

Importance of Dietary Phytonutrients. Molly Kretsch, Ph.D. National Program Leader Human Nutrition. USDA, Agricultural Research Service, Beltsville, MD.

Phytonutrients are organic components in plants, not essential for life, but thought to promote human health. Fruits, vegetables, grains, legumes, nuts and teas are rich sources of these health-promoting components. Bioactive compounds in these plants vary widely in chemical structure and function. Some of the common classes of phytonutrients are carotenoids, flavonoids, lignans, and phenols among others. A comprehensive phytonutrient database, maintained by researchers at the USDA, ARS' Beltsville Human Nutrition Research Center, can be accessed at www.pl.barc.usda.gov/home.cfm.

Currently, media and consumer interest in these new food bioactive constituents is far ahead of the research on their bioavailability and their health promoting benefits in humans, i.e. protection against diseases such as cardiovascular disease, hypertension, cancer, etc. There is ample evidence supporting the health benefits of diets rich in fruits, vegetables, legumes, whole grains and nuts but limited evidence that these same protective effects are due to specific phytonutrients. Some of the proposed health-promoting mechanisms of action include functioning as antioxidants, enhancing the immune system and cell to cell communication, altering estrogen metabolism, repairing DNA damage, and detoxifying carcinogens through activation of the cytochrome P450 and Phase II enzyme systems.

Carotenoids are one class of phytonutrients for which a fair amount of evidence exists, and therefore, are appropriate for examining the question: "Does dose matter?" Epidemiological and case-control studies show that people consuming diets high in carotenoid-containing fruits and vegetables have a lower risk for many cancers, including lung cancer. However, several large randomized clinical trials feeding high dosage beta-carotene supplements (one of the carotenoids) for 4-6 years have not substantiated this protection against cancer. In fact, in two large trials with smokers and/or asbestos exposed people, those taking the high dose beta-carotene supplements (20 – 30 mg/d) had more lung cancer compared to the placebo group. It is known that beta-carotene, at the physiological levels found in foods, is for the most part centrally cleaved in the intestinal mucosa to yield vitamin A. However, at high doses, there is more noncentral beta-carotene cleavage yielding a variety of metabolic products such as aldehyde, acid, alcohol, and epoxide derivatives. These noncentral cleavage products appear to facilitate the binding of smoke derived carcinogens to DNA in animals. Furthermore, it has been found that high dose carotenoid supplements (beta-carotene and lycopene), but not low dose supplements, promote precancerous lung lesions in ferrets exposed to tobacco smoke. These findings suggest that the beneficial effects of carotenoids in preventing lung cancer, and possibly other cancers, are dose dependent for some populations. This demonstrates the need for research to better understand absorption, metabolism, functions, and safe dosages of phytonutrients prior to enhancing their levels in foods and other food products. (see slides for references)