

CHARACTERISTICS OF NUTRITION AMONG CENTENARIANS LIVING IN WARSAW

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The aim of the study was to assess energy, protein, fat and carbohydrates intake by centenarians living in Warsaw. The study was conducted between the years 2001 and 2004. An average dietary energy covered only approximately 81% of Polish RDA for elderly people over 60 years of age, and for 7 persons (1 male and 6 females) was lower than 66.7% of the RDA. Protein and fat intake fully covered nutritional recommendations for these nutrients with exception of 2 women for protein and 4 women for fat. The energy distribution figures were slightly higher for protein and fat, while for carbohydrates lower than recommended. It is very difficult to assess whether energy and nutrient intake by centenarians were adequate because of a lack of nutritional recommendations for such old people. It is necessary to determine the RDA values for a group of 85+ years old.

INTRODUCTION

Aging of the population results not only in increasing the total number of elderly people, but also in aging of the elderly population itself. According to demographic data, people over the age of 85 years are the fastest growing population in developed countries. A special group of the oldest old are centenarians – people who reached the extreme limit of human life-span. It seems that reaching the age of at least 100 years is possible when numerous factors including genetic factors, genome expression, physical and social environment, lifestyle, dietary habits and physical activity level, interact. One of the most important factors involved in human longevity is gender. Females have a longer life expectancy than males (about 6 years longer in developed countries) and lower mortality rates at all ages. As a result, the proportion of centenarians' male/female gender is between 1:2 and 1:7 [Passarino *et al.*, 2002; Stathakos *et al.*, 2005]. Healthy centenarians are considered to be “successfully ageing”, which is defined as: low risk of disease and disease-related disability, high mental and physical function, active engagement in life, adequate personal autonomy and positive feeling of wellbeing [ADA Reports, 2005; Stathakos *et al.*, 2005].

Nutrition is believed to be one of the major determinants of successful ageing. The SENECA study conducted in 1988-1999 in 12 European countries among elderly born between 1913 and 1918 indicated that energy intake declines with age making a nutritionally adequate diet more difficult to achieve [SENECA investigators, 1996]. It could be connected with changes in food preferences and perception with ageing [Elsner, 2002]. Some authors conclude that caloric restriction is a possible life-span modulator, but the evidence

of such a phenomenon was observed for such organisms as yeast, nematode, fish, rodents [Paoloni-Giacobino & Pichard, 2003]. However, the decrease of energy intake observed among elderly caused an increase of the risk of malnutrition in European elderly [SENECA investigators, 1996].

Most of the surveys on nutritional habits and nutrient intake conducted among older people refer to people aged 65-90 years, and very little is known about centenarians. The aim of this study was to assess energy and chosen nutrients intake of centenarians living in Warsaw.

MATERIALS AND METHODS

The study was conducted in Warsaw in the years 2001-2004 as a part of the project “Genetic and environmental factors of longevity of Polish Centenarians”. Recruitment of individuals for the study was conducted continuously throughout the entire period of the study and was based on information obtained from the office of PESEL (Powszechny Elektroniczny System Ewidencji Ludności, General Electronic Population Register System). In total, information about 307 centenarians was obtained. After verification, it turned out that 165 of the individuals are unknown or died a long time ago, 11 individuals died in the period between establishing contact and the interviewer's visit, 9 individuals changed the place of residence, and 22 refused to participate in the study. Finally, out of 100 individuals taking part in the study 33 agreed to fill in 3-day dietary records, among them 30 women and 3 men.

The demographic data health and lifestyle data were collected with the use of a questionnaire method. Functional status of the subjects was assessed using Activities of Daily

Living (ADL) Scale evaluating six basic activities: eating, dressing, bathing, transferring, toileting and continence. Mini Mental State Examination (MMSE) was used to assess cognitive functions and diagnose dementia.

The energy and nutrient intake was assessed with the use of a 3-day record method. Respondents were asked to report all meals, dishes, food products, beverages during three consecutive days, including one weekend day (Saturday or Sunday). Most of the questionnaires were filled in by centenarians' family members or caregivers. The portion sizes were estimated in household measures and then checked with the photographs of food products and dishes [Szponar *et al.*, 2000]. The energy and nutrient intake was calculated using Polish food composition tables [Kunachowicz *et al.*, 1998]. The calculated energy values and nutrient intakes were reduced by 10% due to processing losses and then were compared with the Polish RDA for the people above 60 years of age [Ziemlański, 2001]. For descriptive purposes, the medians, means and standard deviations of nutrient intake (SD) were calculated.

Measurements of body weight and height were done among individuals capable of standing in an erect position: 16 women and 3 men. Standing height was measured to the nearest 0.5 cm with the elderly standing in an erect position and wearing no shoes. Weight was recorded to the nearest 0.1 kg using electronic digital scales. Body mass index (BMI) was calculated as body weight in kg divided by the square of height in meters, $BMI = \text{kg}/\text{m}^2$.

Statistica v. 6.0 computer program was used for all statistical analyses.

RESULTS AND DISCUSSION

The main characteristics of the respondents are presented in Table 1. The average age of women and men was similar (about 101 years), but the oldest person taking part in the survey was a woman aged 107 years. The proportion of women to men was 10:1 and was higher than found in other countries [Passarino *et al.*, 2002; Stathakos *et al.*, 2005]. Most of the centenarians lived with family members, one woman – alone, and four – in a care institution for the elderly. According to ADL Scale, 55% of the studied centenarians were totally dependent on the help of caregivers in their basic daily activities, 27% needed some assistance and were defined as partially dependent, and only six subjects (18%) were classified as independent. Nine individuals (27.3%) were able to walk independently outside of their apartments. Results of MMSE indicated that 24 (72.7%) centenarians had dementia, including 10 with severe dementia, five (15.2%) centenarians showed signs of mild cognitive impairment (MCI), and four (12.1%) subjects had normal cognitive functions.

The state of oral health of centenarians was poor. Most of them had no own teeth (28 persons), three persons had 1-2 teeth, and one woman had 13 teeth. Only 25 persons declared denture use. Such a situation may be a cause of the lower chewing ability, increased difficulty in eating hard foods, decreased eating pleasure and, as a consequence, lower energy intake and involuntary weight loss [Position of the American Dietetic Association, 1996; Lamy *et al.*, 1999].

TABLE 1. Characteristics of Warsaw centenarians by gender.

	Men (n=3)	Women (n=30)
Age (years)		
Median	100.5	100.7
Mean (SD)	101.1 (1.2)	100.1 (1.4)
Range	100.3 – 102.5	100.1 – 107.3
Living with (n)		
Children	1	20
Husband/wife	2	0
Friends	0	2
Institution for elderly	0	4
Alone	0	1
Others	0	2
Cognitive status (n)		
Dementia	1	23
Mild cognitive impairment	2	3
Normal	0	4
Activities of Daily Living (ADL) (n)		
Independent	2	4
Partially dependent	0	9
Totally dependent	1	17
Ability to walk independently outside of the apartment (n)		
Yes	1	8
No	2	22
Number of teeth (n)		
0 teeth	2	26
1-2 teeth	1	2
13 teeth	0	1
Denture use (n)		
Yes	3	22
No	0	7
Weight at 100 years (kg)		
Median	61.2	46.3
Range	50.0- 62.7	35.0-55.0
Mean (SD)	63.4 (4.9)	46.1 (4.8)
Height at 100 years (cm)		
Median	155	143
Range	152-157	135-152
Mean (SD)	155 (0.9)	142 (0.5)
BMI		
Median	23.3	22.1
Range	20.3-27.1	17.9-27.4
Mean (SD)	23.7 (3.5)	22.6 (2.9)

Median weight was 61 kg for men and 46 kg for women, and median height was 155 and 143 cm, respectively. Median BMI was 23.3 kg/m² for men and 22.1 kg/m² for wom-

TABLE 2. Average nutrient intakes on three consecutive days in Warsaw centenarians.

Nutrient	Men		Women	
	Nutrient intake (Mean \pm SD)	% of the RDA	Nutrient intake (Mean \pm SD)	% of the RDA
Energy (MJ)	6.27 (1.35)	81.2 (15.1)	5.39 (1.13)	81.0 (18.8)
(kcal)	1497 (321.7)		1286.7 (268.6)	
Total protein (g)	57.6 (9.7)	116.4 (15.3)	50.8 (15.2)	131.3 (43.9)
Animal protein (g)	42.4 (5.6)		36.4 (14.4)	
Vegetable protein (g)	15.1 (5.4)		14.4 (3.7)	
Total fat (g)	58.0 (9.9)	113.5 (15.8)	47.9 (13.7)	108.3 (32.7)
Carbohydrates (g)	197.4 (60.4)	-	175.5 (48.1)	-
Fiber (g)	13.2 (3.4)	-	13.5 (5.8)	-
Energy distribution as % of energy from:				
Protein	15.5 (0.8)	-	15.9 (3.7)	-
Fat	35.6 (6.6)	-	33.6 (6.6)	-
Carbohydrate	48.6 (6.7)	-	50.3 (8.2)	-
Alcohol	0.3 (0.2)	-	0.3 (0.3)	-

en. BMI of the centenarians fell within the range of normal values for most of the individuals. BMI for two women was lower than 18.5 kg/m² and for six persons (4 women and 2 men) – was above 25 kg/m².

In comparison to the study conducted in 2000–2002 in Greece among elderly aged above 100 years, centenarians living in Warsaw were lighter and smaller. The average weight of Greek centenarians was 68 kg for men and 53 kg for women and height 170 cm and 157 cm, respectively. This difference may be associated with other method of data collection. In the Greek study, the weight and height data were obtained by a questionnaire method, while in our study, the individuals were measured and weighed. However, the BMI in a group of Greek centenarians was the same: 23.2 kg/m² for men and 22.1 kg/m² for women [Stathakos *et al.*, 2005]. The SENECA study conducted in 12 European countries among elderly aged 70–75 showed that average BMI varied within a wide range from 24.4 to 30.3 among men and 23.9 to 30.5 among women, with the lowest values in Norway (men) and France (women) and the highest in central Italy (men and women) and in Poland (women) [Volkert, 2005].

BMI is often used in surveys as a simple and inexpensive measurement of both, overnourishment and undernourishment. Very high and very low values of BMI are associated with a higher risk of mortality and impairment [Jensen *et al.*, 1995]. However, due to age-associated changes in body shape, size and composition, anthropometric measures are more difficult to evaluate and interpret in elderly people [WHO, 1995; Broczek *et al.*, 2005]. Many studies indicated that the U-shaped relation between BMI and mortality becomes less pronounced in the elderly [Seidell & Visscher, 2000; Henderson, 2005].

In the present study, the average energy intake was very low and covered only approximately 81% of Polish RDA for elderly people (Table 2), and for 7 individuals (1 male and 6 females) – was lower than 66.7% of the RDA. It is known that, as a consequence of body mass loss, a decrease of basal metabolic rate and a decline of physical activity level associ-

ated with aging, the energy requirement decreases. A gradual decline in energy intake with increasing age has been well documented [de Groot *et al.*, 2000]. A low energy intake may cause negative energy balance leading to a loss of weight. Energy intake by centenarians in our study was lower than total daily energy expenditure measured with DLW (double labeled water) method among elderly aged above 90 in the USA. The total energy expenditure in men was about 8.1 MJ/day (1935 kcal/day) and in women – 5.1 MJ/day (1356 kcal/day) [Report of a Joint FAO/WHO/UNU, 2004]. However, in our study the BMI of most of the individuals was in the normal range in spite of low energy intake.

In comparison to the results of the SENECA study, energy intake among Warsaw centenarians was lower. Median energy intake among SENECA participants ranged from 7.6 MJ/day (1820 kcal) in central France to 11.8 MJ/day (2820 kcal) in Poland in men and from 6.0 MJ/day (1435 kcal) in Portugal to 10.1 MJ/day (2416 kcal) in Poland in women [Volkert, 2005]. In the SENECA study, a modified dietary history method, including a 3-day estimated record and food-frequency list for dietary assessment was used.

Many studies indicated that malnutrition among the elderly is a common problem, causing an increase in mortality risk [Naber *et al.*, 1997; Flodin *et al.*, 2000]. Survey conducted in the Netherlands among 155 hospitalized elderly aged above 70 years revealed that 37% of them were malnourished [Naber *et al.*, 1997]. A low intake of some nutrients, especially B group vitamins, zinc and calcium is often associated with low dietary energy consumption. The survey conducted during ten years (1978–1988) in Japan, a country with the highest life expectancy in the world, showed that the elderly aged 65–85 years had a higher energy intake – 8.7 MJ (2068 kcal) in 1978 (start point of the survey) and about 7.5 MJ (1800 kcal) in 1988 (end point) for men, and about 6.5 MJ (1550 kcal) and 6.4 MJ (1520 kcal), respectively, for women [Shibata *et al.*, 1995]. Differences in the studied age groups and methodology make the reliable comparison of this study with ours impossible.

Centenarians examined in our study, on average, fully covered nutritional recommendations for protein and fat. However, in some cases the level of RDA realization was below 66.7% (2 women for protein and 4 women for fat). The distribution of energy giving nutrients for men and for women was: 15.5% and 15.9% from protein, 35.6% and 33.6% from fat, 48.6% and 50.3% from carbohydrate, respectively. The energy distribution figures were slightly higher than recommended for protein and fat, while lower for carbohydrates. However, there is still a controversy regarding minimal requirements of protein for the elderly. Some authors consider that the elderly have a greater need for protein than younger individuals because of the higher prevalence of infectious diseases. The suggested daily requirement is about 1 g protein/kg body weight (about 15% of energy intake) [Steen & Rothenberg, 1998]. The share of energy from protein and carbohydrates among centenarians in our study was greater than among 75-80-year-old European elderly examined in the SENECA study (14.4% and 44.2% in men and 15.4% and 44.1% in women, respectively) [de Groot *et al.*, 2000].

CONCLUSIONS

Energy intake of centenarians was low in comparison with RDA for the elderly, while protein and fat intake were adequate. However, the RDA values for the elderly were determined for people over 60 years old and it is not certain whether these values are applicable to centenarians. It is necessary to determine the RDA values for a group of 85+ years old.

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CHARAKTERYSTYKA SPOSOBU ŻYWIENIA STULATKÓW MIESZKAJĄCYCH W WARSZAWIE

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Celem badania była ocena wartości energetycznej i zawartości białka, tłuszczu i węglowodanów w diecie stulatków mieszkających w Warszawie. Badanie prowadzone było w latach 2001-2004. Średnio wartość energetyczna diety wynosiła 81% normy na poziomie bezpiecznym dla osób w wieku powyżej 60 lat, a dla 7 osób (1 mężczyzny i 6 kobiet) nie przekraczała 66,7%. Ilość białka i tłuszczu w diecie całkowicie pokrywała normy u większości osób, z wyjątkiem dwóch kobiet dla białka i czterech kobiet dla tłuszczu. Udział energii z białka i tłuszczu był nieco wyższy niż zalecany, natomiast z węglowodanów – niższy. Ze względu na to, że brak jest norm/zaleceń żywieniowych dla osób w tak sędziwym wieku, a wskaźniki stanu odżywienia oparte na pomiarze wzrostu nie są dokładne ze względu na pochylenie sylwetki, trudno jest ocenić, czy sposób żywienia stulatków był właściwy. Ze względu na rosnącą liczbę osób w wieku powyżej 85 lat na świecie, a także w Polsce, istnieje konieczność opracowania norm/zaleceń dla tej grupy wiekowej.