.29

dents. Men saw their financial situation as better than women did, while women saw their health status as better than men. An evaluation of the general eating habits has showed (Table 4) that they were mostly correct. Only five women did not eat enough meals during the day. It was also worrying that most women ate snacks between meals and that the majority of men and women did not control the amount of calories consumed. The statistical analysis showed that the place of residence significantly affected the statistical number of consumed meals and the limitation of cholesterol intake ( $p < 0.05$ ), sex significantly affected eating snacks between meals ( $p < 0.05$ ) and education significantly affected the time of the last meal of the day ( $p < 0.05$ ).

An assessment of the frequency of consumption of specific groups of foods (Table 5) showed that about 3/4 of men and women ate wholemeal bread and they usually spread butter on it. About 3/4 of the respondents declared that they used all-purpose (rapeseed) oil for frying. Only a little more than half of the respondents ate vegetables every day, which was slightly better than their consumption of fruit. However, women declared that they ate fruit every day more often than men. It was also shown that education significantly affected the statistical frequency of consumption of vegetables ( $p < 0.05$ ). Less than 40% of men and women ate milk and dairy products every day. However, the frequency of eating fish was the lowest. The majority of both men and women ate fish once a week. The population under study took vitamin and mineral supplements and about

**Table 5.** Frequency of consumption of specific groups of products

	Men		Women	
	n	%	n	%
Often bread eating				
Wholemeal	26	76.47	113	72.90
Ordinary	7	20.59	11	7.10
Don't eat bread	1	2.94	31	20.00
Spreading bakery products				
Butter	17	50.00	112	72.26
Margarine	10	29.41	33	21.29
Don't spread bakery	7	20.59	10	6.45
Frying dishes				
Universal oil	25	73.53	106	68.39
Olive oil	8	23.53	42	27.10
Lard	1	2.94	7	4.52
Frequency of eating vegetables				
Every day	18	52.94	81	52.26
A few times per week	15	44.12	67	43.23
Once a week	1	2.94	7	4.52
Never	-	-	-	-
Type of vegetables consumed				
Raw	23	67.65	103	66.45
Prepared	11	32.35	52	33.55
Frequency of eating fruits				
Every day	20	58.82	107	69.03
A few times per week	13	38.24	43	27.74
Once a week	1	2.94	4	2.58
Never	-	-	1	0.65
Type of fruits consumed				
Raw	33	97.06	139	89.68
Prepared	1	2.94	16	10.32
Frequency of eating milk and milk products				
Every day	13	38.24	56	36.13
A few times per week	8	23.53	56	36.13
Once a week	11	32.35	26	16.77
Never	2	5.88	17	10.97
Frequency of eating fish				
Every day	1	2.94	3	1.94
A few times per week	10	29.41	21	13.55
Once a week	21	61.76	120	77.42
Never	2	5.88	11	7.10
Type of fish consumed				
Fatty	21	61.76	84	54.19
Low fat	11	32.35	60	38.71

3/4 of both men and women declared physical activity at least several times a week (Table 6).

## Discussion

The nutritional habits of elderly people need to be constantly monitored in order to maintain their health. Evaluation of eating habits helps to carry out effective actions to prevent chronic diseases and, in consequence, to improve the quality of life [18].

**Table 6.** Assessment supplementation and physical activity level

Type of supplementation	Men		Women	
	n	%	n	%
Vitamins and Minerals	12	35.29	73	47.09
Omega-3 fatty acid	9	26.47	38	24.51
Other	2	5.88	9	5.80
Physical activity				
Every day	16	47.06	47	30.32
A few times per week	10	29.41	62	40.00
Once a week	5	14.71	25	16.13
Never	3	8.82	21	13.55

Undernourishment in elderly people results in progressive deterioration of their health and lowering of their quality of life [19]. The anthropometric measurements showed suspected undernourishment in only one female student. A study conducted by Krajewska-Pędzik et al. [20] among female students of the University of the Third Age in Szczecin did not reveal any undernourishment in that group of respondents. However, according to many reports, the rate of undernourishment in elderly people ranges from 5% to 10% [21]. Excessive fatty tissue in elderly people results mainly in hyperlipidaemia, arterial hypertension and type II diabetes [22]. An increase in the waist circumference is positively correlated with nutritional diseases. The risk of metabolic complication increases above 80 cm in women and above 94 cm in men [23]. This study has shown that a waist circumference which indicates a risk of metabolic complications was observed in 38% of the study population. The BMI is also positively correlated with potential nutritional diseases. A study conducted by Krajewska-Pędzik et al. [20] among female students of the University of the Third Age in Szczecin showed – like in students of the UTA at the Koszalin University of Technology – that the BMI was normal in only 1/3 of all students. Obesity in a considerable portion of the elderly population has also been confirmed by Stawarska et al. [24].

The number of meals declared by about 3/4 of students of the UTA at the Koszalin University of Technology indicates correct behaviour which is consistent with recommendations [18]. A study conducted by Krajewska-Pędzik et al. [20] showed that about 90% of female students of the UTA in Szczecin had more than three meals a day. For eating snacks between meals, the study found that men were more disciplined than women. For regularity of eating and the time of the last meal, this habit was correct in a considerable percent of the respondents. A majority of respondents also declared that they controlled the amount of cholesterol

consumed. However, a number of studies of the eating habits of elderly people have indicated that an excessive amount of cholesterol is eaten in Poland [25, 26]. In addition, the current study has also shown that respondents should pay more attention to controlling the amount of calories consumed. Appropriate control of the supply of calories may reduce problems with excessive body weight, thereby considerably improving the quality of life [27]. More frequent consumption of wholemeal bread than white bread in the study population indicates that many valuable nutrients are supplied, including dietary fibre, which is particularly beneficial to health [28]. However, a deficit of dietary fibre is frequently observed in the diets of elderly people. This tendency has been confirmed in the studies conducted by Ilow et al. [29] and Stawarska et al. [30]. A study conducted by Różańska et al. [31] showed that the dietary fibre consumed by a selected population of elderly people met only 15% of the daily demand. Despite declarations of controlling the amount of cholesterol consumed, the majority of the respondents chose to spread butter on bread. Only about 1/4 of the respondents declared eating a margarine whose fatty acid profile was much more beneficial and which did not contain cholesterol [32]. The majority of the respondents used an all-purpose (rapeseed) oil for frying, which was characterised by lower oxidative stability, thereby exposing themselves to harmful products of adverse chemical transformations [33]. Vegetables were consumed every day by about half of the respondents, although fruit consumption was slightly higher. Since these products are a source of many bioactive components (antioxidants as well as vitamins and minerals) they should be the main component of an elderly person's diet [34]. A study conducted by Krajewska-Pędzik et al. [20] showed that about 3/4 of students of the UTA in Szczecin ate fruit and vegetables every day. The low consumption of milk and dairy products is worrying. Although production of lactase at an elderly age

decreases, dairy products should be eaten regularly by elderly people. Apart from containing valuable proteins, they are an important source of calcium. Studies of eating habits have shown an adverse tendency in the consumption of this group of products in elderly people. Only 44% reported the daily consumption of milk in the years 1989–2004 [35]. A study conducted by Krajewska-Pędzik et al. [20] showed that only 58% of them declared drinking milk and eating dairy products every day. A study conducted by Myszkowska-Ryckiak et al. [36] among students of the UTA in Warsaw also found a low level of calcium consumption. Markiewicz et al. [37] showed that the amount of calcium supplied with the diet did not cover the recommended standards. The low level of fish consumption among students of the UTA at the Koszalin University of Technology reflected the general trend in Poland. Although it is recommended that they should be eaten 1–2 times a week as a source of valuable proteins, fatty acids with beneficial biological properties (n-3) and many vitamins, including vitamin D and minerals, studies have shown that 80% of Poles eat fish once a week or less often [38, 12, 39]. Nearly half of the study population took supplements, especially minerals and vitamins. Kałuża et al. [40] found that elderly people commonly take vitamin and/or mineral supplements. A study conducted by Tokarz et al. [41] on a group of 86 people aged 60–90 years showed that the respondents did not consume most minerals at a safe level. Considering that the absorption rate of nutrients decreases with age, which causes development or exacerbation of many diseases, such supplementation seems justified [42]. Regular exercise by elderly people reduces levels of diabetes, osteoporosis, atherosclerosis, arterial hypertension and brain diseases, such as Alzheimer's disease [43]. It can also significantly delay or reduce the effects of ageing of skeletal muscles [44]. This is why the fact that about 3/4 respondents declared performing some physical exercise at least several times a week should be seen as positive.

### Conclusions

1. The high obesity rate among the students of the UTA indicates that it is necessary to take actions to further control of the amount of calories consumed.
2. It is recommended that the consumption frequency of vegetables, fruit, dairy products and fish should be increased in order to eliminate the risk of a deficit of certain nutrients.

3. Education regarding healthy eating should be provided to eliminate nutritional errors.

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### References

1. Poniewierka E. Healthy eating of the elderly. Senior Guide. Dolnośląski Ośrodek Polityki Społecznej, Wrocław. 2012:1–96.
2. Roszkowski W. Nutrition of the elderly. in: Hasik J, Gawęcki J. (eds.). Human Nutrition healthy and the sick. Warszawa, PWN, 2000:86–94.
3. Langley-Evans S. Nutrition: a lifespan approach. Warszawa, PZWL, 2014:216–241.
4. Pędich W. Notes on the specifics of the elderly population surveys. Gerontol Pol. 1998;6(2):3–5.
5. 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(3):104–108.
6. 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. 2005;13(4):250–254.
7. Gabrowska E, Spodaryk M. Nutrition guidelines for the elderly. Gerontol Pol. 2006;14(2):57–62.
8. Tańska T, Babicz-Zielińska E, Przysławski J. Attitudes of the elderly towards the issues of health and healthy food. Probl Hig Epidemiol. 2013;94(4):915–918.
9. Jabłoński E, Kaźmierczak U. Nutrition in the elderly. Gerontol Pol. 2005;13(1):48–54.
10. Jurczak I, Barylski M, Irzmański R. The importance of diet in the elderly – an important aspect of preventive health care or irrelevant daily regime? Geriatria. 2011;5:127–133.
11. Width M, Reinhard T. Clinical dietetics. Wrocław, Elsevier Urban & Partner, 2014:95–110.
12. Suliga E. Health behaviours related to the nutrition of adults and elderly people. Hygeia Public Health. 2010; 45(1):44–48.
13. 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(4):576–584.
14. Piórecka B, Międzobrodzka A. Evaluation of the diet and nutritional status of elderly people living in Krakow. Journal of Medical Science. 2002;4–5(71):249–254.
15. Drozdowski Z. Anthropometry in physical education. Poznań, AWF Poznań, 1998.
16. World Health Organization. Obesity: preventing and managing the global epidemic: WHO Technical Report Series 894. WHO Geneva. 2000.
17. StatisticaPL Version 10, 64-Bit. Licencja AGA-P207E324303AR-P. 2015. StatSoft Polska, Kraków
18. Gacek M. Eating behavior of the elderly in Poland and Germany. Probl Hig Epidemiol. 2008;89(3):401–406.

19. Mirczak A. Risk factors of malnutrition among the elderly living in rural areas. *Environmental Medicine*. 2014;17(4):68–75.
20. Krajewska-Pędzik A, Ratajczak J, Stępień-Słodkowska M. Evaluation of nutrition of the university of the third age participants. *Aktywność Ruchowa Ludzi w Różnym Wiek*. 2014;1–4(21–24):83–91.
21. Wojszel Z.B. Malnutrition and nutritional treatment dilemmas in geriatrics. *Post Nauk Med*. 2011;8:649–657.
22. Kvamme JM, Holmen J, Wilsgaard T, Florholmen J, Midthjell K, Jacobsen BK. Body mass index and mortality in elderly men and women: the Tromso and HUNT studies. *J Epidemiol Community Health*. 2011;66(7):611–7.
23. Kinalska K, Popławska-Kita A, Telejko B, Kinalski M, Zonenberg A. Obesity and carbohydrate metabolism. *Endokrynol Otyłość*. 2006;2(3):94–101.
24. Stawarska A, Tokarz A, Kolczewska M. Quantitative assessment of minerals and vitamins in diets of elderly people from selected Warsaw social associations. Part III. *Bromat Chem Toksykol*. 2009;42(2):117–122.
25. Gabrowska E, Spodaryk M. Assessment of diets of the elderly living in Krakow. *Żyw Człow*. 2002;29(Suppl.):203–208.
26. Sadowska J, Śliwińska U. Assessment of diet and nutritional status in the elderly, living in rural areas. *Żyw Człow*. 2005;32:187–202.
27. Książek K. The impact of limiting calorie intake in length and quality of life. Materials Conference Second National Scientific Conference "Nutrition gerontological – Challenges and Opportunities". Wydawnictwo Naukowe Uniwersytetu Medycznego im. Karola Marcinkowskiego w Poznaniu, Poznan, 2014:11.
28. Górecka D. Dietary fiber – health and technological benefits. *Przem Spoż*. 2009;63(12):16–20.
29. Iłow R, Regulska-Iłow B, Biernat J, Kowalisko A. The assessment of dietary intake of the selected groups from Lower Silesia population 50-year-old. *Bromat Chem Toksykol*. 40(3):293–298.
30. Stawarska A, Tokarz A, Kolczewska M. Energy value and basic ingredients in diet of elderly people from selected Warsaw social associations. Part II. *Bromat Chem Toksykol*. 2008;41(4):987–991.
31. Różańska D, Wyka J, Biernat J. Food intake of elderly inhabitants of a small town – Twardogora. *Probl Hig Epidemiol*. 2013;94(3):494–502.
32. Krygier K. The nutritional value of margarines. in: Krygier K. (ed.). *Modern margarine nutritional and technological aspects*. Warszawa, WNT, 2010:141–155.
33. Cichosz G, Czeczot H. Oxidative stability of edible fats – consequences to human health. *Bromat Chem Toksykol*. 2011;44(1):50–60.
34. Brończyk-Puzoń A, Bieniek J. Nutrition elderly based on nutritional standards amendment Institute of Food and Nutrition for the Polish population of. 2012 years. *Nowa Med*. 2013;4:151–155.
35. Sikora E, Pysz M, Leszczyńska T. Changes in daily supply of basic groups of food products in households of pensioners in the years from 1989 to 2004. *Żywn Nauka Technol Jakość*. 2009;5(66):132–147.
36. Myszkowska-Ryciak J, Bujako J, Malesza M. Evaluation of nutrition in elderly women associated in the University of the Third Age in Warsaw. *Żyw Człow*. 2003;30(1–2):357–361.
37. Markiewicz R, Borawska M.H, Socha K, Gutowska A. Calcium and magnesium in diets of people from Podlasie region. *Bromat Chem Toksykol*. 2009;42(3):629–635.
38. Kulikowski T. Consumption of fish and fish products in view statistical data and surveys. [http://www.lgropolszczyzna.pl/pobierz/prezentacja\\_1\\_tomasz\\_kulikowski.pdf](http://www.lgropolszczyzna.pl/pobierz/prezentacja_1_tomasz_kulikowski.pdf). 2014. (30.03.2015).
39. Tkaczewska J, Migdał W. Consumption and purchasing preferences among fish consumers in Poland. *Przem Spoż*. 2013; 67(5):42–46.
40. Kałuża J, Bagan A, Brzozowska A. The assessment of supplements contribution to vitamins and mineral intake by the elderly. *Rocz Państ Zakł Hig*. 2004;55(1):51–61.
41. Tokarz A, Stawarska A, Kolczewska M. Nutritional habits and supplementation of elderly people with cardiovascular diseases from Warsaw. *Rocz Państ Zakł Hig*. 2008;59(4):467–472.
42. Duda G, Saran A. Vitamins and minerals pharmaceutical preparations for elderly people. *Gerontol Pol*. 2009;16(3):106–113.
43. Gębka D, Kędziora-Kornatowska K. Benefits of health training in elderly people. *Probl Hig Epidemiol*. 2012;93(2):256–259.
44. Budzińska K. Biology of skeletal muscle aging. *Gerontol Pol*. 2005;13(1):1–7.

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