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ALL-CAUSE MORTALITY AMONG THE OLDER PEOPLE FROM OLSZTYN AND WARSAW REGIONS IN RELATION TO SOCIO-DEMOGRAPHIC AND LIFESTYLE FACTORS AND FOOD INTAKE – A SHORT REPORT

Małgorzata A. Słowińska[1], Joanna Kałuża[2], Anna Brzozowska[2], Wojciech Roszkowski[2], Lidia Wądołowska[1]

[1]Department of Human Nutrition, University of Warmia and Mazury, Olsztyn, Poland; [2]Department of Human Nutrition, Warsaw University of Life Sciences – SGGW, Warsaw, Poland

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In this work relations between food intake and all-cause mortality were analysed. Socio-demographic situation and lifestyle factors were also taken into account. The study included 653 people (306 men and 347 women) aged 75-80 years living in the Warsaw and Olsztyn regions. Lower all-cause mortality risk was associated with higher consumption of eggs, fruit and vegetables rich in β-carotene and fats such as olive, oils and margarines. Overweight as well as moderate and high physical activity decreased the risk of all-cause mortality by 39% and 47%, respectively. Age, being men, smoking and eating less than 3 meals per day increased the death risk by 12%, 36%, 99%, 42%, respectively.

INTRODUCTION

A significant increase of longevity and gradual ageing of population lead to manifestations of chronic health problems related to diet and lifestyle factors [Kesteloot *et al.,* 2002]. Prevention of diet-related diseases is a real challenge for contemporary science, both Polish and worldwide. New approach to better understanding of complex relationships between socio-demographic, lifestyle factors and diet and the occurrence of chronic diseases and mortality includes studies of food habits, instead of particular nutrient intakes studies [Bamia *et al.,* 2007; Haveman-Nies *et al.,* 2002; Kant *et al.,* 2004; Lallukka *et al.,* 2007]. This approach stimulates the concern of advanced statistical methods. Multidimensional techniques most often extend and complement the single-dimension methods. They enable the analysis of relationships between many variables and also reducing and simplifying the structure of data [Dodd *et al.,* 2006; Hill & Lewicki 2006; Stanisz, 2007].

The aim of this study was to investigate the multidimensional relations between all-cause mortality and socio-demographic, lifestyle factors and food intake in older people from two regions of Poland.

MATERIAL AND METHODS

Baseline examination was carried out in 1999 among 653 people (306 men and 347 women) aged 75-80 years in Warsaw and Olsztyn regions. The participants were drawn in the Census Bureau according to the Personal Identification Number (PESEL) by quota (men and women by 50%, people from a city, small town or village by 1/3 of the sample) and participation rate was 54.4%. Data about deaths from all-causes were collected till 31 December 2003 in Warsaw region and till 31 August 2004 in Olsztyn region.

The BMI (kg/m^2) was calculated on the basis of the body mass (kg) and height (cm) measurements. During a home visit trained interviewers gathered information on socio-demographic and health situation using a questionnaire. The questionnaire was developed by two research teams from Department of Human Nutrition SGGW in Warsaw and Department of Human Nutrition UWM in Olsztyn. They were together realizing a research project entitled "Conditionings of eating habits and nutritional state of older people from the Warsaw and Olsztyn regions" (No. 4 P05D 01713). During the questionnaire development they were taking into account previous experiences of the Warsaw team in the SENECA project. Before using the questionnaire in the studies it was checked in the pilot studies in both centers. Food consumption data were collected by the 3-day dietary intake record (in Warsaw region) and 24-h recall method (in Olsztyn region) [Charzewska *et al.,* 1997; Gibson 1990; Kunachowicz *et al.,* 1998; Szczygłowa *et al.,* 1991]. Intake of each group of food products was adjusted to 2500 kcal for men and 2000 kcal for women.

Cox's proportional hazards regression models were used to estimate the effect of socio-demographic and lifestyle factors and the intake of each food groups on the all-cause mortality hazard ratios (HRs) and 95% confidences intervals (95% CIs) in whole population under study and separately for men

Author's address for correspondence: prof. dr hab. Lidia Wądołowska, Department of Human Nutrition, University of Warmia and Mazury in Olsztyn, ul. Słoneczna 44a, 10-718 Olsztyn, Poland; tel.: (48 89) 523 43 53; e-mail: lidia.wadolowska@uwm.edu.pl

and women. Participants with consumption of each group of food products below the median were coded as a reference group. The regression models included not only food products intake (cereals products, milk and dairy products, eggs, meat and processed meat and fish, butter and cream, other fats (olive, oils and margarines), potatoes, fruit and vegetables rich in vitamin C, fruit and vegetables rich in β-carotene, other fruit and vegetables, legumes, and sugar and sweets), but also socio-demographic and lifestyle factors: age (continuous variable), place of living (city, town, village), research region (Warsaw, Olsztyn), living with somebody (yes, no), education (elementary, secondary/higher), physical activity (low, moderate/high), health status (bad/moderate, good/very good), chronic diseases (yes, no), smoking status (former, current, never), alcohol use (yes, no), economic situation (bad, average, good), number of meals per day (3 and more, less than 3), using any dietary supplements in the last year (no, yes), and the BMI (below 25 kg/m^2, 25-30 kg/m^2, over 30 kg/m^2). The statistical analysis was carried out using the Statistica PL v. 8.0 and SPSS PL v. 14.02 programmes.

RESULTS AND DISCUSSION

At the beginning of the study the mean age of men was 77.1±1.7 years, and that of women was 77.0±1.7 years. The study sample consisted of 46.9% men, over a half of respondents lived in the Olsztyn region (Table 1). Most participants evaluated their physical activity as moderate or high, while health status as bad or moderate. Almost 14% of the subjects were smokers and over a half (54%) never smoked. The respondents usually consumed less than 3 meals per day (72.4%), and the dietary supplements in the last 12 months were used by 30.5% of them. BMI values lower than 25 kg/m^2 were observed among 22.7% of the participants. More respondents had overweight (BMI in the range 25-30 kg/m^2) and obesity (BMI > 30 kg/m^2), 36.3% and 29.2%, respectively. Energy-adjusted food intake was shown in Table 2.

Over the study period, 161 people died (24.7% of the study population), including 91 men (29.7%) and 70 women (20.2%). Our results confirmed higher mortality of men than of the women, *i.e.* women had by 36% lower risk of all-cause mortality than the men did (HR: 0.64, 95% CI: 0.42-0.99, p=0.046), (Table 3). Despite a narrow range of age of respondents (75-80 years old) the 12% increase risk of all-cause mortality with age was noted (HR: 1.12, 95% CI: 1.02-1.23 p=0.015). Our results did not confirm recent reports on a significant role of place of living on health status [Kesteloot *et al.,* 2002]. However, there was a downward tendency of mortality risk among men who lived in villages as compared to those from cities (HR: 0.51, 95% CI: 0.25-1.02, p=0.057).

As expected, 55% significant lower risk of all-cause mortality in men (HR: 0.45, 95% CI: 0.27-0.74, p=0.002) and 44% significant lower risk in women (HR: 0.56, 95% CI: 0.33-0.96, p=0.036) were observed among subjects with higher physical activity as compared to those with lower (Table 3). Moreover, there was a statistical significant association of higher all-cause mortality risk among smokers than among the non-smokers (HR: 1.99, 95% CI: 1.21-3.26, p=0.006), however for the former smokers a similar relationship was not observed.

TABLE 1. Baseline characteristics of the study population (% of the respondents).

Variables	Total N=653	Men N=306	Women N=347
Place of living			
city	26.6	27.1	26.2
town	30.2	31.7	28.8
village	43.2	41.2	45.0
Region			
Warsaw	45.6	47.7	43.8
Olsztyn	54.4	52.3	56.2
Living with somebody	73.8	86.6	62.5
Secondary or higher education	24.7	29.7	20.2
Economic situation			
bad	22.8	18.6	26.5
average	59.0	60.5	57.6
good	18.2	20.9	15.9
Health status bad or moderate[a]	78.7	74.8	82.1
Chronic diseases	77.5	70.6	83.6
Physical activity moderate or high[a]	67.7	72.5	63.4
Smoking status			
never	54.4	26.1	79.3
former	32.2	51.0	15.6
current	13.5	22.9	5.2
Avoiding alcohol	19.1	20.3	18.2
< 3 meals a day	72.4	72.5	72.3
Dietary supplements use	30.5	24.2	36.0
BMI[b]			
<25 kg/m^2	22.7	23.9	21.6
25-30 kg/m^2	36.3	40.8	32.3
>30 kg/m^2	29.2	20.6	36.9

[a] – self-perceived; [b] – no data from some respondents.

According to nutritional recommendations, the older people should eat at least 3 meals per day. In our study, the people who ate less than 3 meals per day had by 42% higher risk of all-cause mortality than those who consumed more meals (HR: 1.42, 95% CI: 1.00-2.03, p=0.050). This association was stronger for men (HR: 1.69, 95% CI: 1.15-2.71, p=0.030). It confirms the nutritional recommendations for eating a higher number of meals per day but of smaller portions.

All-cause mortality was by 46% lower in women who did not apply any type of dietary supplements as compared to those who used them (HR: 0.54, 95% CI: 0.30-0.98, p=0.043). Similar relationships were observed by Omenn *et al.* [1996], Watkins *et al*. [2000], Bjelakovic *et al.* [2007] and Brzozowska *et al.* [2008]. The mechanisms of the adverse effects of vitamins supplementation are still not fully explained. Probably, the observed outcomes may result from a pro-oxidative role of antioxidants when their doses are too high.

Obesity is a well-known factor of many diet-related diseases. For the older people overweight, especially moderate,

TABLE 2. Energy-adjusted food intake among the older people aged 75-80 years from the Olsztyn and Warsaw regions.

Variables	Total N=653		Men N=306		Women N=347	
	Me	Q25–Q75	Me	Q25–Q75	Me	Q25–Q75
Energy (kcal)	1497	1164–1949	1756	1339–2251	1349	1059–1687
Energy (% of polish RDA)	79	62–102	85	64–107	76	58–95
Cereals (g)	239	174–307	279	213–344	205	151–268
Milk and dairy products (g)	448	0–899	476	0–931	425	0–868
Eggs (g)	0	0–23.4	0	0–27.1	0	0–21.6
Meat, processed meat and fish (g)	190	85–315	225	124–360	150	56–275
Butter and cream (g)	15.4	3.6–34.2	16.0	3.4–36.7	14.8	3.6–29.5
Other fats (g)	23.5	9.9–39.9	26.1	12.5–44.8	19.2	7.5–37.0
Potatoes (g)	211	0–402	207	0–441	217	0–360
Fruit and vegetables rich in vitamin C (g)	30.9	4.9–107	31.1	6.9–102	30.8	2.4–113
Fruit and vegetables rich in carotene (g)	14.7	0–47.6	20.8	0–51.8	9.0	0–43.5
Other fruit and vegetables (g)	169	37–327	174	42–350	160	34–320
Legumes (g)	0	0–0	0	0–0	0	0–0
Sugar and sweets (g)	54.7	26.5–94.1	54.7	28.0–99.6	55.5	25.2–90.5

Me – median, Q25-Q75 – quartile range.

seems to have a protecting effect [WHO, 1995], which is confirmed by our results. Older people with overweight (BMI 25-30 kg/m^2) had by 39% lower risk of all-cause mortality (HR: 0.61, 95% CI: 0.40-0.94, p=0.026) than the people with the BMI<25kg/m^2.

From 12 groups of products analysed, significant associations with all-cause mortality were observed only for 3 groups: eggs, other fats (olive, oils, margarines) and fruit and vegetables rich in β-carotene. It should be underlined that the energy value of participants diets was low. The median energy value amounted to 1756 kcal/d for men and 1349 kcal/d for women. A large group of the subjects did not eat sufficient amounts of products important for health. At least 25% of men and women did not eat milk and dairy products and fruit and vegetables rich in β-carotene every day. At least 50% of older people did not eat eggs and 75% legumes (Table 2). Respondents with a higher intake of eggs and men with higher intake of fats such as olive, oils and margarines and with a higher intake of fruit and vegetables rich in β-carotene were at lower risk of all-cause mortality when compared to the respondents with a lower intake of the mentioned foods, *i.e.* by 30%(HR: 0.70, 95% CI: 0.50-0.99, p=0.041), 39% (HR: 0.61, 95% CI: 0.38-0.98, p=0.043), and 39% (HR: 0.61, 95% CI: 0.38-0.98, p=0.039), respectively.

The relationships between diet quality and diet--related diseases risk and mortality were reported by other researchers. Kant *et al.* [2000] and Kaluza *et al.* [2007] showed that people having a diet rich in fruit, vegetables, whole grain cereals, low-fat milk and dairy products, and white meat (high value of the diet quality index – Recommended Food Score (RFS)) were at a lower risk of all-cause mortality (by 20-30%) than the people with a lower intake of those foods. Similarly, Mai *et al.* [2005] observed a reverse association between RFS index and all-cause mortality (HR=0.80) and cancer mortality risk (HR=0.74). These studies took into consideration not only nutritional habits, but also lifestyle factors such as: education, smoking, drinking alcohol, and prophylactic medical examinations. An interesting observation was made by Michels & Wolk [2002] who showed, likewise in the above mentioned studies, that longevity was positively influenced by habits consistent with nutritional recommendations. They noted that much more important was to increase the assortment of health-promoting food products in the diet and to consume them regularly than to decrease the amount of unhealthy products eaten daily [Horwath *et al.,* 1999].

The socio-demographic and lifestyle factors analysis enables making a full picture of relations between nutritional habits and health risks. Using the factor analysis, Park *et al.* [2005] separated three eating models: "fat and meat", "vegetables" and "fruit and milk". They noticed a strong relation between the separated eating models and age, sex, ethnic group and a weak relation connected to education. Positive correlations were noted between the BMI>30kg/m^2 and the "fat and meat" model, and also between smoking and the "fat and meat" model and a reverse correlation with the "vegetables" and "fruit and milk" models. These and ample other studies confirm a hypothesis that nutrition habits are influenced by socio-cultural, demographic and lifestyle factors [Haveman--Nies *et al.,* 2002; Lallukka *et al.,* 2007]. Our results confirm relationships between nutrition, health, lifestyle and socio--demographic factors of older people.

CONCLUSIONS

1. Based on the population of 75-80-year-olds from Warsaw and Olsztyn regions we determined that not only socio-demographic and lifestyle factors were associated with all-cause mortality, but also the intake of some food products.

TABLE 3. Multivariate-adjusted hazard ratios (HRs)[a] and the 95% confidence intervals (CIs)[a] for the all-cause mortality in relation to socio-demographic, lifestyle factors and food intake.

Variables	Total			Men			Women		
	HR	95% CI	*P*-value	HR	95% CI	*P*-value	HR	95% CI	*P*-value
Sex									
men (ref)	1.00								
women	0.64	0.42–0.99	0.046						
Age	1.12	1.02–1.23	0.015	1.11	0.97–1.26	0.137	1.13	0.98–1.31	0.098
Physical activity									
low (ref)	1.00			1.00			1.00		
moderate and high	0.53	0.37–0.76	0.001	0.45	0.27–0.74	0.002	0.56	0.33–0.96	0.036
Smoking status									
never (ref)	1.00			1.00			1.00		
former	1.07	0.69–1.65	0.766	0.85	0.47–1.52	0.581	1.41	0.70–2.82	0.336
current	1.99	1.21–3.26	0.006	1.50	0.77–2.92	0.233	2.63	1.07–6.43	0.034
Number of meals per day									
≥ 3 (ref)	1.00			1.00			1.00		
< 3	1.42	1.00–2.03	0.050	1.69	1.15–2.71	0.030	1.20	0.66–2.17	0.544
Dietary supplement use									
yes (ref)	1.00		0.111	1.00			1.00		0.043
no	0.73	0.50–1.08		0.91	0.52–1.59	0.728	0.54	0.30–0.98	
BMI									
<25 kg/m^2 (ref)	1.00			1.00			1.00		
25-30 kg/m^2	0.61	0.40–0.94	0.026	0.58	0.32–1.05	0.070	0.73	0.36–1.51	0.401
>30 kg/m^2	0.84	0.54–1.31	0.444	1.10	0.57–2.12	0.773	0.70	0.35–1.39	0.305
Eggs intake									
< median (ref)	1.00			1.00			1.00		
≥ median	0.70	0.50–0.99	0.041	0.64	0.40–1.03	0.063	0.80	0.47–1.38	0.428
Olive, oils and margarines intake									
< median (ref)	1.00			1.00			1.00		
≥ median	0.75	0.54–1.06	0.104	0.61	0.38–0.98	0.043	0.98	0.58–1.67	0.950
Fruit and vegetables rich in β-carotene intake									
< median (ref)	1.00			1.00			1.00		
≥ median	0.85	0.60–1.19	0.337	0.61	0.38–0.98	0.039	1.28	0.74–2.22	0.386

(ref) – reference group; [a] – in the table only statistically significant variables of the Cox's proportional hazards regression models were presented; Multivariate HRs and 95%CIs were also adjusted for region, place of living, living with somebody, education, economic status, health status, chronic diseases, alcohol use, cereals products intake, milk and milk products intake, meat and fish intake, butter and cream intake, potatoes intake, fruit and vegetables rich in vitamin C, other fruit and vegetables, legumes intake, and sugar and sweets intake.

2. The study demonstrated that all-cause mortality was significantly lower among people who ate more fruit and vegetables rich in β-carotene, fat such as olive, oils and margarines and among those with a higher intake of eggs as compared to the respondents with the lower intake of those products.

3. Respondents' all-cause mortality was positively correlated with overweight and high physical activity, while inverse associations were observed with age, among men, smokers and eating less than three meals a day.

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