SHORT COMMUNICATION

Antioxidant vitamins levels – nutrition and smoking

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Abstract

The plasma levels of antioxidant vitamins express the risk rate of free radical disease. Limit values (risk threshold) were determined in long-term epidemiological and clinical studies. Over-threshold (optimal) values mean an effective protection and a reduced risk of the disease. Values below threshold (deficient) from antioxidant point of view increase this risk. Optimal levels of each antioxidant at different age are required for the maintenance of optimal health. Vitamin C and ß-carotene are derived from fruits and vegetables. The decrease of antioxidant vitamins in smokers caused by free radical presence in tobacco smoke is known. The levels of vitamins C, E and ß-carotene were estimated in two ethnic groups of young adult population of Western Slovakia (n=122 – Gipsy minority; n=137 – majority population). Vitamins levels are correlated to nutrition, smoking and education. Vitamin E levels are similar in both groups; frequency of values with optimal antioxidant effect is equal (21 %). In Gipsy group are significantly reduced the vitamin C and ß-carotene levels with only 28 % over-threshold values of vitamin C and 7 % over-threshold values of ß-carotene vs 46 % and 25 % in the majority group. The reduced levels of antioxidant vitamins in Gipsy minority group are a consequence of inadequate nutrition (lower and infrequent consumption of fruit and vegetables, low knowledge about optimal nutrition affected by low education – 85 % of Gipsy subjects have elementary and apprentice education vs 27 % of majority subjects) and smoking (smokers – 55 % of Gipsy persons vs 25 % in majority group subjects; 42 and 50 % reduced vitamin levels in smokers). (Tab. 1, Fig. 1, Ref. 17.)
Key words: antioxidant, vitamin, nutrition, smoking.

Intensive background, clinical and epidemiological research in past 2–3 decade underlines the protective effect of antioxidant nutrients as are vitamin C, vitamin E, ß-carotene, selenium and zinc in prevention of risk of so-called free radical diseases mainly cancer and cardiovascular diseases (Ames, 1987; Sies et al, 1992). Continuation of research brought arguments on inverse relation between intake of antioxidant vitamins and trace elements or their serum levels to risk of diseases development (Block et al, 1992; Gey, 1987; Stampfer and Rimm, 1995). There were so-called threshold values of risk for antioxidant vitamins assigned, the molar ratio vitamin E/cholesterol, and for selenium (Gey, 1995). Levels over threshold represent a protective antioxidant effect and a reduction of risk of disease development (optimal values). The values of antioxidants 20–50 % below the threshold (deficient values) double increase the risk.

In this work we confront levels of essential antioxidants with nutrition regime and smoking.

Material and methods

A group of volunteers consisted of 137 subjectively healthy subjects of Slovak young population in majority (age 18–35 years; body mass index BMI=23.6±0.3 kg/m^2) and 122 subjectively healthy young Gipsy probands (BMI=26.2±0.5 kg/m^2) from two regions of Slovakia (Dunajska Streda, Skalica).

The blood samples were obtained from fasting probands by a standard method. EDTA was used as an anticoagulant. The levels of vitamins C, E and ß-carotene in plasma were measured by HPLC methods (Cerhata et al, 1994; Lee et al, 1992). Beside anthropometric characteristic and biochemical measurements the

Tab. 1. Antioxidant vitamins levels, smoking and nutrition data.

	Majority group	Gipsy group	
n (m+w)	137	122	
smokers	25%	55 %	
vitamin C (μmol/l)	49.1±2.4	37.0±2.0	p=0.0002
>50	46%	28%	
vitamin E (μmol/l)	24.9±0.5	25.5±0.6	
>30	21%	21%	
vitamin C/vitamin E	2.03±0.08	1.48±0.09	p=0.0001
>1.0	55%	33%	
ß-carotene (μmol/l)	0.333±0.035	0.188±0.015	p=0.0004
>0.4	25%	7%	
consumption frequency vegetables			
daily or every other day	21%	7%	
1–2 times weekly	55%	44%	
1–2 times monthly	10%	14%	
never or rarely	14%	35%	
fruit			
daily or every other day	51%	28%	
1–2 times weekly	44%	41%	
1–2 times monthly	4%	25%	
never or rarely	1%	6%	

Results are expressed as mean±SEM.

life style of probands was estimated by frequency questionnaires. The survey was carried out in spring. Chi-square test was used for final statistical evaluation.

Results and discussion

Oxidatively modified LDLs represent the key step in the pathogenesis of atherosclerosis (Esterbauer et al, 1993). Dominant role in protection against peroxidation of lipids have vitamins E and C (Gey, 1987). Beside the over-threshold values of these vitamins the optimal ratio of vitamin C/vitamin E must be more than one; at this condition is the activity of vitamins against free-radicals most effective,as is also the regeneration of tocopheryl-radical by vitamin C (Gey, 1998). The mean level of vitamin C is significantly reduced in Gipsy population (Tab. 1) with optimal values in 28 % of Gipsy and 46 % of the majority group probands. The average value of vitamin E as well as the finding of values over threshold are equal in both groups (Tab. 1). The optimal value of vitamin C/vitamin E ratio was found only in 33 % of Gipsy probands vs 55 % of majority group subjects (Tab. 1). The finding of protective values of vitamin C and vitamin E in majority population is lower in comparison with population e.g. in Bratislava, where for vitamin C it is 68 % of the population and for vitamin E 46 % (Krajcovicova-Kudlackova et al, 2000). The lower incidence of protective values of antioxidants in two provincial regions can be explained by inaveraged lower education level of rural subjects and thus by possible lower knowledge about optimal nutrition as well as by possible worse economical state of rural subjects in comparison to capital city. The equal values of vitamin E in majority and minority group

subjects express a higher daily consumption of animal food in Gipsy subjects, and on the other hand, a higher frequency of consumption of dark cereal products and soya products in majority group group (Krajcovicova-Kudlackova et al, 2002; Valachovicova et al, 2002). Values of ß-carotene are significantly lower in the Gipsy group (Tab. 1). The finding of protective over-threshold values is detected only in 7 % individual values vs 25 % in majority population group.

In other part of this work we concentrated on vitamin C and ß-carotene that have the significantly different levels in mentioned ethnic groups. We evaluated nutrition, smoking and education effects. These vitamins are derived from fruit and vegetables. Table 1 shows the higher daily or every other day and 1–2 times weekly consumption of mentioned food commodities in majority group and on the other hand the higher 1–2 times monthly and never or rarely consumption in Gipsy group. An insufficient consumption of fruit and vegetables in Gipsy subjects explicates the lower levels of vitamins. In healthy subjects with normal nutrient absorption, direct relation between vitamin intake and vitamin level in plasma was recorded (Krajcovicova-Kudlackova et al, 2001). Fig.1 illustrates positive relation between vitamin C levels and increasing consumption of fruit in Gipsy subjects. The decrease of vitamin C levels is significant in case of very infrequent consumption. Similar correlation was found also for ß-carotene and fruit consumption as well as vegetable consumption.

Presence of free radicals in tobacco smoke is known. Compounds specific to tobacco smoke, such as carbon monoxide or aromatic hydrocarbons, probably play a prominent role (Russell et al, 1985). The levels of antioxidant vitamins are reduced in smokers (Stegmayr et al, 1993). The serum levels of ascorbate
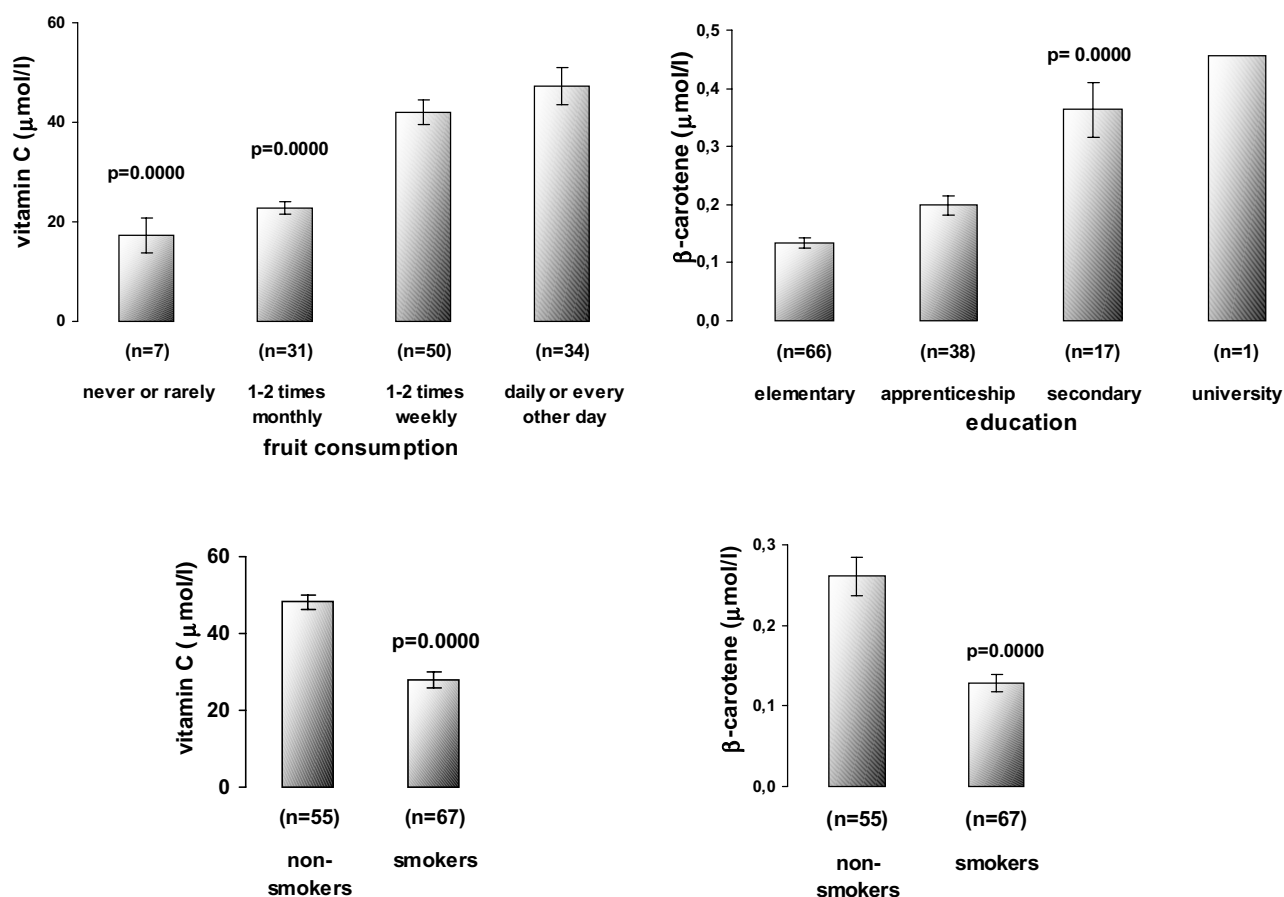
Fig. 1. Vitamin C and ß-carotene levels in relation to fruit consumption, smoking and education (p compared to daily or every other day fruit consumption, to non-smokers, to elementary education).

and ß-carotene have been shown to be decreased approximately by 30 % (Pelletier, 1977; Stegmayr et al, 1993). In Gipsy minority group is the occurrence of smokers higher what could apart from nutrition play a role in lower levels of vitamin C and ß-carotene and higher incidence of deficient (below threshold) values. The decrease of vitamins in smoking Gipsy probands is 42 % for vitamin C and 50 % for ß-carotene (Fig. 1). Smokers have reduced body stores of ascorbate and their fractional turn-over rate of ascorbate is increased, probably because of high expenditure, therefore recent studies show that smokers should have a daily intake of as much as 200 mg or more to reach the same plasma levels of ascorbate as non-smokers (Stegmayr et al, 1993).

Direct relation of levels of vitamin C and ß-carotene to the education of Gipsy subjects (Fig. 1) is the interesting but anticipated result. In evaluated ethnic groups, elementary education was recorded in 54 % of Gipsy subjects vs 3 % of majority group subjects, apprenticeship in 31 % of minority group subjects vs 24 % of majority group persons, secondary education was indicated in questionnaires by 14 % of Gipsy subjects vs 53 % of majority group subjects and University education had one minority person vs 20 % of majority group persons. Expressed positive relation of ß-carotene levels to increasing education shows

2.4 times higher vitamin level in secondary education if it is compared with elementary education as well as 1.8 times higher vitamin level in comparison to apprentice education. Higher incidence of deficient (below threshold) levels of vitamin C and ß-carotene in Gipsy population can be also connected with below education and thus probably with relatively lower knowledge about optimal nutrition.

In conclusion, lower levels of vitamin C and ß-carotene in group of young Gipsy subjects are connected with incorrect nutrition and smoking. The development of free radical diseases is a long-term process. The optimal level of each antioxidant in each age is required for the maintenance of optimal health (Gey, 1993, 1998). The Gipsy minority is a risk group from the view of cardiovascular disease development and generally of free radical disease development (Krajcovicova-Kudlackova et al, 2002; Valachovicova et al, 2002).

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