Age-related maculopathy and consumption of fresh vegetables and fruits in urban elderly

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Key words: *age-related maculopathy, vegetables and fruit.*

Summary. *The purpose of this study was to investigate the rate of age-related maculopathy among elderly males and females in relation to frequency of consumption of fresh vegetables and fruit. During ophthalmological investigation of Kaunas city inhabitants aged 65–74 years (240 males and 206 females) age-related maculopathy (early and late) was determined for 22.1% of males and 20.4% of females. Frequency of usage of fresh (uncooked) vegetables and fruits in winter-spring and in summer-autumn seasons by investigated persons was determined, using food frequency questionnaire. In this work an association between age-related maculopathy and usage of vegetables and fruits has been investigated in 170 males and 181 females aged 65–74 years without diabetes who never smoked; age-related maculopathy was found for 18.8% of males and 17.7% of females. Obtained data have demonstrated an inverse association between consumption of vegetables during winter-spring season and age-related maculopathy: usage of vegetables two times a week or more versus usage less than two times a week decreases prevalence of age-related maculopathy 2.0 times among males (OR=0.42; 95% CI 0.18–1.0; p=0.05) and 2.2 times among females (OR=0.37; 95% CI 0.15–0.9; p=0.02). Data have demonstrated a tendency that increasing consumption of fresh vegetables and fruits during both seasons can reduce risk of age-related maculopathy among females. In conclusion, characteristic for Lithuanian urban elderly rare usage of fresh vegetables during winter-spring season can increase risk of age-related maculopathy independently from other risk factors.*

Introduction

Age-related maculopathy (ARM) is the leading cause of blindness registration in the developed world. According to data of investigation of Kaunas city elderly cohort (335 males and 249 females, aged 65–80 years) ARM was determined for 27.5% of males and 18.9% of females (1).

Pathogenesis of ARM remains poorly understood. The role of oxidative stress in pathogenesis of ARM is biologically plausible, but remains unproven (2). The concepts of the pathogenesis of ARM include cumulative light damage by oxidative processes in the macular photoreceptors as environmental co-factor for the development of ARM (2–4).

A summary of the epidemiologic evidence suggests that it is prudent to consume diets high in essential dietary antioxidants – vitamins C, E and carotenoids, particularly the xanthophylls, as insurance against the development of ARM (5, 6). A new role for the polar carotenoids lutein and zeaxanthin was identified, when those carotenoids were found to constitute the macular pigment (the yellow spot at the center of the human retina) (7). Fruits and vegetables are the main source of carotenoids and vitamin C especially for people who do not use any vitamin supplement: carrots are rich in beta-carotene, dark leafy vegetables (broccoli and spinach) are main source of lutein and zeaxanthin, vitamin C is found in all fruit and vegetables, mainly in citrus fruit and black currants. An analysis of cross-sectional data for about 3000 participants in the National Health and Nutrition Examination Survey in the USA indicated that persons who reported high intake of fruit and vegetables rich in carotenoids had about 40% reduced risk of ARM (8).

The median intake of vegetables and fruit in populations of Baltic States is considerably below the recommended level (9). Rare consumption of fresh fruit and vegetables is characteristic for Lithuanian elderly during winter-spring season (10). Therefore a high probability can exist that this undesirable nutrition habit can be related with increased risk of age-related diseases.

The purpose of this study was to investigate a rate of ARM in Kaunas city elderly cohort in relation to the consumption of fresh vegetables and fruits.

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Material and methods

Material of this study – Kaunas city random sample of elderly inhabitants aged 65–74 years. They were participants of epidemiological study "The main changes of the epidemiological situation of the cardiovascular diseases and their risk factors prevalent among the elderly and influence upon the survival" performed in 1995–1997 by scientific researchers of the Institute of Cardiology of Kaunas University of Medicine. In this study 539 males and 328 females aged 65–80 years were investigated for health parameters and lifestyle habits (11). Out of participants of the study 240 males and 206 females aged 65–74 years were investigated for eye diseases (cataract, glaucoma, ARM) in the Laboratory of Ophthalmology of the Institute for Biomedical Research of Kaunas University of Medicine using direct ophthalmoscopy method and evaluating fundus pathology.

Frequency of usage of fresh (uncooked) vegetables and fruits by elderly during past years in winter-spring and in summer-autumn seasons was determined, using food frequency questionnaire with a six-category frequency scale, ranging from less than 1–2 times per month or never to daily usage. For analysis of association between ARM and usage of vegetables and fruits, elderly were distributed into groups A and B with different frequency of usage of those products in relation to season.

Age of persons in comparing groups was presented as mean ±SD. A Student test (t) was used for comparing the means. The difference of rate of ARM in comparing groups of persons with different status for diabetes mellitus and smoking and the risk of ARM among people with different usage of fresh vegetables and fruit was computed as odds ratio (OR) and 95% confidence interval (CI). P less than 0.05 was considered significant.

Results

ARM (early and late) was found for 22.1% of males and 20.4% of females aged 65–74 years (Table 1).

There are data about the evidence for the role of diabetes mellitus and smoking in etiology of ARM (3). In this work an association of rate of ARM among elderly with diabetes and without and among persons with different habits of smoking was compared. Thirty five males and 16 females suffered from diabetes mellitus; 37 males and 2 females smoked regularly, 89 males and no one female were past smokers, 114 males and 202 females never smoked.

Table 1. **Rate of age-related maculopathy (early and late) among males and females aged 65–74 years**

Gender	Number of investigated persons	Number of persons with ARM	Rate of ARM (percent)
Males	240	53	22.1
Females	206	42	20.4

Risk of ARM was compared among males and females with diabetes and without diabetes and also among males and females with different habits smoking (Table 2). Mean age in comparing groups did not differ.

The rate of ARM was significantly higher among persons with diabetes mellitus than among persons without diabetes: among males – 1.9 times higher, among females – 2.8 times higher ($p<0.05$). The rate of ARM among male current smokers was not significantly higher than among males who never smoked; the rate of ARM among past smokers was lower than among current smokers ($p>0.05$); the rate of ARM among female current smokers was 2.5 times higher than among females who never smoked but the number of female current smokers was too small for the evaluation of obtained data.

In this work an association between ARM and frequency of usage of vegetables and fruits was investigated among never smoked elderly without diabetes (170 males and 181 females). ARM was obtained for 32 males (18.8%) and 32 females (17.7%).

Distribution of elderly according to frequency of usage of fresh (uncooked) vegetables and fruits during summer-autumn and winter -spring season is shown in Table 3.

Frequency of usage of vegetables and fruits by elderly especially by males during winter-spring season was significantly lower than usage of those products during summer-autumn season. More than half of investigated elderly ate vegetables and fruits daily during summer-autumn season; during winter-spring season more than half of elderly ate fresh vegetables and fruits only 2–3 times per week or less (Table 3).

Prevalence of ARM was compared in groups of males and females (A and B) with different frequency of usage of fresh vegetables and fruits during summer-autumn season (A group – daily and B group – non-daily usage) and winter-spring season (usage of vegetables: A group – less than 2 times in a week, B group – 2 or more times in a week; usage of fruit: A group – less than 4 times in a week; B group – 4 or more times in a week) (Table 4). Mean age in comparing groups did not differ.

Table 2. **Influence of diabetes mellitus and smoking on prevalence of ARM among elderly aged 65–74 years**

Characteristic	Number of cases	Age, years X±SD	ARM (percent)	OR (95% CI)
Males				
Diabetes mellitus	35	70.5±1.6	37.1	2.44 (1.06–5.59); p=0.04
No diabetes mellitus	205	70.4±2.1	9.5	1
Current smoking	37	70.7±2.2	27.0	1.09 (0.43–2.69); p=1.00
Past smoking	89	70.1±2.0	15.7	0.55 (0.25–1.17); p=0.13
Never smoking	114	70.6±2.0	25.4	1
Females				
Diabetes mellitus	16	68.7±2.3	50.0	4.69 (1.47–15.1); p=0.01
No diabetes mellitus	182	68.9±2.7	17.6	1
Current smoking	2	66.5±2.1	50.0	4.10 (0.11–153.6); p=0.86
Past smoking	0	–	–	–
Never smoking	204	69.0±2.7	20.0	1

X±SD – mean ± Standard deviation; OR – odds ratio; CI – confidence interval.

Table 3. **Distribution of elderly aged 65–74 years (170 males and 181 females without diabetes mellitus who never smoked) according to frequency of consumption of fresh vegetables and fruits during summer-autumn and winter-spring season**

Frequency of consumption of fresh vegetables and fruits	Percent of males				Percent of females			
	Fresh vegetables		Fresh fruits		Fresh vegetables		Fresh fruits	
	summer-autumn	winter-spring	summer-autumn	winter-spring	summer-autumn	winter-spring	summer-autumn	winter-spring
Less 1–2/month	0.6	5.3	0.6	12.4	0	3.9	1.2	5.5
1/week	0.6	22.9	4.1	29.4	2.2	19.9	8.8	17.1
2–3/week	6.5	41.2	9.4	20.6	9.4	31.5	16.6	21.0
4–6/week	12.9	12.9	20.6	10.0	19.3	21.5	19.3	20.5
Daily	79.4	17.7	65.3	27.6	69.1	23.2	54.1	35.9

On comparison of ARM prevalence among persons with relatively frequent usage of fresh vegetables and fruits and among persons with relatively rare usage of those products, obtained data have demonstrated a tendency that increasing consumption of fresh vegetables and fruits during winter-spring season reduced a prevalence of ARM among male and female elderly; during summer-autumn season increasing consumption of fresh vegetables and fruit reduces a prevalence of ARM among female but not among male elderly. Among males and females who used fresh vegetables during winter-spring season two or more times in a week rate of ARM was about two times lower in relation to persons who used vegetables during this season less than 2 times per week ($p \leq 0.05$).

Investigated elderly were interviewed about usage of carrots as the main source of beta-carotene in our population so it was a possibility to examine an association between ARM and frequency of the usage of carrots. Between females who used carrots 2 times per week or more and females who used carrots less than 2 times per week odds ratio of ARM was 0.28 (95% CI 0.08–0.9) (p=0.03).

Discussion

The investigation of age-related eye disorder due to macular anatomic and functional changes, which contributed to non-treatable blindness, is being still in

Table 4. **Association between usage of vegetables and fruits and age-related maculopathy in elderly males and females aged 65–74 years (never smokers without diabetes mellitus)**

Frequency of comsumption of fresh vegetables and fruits	Males				Females			
	Total n	Age, years X±SD	ARM n %	OR (95% CI)	Total n	Age, years X±SD	ARM n %	OR (95% CI)
Fresh vegetables summer-autumn								
A. Less than daily	35	69.8±2.0	5 14.3%	1	56	69.0±3.0	14 25.0%	1
B. Daily	135	70.5±2.1	27 20.0%	1.5 (0.49–4.87) p=0.59	125	68.9±2.5	18 14.4%	0.51 (0.22–1.19) p=0.13
Fresh vegetables winter-spring								
A. <2/week	48	70.0±2.2	14 29.2	1	43	68.9±2.8	13 30.2%	1
B. ≥2/week	122	70.5±2.1	18 14.8%	**0.42 (0.18–1.0) p=0.05**	138	68.9±2.6	19 13.8%	**0.37 (0.15–0.9) p=0.02**
Fresh fruits summer-autumn								
A. Less than daily	59	70.3±1.9	11 18.6%	1	83	69.1±2.7	20 24.1%	1
B. Daily	111	70.4±2.2	21 18.9%	1.0 (0.42–2.5) p=1.00	98	68.8±2.6	12 12.2%	0.44 (0.19–1.03) p=0.06
Fresh fruits winter-spring								
A. <4/week	106	70.3±2.2	22 20.8%	1	79	68.8±2.7	19 24.1%	1
B. ≥4/week	64	70.5±2.1	10 15.6%	0.71 (0.29–1.7) p=0.53	102	69.0±2.7	13 12.7%	0.46 (0.2–1.1) p=0.07

X±SD – mean ± standard deviation; OR – odds ratio; CI – confidence interval.

the initial stage in Lithuanian population. Determination of visual impairment in our population is necessary for finding protective measures for delaying of the onset and development of ARM. Early identification of modificible risk factors of this pathology would help to minimize the risk of blindness among elderly people (11, 13). During ophthalmological investigation of elderly aged 65–74 years (inhabitants of Kaunas city) ARM (early and late) was found for 22.1% of males and 20.4% of females. In this work among elderly with diabetes mellitus prevalence of ARM was significantly higher than among persons without diabetes. The purpose of this study was to investigate a rate of ARM in Kaunas city elderly cohort in relation to the consumption of fresh vegetables and fruits.

Both ecological and epidemiologic evidences suggest that a high consumption of fruit and vegetables is associated with a reduction in the risk of cancer, coronary heart disease and age-related eye diseases, especially in the risk of ARM (8, 14). According to total vegetables and fruits availability of populations Lithuania was in a very low position in 1994 in relation to 45 countries (15). Though investigations of Lithuanian population performed since 1996 demonstrated a tendency that Lithuanians use fresh vegetables more than before (16) but there is still a very high percentage of people who use fresh vegetables rarely: according to data obtained in 2001–2002 years during interview of random sample of 626 males and 777 females from MONICA-4 cohort aged 35–64 years more than 90% of males and females used fresh vegetables less than daily during winter-spring season (unpublished data). During winter-spring season the main fruits for Lithuanian elderly are apples, but they are not rich in carotenoids, so the main source of carotenoids for our population are vegetables.

In this study an association between ARM and usage of fresh vegetables and fruits was investigated among elderly aged 65–74 years who never smoked

and were not diagnosed for diabetes mellitus (170 males and 181 females). ARM was obtained for 18.8% of males and 17.7% of females. Data obtained in this work have demonstrated that among elderly males and females rare usage of fresh vegetables during winter-spring season (it is characteristic for Lithuanian urban elderly) can increase the risk of ARM independently from other risk factors of this pathology (diabetes mellitus and smoking): usage of vegetables two times a week or more versus usage less than two times a week decreases prevalence of ARM 2.0 times among males and 2.2 times among females (mean of age in comparing groups did not differ). Data have demonstrated a tendency that increasing consumption of fresh vegetables and fruits during both seasons can reduce a prevalence of ARM among females. This work can serve for confirmation of data of many authors about a positive effect of fresh vegetables and fruit for prevention of ARM through inhibition of oxidative stress. Our published data have shown that frequent usage of fresh vegetables and fruit may be linked to the decrease parallel development of two age-related eye pathologies associated with oxidative stress – cataract and ARM in Lithuanian elderly (17). In conclusion characteristic for Lithuanian urban elderly rare usage of fresh vegetables during winter-spring season can increase risk of ARM independently from other risk factors.

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Su amžiumi susijusi makulopatija bei šviežių daržovių ir vaisių vartojimas (pagyvenusių žmonių sveikatos studija)

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Raktažodžiai: su amžiumi susijusi makulopatija, daržovės ir vaisiai.

Santrauka. *Darbo tikslas.* Nustatyti su amžiumi susijusios makulopatijos dažnį tarp pagyvenusių vyrų ir moterų, skirtingu dažniu vartojusių šviežias daržoves ir vaisius. Oftalmologiškai ištyrus 65–74 metų (Kauno) 240 vyrų ir 206 moteris, su amžiumi susijusi makulopatija (ankstyvoji ir vėlyvoji) nustatyta 22,1 proc. vyrų ir 20,4 proc. moterų. Šviežių (nevirtų, nekonservuotų) daržovių ir vaisių vartojimas žiemos ir pavasario bei vasaros ir rudens mėnesiais įvertintas naudojant dažninę mitybos įpročių apklausos anketą. Ryšys tarp su amžiumi susijusios makulopatijos ir daržovių bei vaisių vartojimo ištirtas 170 vyrų ir 181 moteriai, kurie nesirgo cukriniu diabetu ir niekada nerūkė; su amžiumi susijusi makulopatija nustatyta 18,8 proc. vyrų ir 17,7 proc. moterų. Nustatytas atvirkštinis ryšys tarp daržovių vartojimo dažnio žiemos ir pavasario mėnesiais bei su amžiumi susijusios makulopatijos: daržovių vartojimas du kartus per savaitę arba dažniau palyginti su vartojimu mažiau kaip du kartus per savaitę makulopatijos, susijusios su amžiumi, riziką vyrams sumažino du kartus (OR=0,42; 95% CI 0,18–1,0; p=0,05), moterims – 2,2 karto (OR=0,37; 95% CI 0,15–0,9; p=0,02). Nustatyta tendencija, kad didesnis daržovių ir vaisių vartojimas abu sezonus moterims gali sumažinti su amžiumi susijusios makulopatijos riziką. *Išvada:* retas daržovių vartojimas žiemos ir pavasario mėnesiais, būdingas Lietuvos miestuose gyvenantiems vyresnio amžiaus žmonėms, gali padidinti su amžiumi susijusios makulopatijos riziką nepriklausomai nuo kitų rizikos veiksnių.

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