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ABSTRACTS

Carotenoids Reduce Risk of Heart Problems

Serum carotenoids and coronary heart disease:

The lipid research clinic's coronary primary prevention trial and follow-up study

Morris D.L.; Kritchevsky S.B.; Davis C.E.

JAMA, 1994, 272/18 (1439-1441)

Objective. To examine the relationship between total serum carotenoid levels and the risk of subsequent coronary heart disease (CHD) events. Design. New analysis of a cohort from the Lipid Research Clinic's Coronary Primary Prevention Trial and Follow-up Study (LRC-CPPT). The LRC-CPPT was a multi-center placebo-controlled trial of cholestyramine resin and CHD with a follow-up period of 13 years. Participants. The placebo group of the LRC-CPPT, which consisted of 1,899 men aged 40 to 59 years with type II-a hyperlipidemia and without known preexisting CHD, cancer, or other major illnesses. Main Outcome Measures. Nonfatal myocardial infarctions and deaths attributable to CHD ascertained from hospital records, autopsy reports and death certificates and reviewed by a panel of cardiologists.

Results. After adjustment for known CHD risk factors including smoking, serum carotenoids were inversely related to CHD events. Men in the highest quartile of serum carotenoids had an adjusted relative risk (RR) of 0.64 (95% confidence interval (CI), 0.44 to 0.92) compared with the lowest quartile. For men who never smoked, this RR was 0.28 (95% CI, 0.11 to 0.73). Conclusions. The LRC-CPPT participants with higher serum carotenoid levels had a decreased risk of incident CHD. This finding was stronger among men who never smoked.

Antioxidant Defense Systems

Antioxidant defense systems: The role of carotenoids, tocopherols, and thiols

Di Mascio P.; Murphy M.E.; Sies H.

Am. J. Clin. Nutr., 1991, 53/1 SUPPL. (194S-200S)

Reactive oxygen species occur in tissues and can damage DNA, proteins, carbohydrates and lipids. These potentially deleterious reactions are controlled by a system of enzymatic and nonenzymatic antioxidants which eliminate prooxidants and scavenge free radicals. The ability of the lipid-soluble carotenoids to quench singlet molecular oxygen may explain some anticancer properties of the carotenoids, independent of their provitamin A activity. Tocopherols are the most abundant and efficient scavengers of hydroperoxyl radicals in biological membranes. Water-soluble antioxidants include ascorbate and cellular thiols. Glutathione is an important substrate for enzymatic antioxidant functions and is capable of nonenzymatic radical scavenging. Thiols associated with membrane proteins may also be important to the antioxidant systems. Interactions between the thiols, tocopherols, and other compounds enhance the effectiveness of cellular antioxidant defense.

Beta-Carotene and Lung Cancer

Dietary beta carotene and lung cancer risk in U.S. nonsmokers.

Mayne ST; Janerich DT; Greenwald P; Chorost S; Tucci C; Zaman MB; Melamed MR; Kiely M; McKneally MF

J Natl Cancer Inst., Jan 5 1994, 86 (1) p33-8

Background: Approximately 15% of all lung cancer deaths in the United States (about 22,350 deaths annually) may not be directly attributable to active cigarette smoking. Consumption of beta carotene, which is derived almost exclusively from intake of fruits and vegetables, has been associated with a reduced risk of lung cancer in smokers. However, studies examining this association in nonsmokers, particularly nonsmoking men, are limited. Purpose: The purpose of this study was to examine whether dietary factors including beta carotene and retinol are associated with a reduced risk for lung cancer in nonsmoking men and women. Methods: A population-based, matched case-control study of lung cancer in nonsmokers was conducted in New York

State from 1982 to 1985. Dietary interviews were completed for 413 individually matched case-control pairs of subjects. To determine whether the relationship between dietary intake from specific food groups and lung cancer differed by type of interview, smoking history, sex, age, or histologic type, we examined data on the case-control pairs from each subgroup separately. The intake of beta carotene and retinol was calculated as the weighted sum of the monthly frequencies of consumption of food items containing these nutrients, where the weights correspond to the nutrient content of a typical portion of the food items.

Results: Consumption of greens (P for trend (.01), fresh fruits (P for trend (.01), and cheese (P for trend .05) was associated with a significant dose-dependent reduction in risk for lung cancer, whereas consumption of whole milk (P for trend .01) was associated with a significant dose-dependent increase in risk. Use of vitamin E supplements was also protective (odds ratio = 0.55; 95% confidence interval [CI] = 0.35-0.85). Increased consumption of the following food groups was associated with a reduction in risk among females: vegetables (P for trend .025), raw fruits and vegetables (P for trend .005), and dairy products (P for trend .025). In males, increased consumption of raw fruits and vegetables was associated with a reduced risk for lung cancer (P for trend .005). Dietary beta carotene (OR = 0.70; 95% CI = 0.50-0.99), but not retinol (OR = 0.98; 95% CI = 0.82-1.17), was significantly associated with risk reduction.

Conclusions: This is the largest study to date of dietary factors and lung cancer in nonsmokers; results suggest that dietary beta carotene, raw fruits and vegetables, and vitamin E supplements reduce the risk of lung cancer in nonsmoking men and women.

Beta-Carotene and Oral Cancer

Emerging role of beta-carotene and antioxidant nutrients in prevention of oral cancer.

Garewal HS; Schantz S

Arch Otolaryngol Head Neck Surg Feb 1995, 121 (2), p141-4

Beta-carotene, and other antioxidant nutrients such as vitamin E, are well suited for widespread preventive use because they are nontoxic and easily given in supplement form. Intervention trials designed to show a reduction of cancer incidence in the general population are logistically and practically impossible for most types of cancer, including cancer of the oral cavity. Thus, evidence for chemoprevention must be indirect, using laboratory and animal models, epidemiologic surveys, and trials showing reversal of premalignant lesions or cancer prevention in high-risk groups. In several animal models, beta-carotene and other antioxidant nutrients inhibit oral carcinogenesis. Epidemiologic studies consistently relate low intake of these nutrients with high cancer risk. Smokers have lower beta-carotene levels in plasma and oral mucosal cells than nonsmokers.

Eight clinical trials have now shown that beta-carotene and vitamin E produce regression of oral leukoplakia, but chemoprevention studies in oral leukoplakia have limitations. All available evidence supports a significant role for antioxidant nutrients in preventing oral cancer.

Immune Response

Carotenoids and the immune response.

Bendich A

J Nutr, Jan 1989, 119 (1) p112-5,

There is growing evidence from in vitro and in vivo laboratory animal studies that beta-carotene can protect phagocytic cells from autooxidative damage, enhance T and B lymphocyte proliferative responses, stimulate effector T cell functions, and enhance macrophage, cytotoxic T cell and natural killer cell tumoricidal capacities, as well as increase the production of certain interleukins. Many of these effects have also been seen with carotenoids lacking provitamin A activity but having the antioxidant and singlet oxygen quenching capacities of beta-carotene. The association of immuno enhancement with decreased tumor burden in animals given carotenoids suggests a potential explanation for the epidemiological data linking lower carotenoid status with higher incidences of certain cancers. Since vitamin A is a relatively poor antioxidant and cannot quench singlet oxygen, beta-carotene may have more importance as a nutrient than simply serving as a precursor of vitamin A. (22 Refs.)

Beta-Carotene and HIV

A preliminary trial of beta-carotene in subjects infected with the human immunodeficiency virus

Garewal H.S.; Ampel N.M.; Watson R.R.; Prabhala R.H.; Dols C.L.

J. Nutr., 1992, 122/3 SUPPL. (728-732)

Beta-carotene is a nontoxic carotenoid with immunomodulating properties in animals and humans. Based on our observations in normal immunocompetent subjects, we studied the effects of this compound in 11 patients infected with the human immunodeficiency virus (HIV). Each subject received 60 mg of beta-carotene daily for four months. Clinical and laboratory studies were obtained at baseline, every month while on treatment and for two months after treatment. Increases in the percent of cells expressing Leu 11 (natural killer cells), Ia antigen and transferrin receptor (activated lymphocytes) were observed after three

months of treatment with beta-carotene and diminished thereafter. Major changes were not seen in total lymphocyte count or in the percent of cells expressing CD11, CD8 or CD4 antigens. No clinical toxicity was observed. These data suggest that beta-carotene can modulate certain immune markers in HIV-infected subjects. Further study of this compound in HIV infection may be warranted.

Vitamin E Protection

Protection by vitamin E selenium, trolox C, ascorbic acid palmitate, acetylcysteine, coenzyme Q, beta-carotene, canthaxanthin, and (+)-catechin against oxidative damage to liver slices measured by oxidized heme proteins.

Chen H; Tappel AL

Free Radic Biol Med, Apr 1994, 16 (4) p437-44

Male SD rats were fed a vitamin E- and selenium-deficient diet, a diet supplemented with vitamin E and selenium, and diets supplemented with vitamin E, selenium, trolox C, ascorbic acid palmitate, acetylcysteine, beta-carotene, canthaxanthin, coenzyme Q0, coenzyme Q10, and (+)-catechin. Liver slices were incubated at 37 degrees C with and without CBrCl3, t-butyl-hydroperoxide, Fe+2, or Cu+2. The effect of antioxidant nutrients on the oxidative damage to rat liver was studied by measurement of the production of oxidized heme proteins (OHP) during the oxidative reactions. Diet supplemented with vitamin E and selenium showed a strong protection against heme protein oxidation compared to the antioxidant-deficient diet. Furthermore, increasing the diversity and quantity of antioxidants in the diets provided significantly more protection.

Lycopene as Singlet Oxygen Quencher

Lycopene as the most efficient biological carotenoid singlet oxygen quencher.

Di Mascio P; Kaiser S; Sies H

Arch Biochem Biophys, Nov 1 1989, 274 (2) p532-8.

Lycopene, a biologically occurring carotenoid, exhibits the highest physical quenching rate constant with singlet oxygen ($k_q = 31 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$), and its plasma level is slightly higher than that of beta-carotene ($k_q = 14 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$). This is of considerable general interest, since nutritional carotenoids, particularly beta-carotene, and other antioxidants such as alpha-tocopherol ($k_q = 0.3 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$) have been implicated in the defense against prooxidant states; epidemiological evidence reveals that such compounds exert a protective action against certain types of cancer. Also, albumin-bound bilirubin is a known singlet oxygen quencher ($k_q = 3.2 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$). When these differences are taken into account, the singlet oxygen quenching capacities of lycopene (0.7 microM in plasma), beta-carotene (0.5 microM in plasma), albumin-bound bilirubin (15 microM in plasma), and alpha-tocopherol (22 microM in plasma) are of comparable magnitude.

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