

Physiological Functions of Phytonutrients, Part 2 of 3

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The Other Terpenes: Limonoids, Saponins and Chromonals

Limonoids, like carotenoids (a subclass of terpenes), are found in citrus fruit peels, and may be specifically directed toward protection of the lungs. Rohr, et al., found that a standardized extract of d-limonene, pinene and eucalyptol was effective in clearing congestive mucus from the lung in chronic obstructive pulmonary disease.¹

Additionally, limonoids may be specific chemopreventive agents. Results of animal studies suggest the chemotherapeutic activity of limonoids can be attributed to induction of phases I and II detoxification enzymes in the liver,² and it has been reported that limonoids, administered in large, concentrated therapeutic doses in humans, support detoxication of hormones and related substances that can have a negative effect on cellular DNA and cell proliferation.³ In food, eight ounces of orange juice usually contain approximately 19 mg of d-limonene, but the largest growth segment has been its use in cleaning products!

Saponins and chromanols constitute the last subclass of terpenes presented here. As mentioned in part one of this series, it has been shown that saponins lower cholesterol by binding to it in the digestive tract. According to Princeton University, saponins also inhibit the multiplication of cancer cells by interfering with their DNA.⁴ Alfalfa and other legumes are the most common sources.

The most familiar chromanols are the tocotrienols and tocopherols, both of which occur naturally in palm oils, whole grain germ and bran, yet research has shown that the biologic functions of tocopherols and tocotrienols are unrelated. Tocotrienols appear to inhibit breast cancer cell growth, whereas tocopherols have been studied mostly in terms of their cardiovascular health effects.⁵

Phenols

Phenols include antho- and beta-cyanins; flavonoids; isoflavones; lignans; and lignins. The blue, blue-red and violet colorations seen in berries, grapes and purple eggplant are due to their phenolic content. Bilberries, for example, are high in phenolic anthocyanidins, giving them their reddish hue.

Phenols have been the subject of extensive research as disease preventives and for their ability to protect plants and humans from oxidative damage. Perhaps of greatest interest to chiropractic doctors is the ability of phenols to block specific enzymes that cause inflammation. They also modify the prostaglandin pathways, protecting platelets from clumping.⁶

Flavonoid Functions

Perhaps best known for their ability to enhance the effects of ascorbic acid, flavonoids, along with vitamin C, are well-known for their ability to protect the vascular system by strengthening, maintaining and repairing capillaries.⁷

Once lumped together as vitamin P, science has now discovered more than 1,500 flavonoids! Here is a partial listing: anthocyanins; proanthocyanins; flavones; flavonols; flavonones; bioflavonoids; flavin-3-4-diols; isoflavones; and catechins.

Flavonoids are found in apigenin in chamomile (flavone); quercetin in onion and green apples; rutin in buckwheat; ginkgoflavonglycosides in ginkgo (flavonols); hesperidin in citrus fruits; silybin in milk thistle (flavanones); catechins in green tea; isoflavones in soy; anthocyanins in blueberries; and proanthocyanins in grape seeds and pine bark.

The biologic functions of flavonoids include action against allergies; inflammation; free radicals; platelet aggregation; microbes; ulcers; hepatotoxins; viruses; and tumors.⁸ Flavonoids inhibit specific enzymes such as the angiotensin-converting enzyme (ACE) that raises blood pressure, and cyclooxygenase that breaks down prostaglandins, thereby inhibiting platelet aggregation.

Flavonoids reduce the risk of estrogen-induced cancers by interfering with the enzymes that produce estrogen. For example, flavonoids inhibit estrogen synthase, an enzyme that binds estrogen to receptors in several organs.⁸

Cataracts are a common development in diabetics who, unable to metabolize sugar normally, build up damaging levels of "alcohol sugars" that cause the clouding of the lens. Flavonoids appear to retard the development of cataracts by interfering with aldose-reductase, which converts galactose into the potentially harmful galactitol.⁹

Anthocyanidins are flavonols that provide cross-links that connect and strengthen intertwined strands of collagen protein (the most abundant protein in the body that makes up a large proportion of muscle sheaths; skin; tendon; ligament; and bone matrix). They also are powerful water-soluble antioxidants that inhibit free radicals, whose buildup is one of the main causes of aging. Larger doses are often useful in conditions in which there is a profuse free radical cascade, such as trauma, inflammation, allergic reactions and heavy exercise.

Catechins, the polyphenolic compounds that provide the antioxidant activity of green tea, are members of the flavan-3 class of flavonoids. The most common catechins are gallic esters: epicatechin; epicatechin gallate; epigallocatechin; and epigallocatechin gallate (viewed as the most significant). All are found in green tea and are thought to be responsible for many of the protective benefits of this beverage, which include inhibition of apoptosis of cancer cells in prostate; stomach; skin; lung; breast; and colorectal tissues. Initial studies suggest this may be related to an anti-angiogenesis effect.¹⁰

According to Dr. James F. Balch, co-author of *Prescription for Nutritional Healing*, green tea lowers cholesterol and acts as a powerful antioxidant that helps inhibit the oxidation of cholesterol. According to a recent study presented at the annual meeting of the American Academy of Neurology, green tea polyphenols also may have a protective effect on Parkinson's disease.

Isoflavones

Isoflavones (of which genistein and daidzein are the most known and studied) are most abundant from kudzu, soybeans and other legumes. In spite of their name, isoflavones are distant cousins of

flavonoids. Isoflavones, which are phytoestrogens, effectively modulate estrogen levels in humans and are often of clinical value in low estrogen states like menopause, or imbalanced and toxic estrogen-sensitive conditions like breast, uterine and prostate tumor growth. It is now well-recognized that people who consume traditional diets rich in fermented soy foods experience lower rates of breast, uterine and prostate cancers.

Lignans

Lignans are found in seeds and grains, especially flaxseed. The lignan found in flaxseed is called secoisolariciresinol glucoside. The National Cancer Institute reports that vegetarians have higher concentrations of lignan than omnivores; tumor-free patients also have higher concentrations compared to breast and colon cancer patients.

According to Dr. Dan Junke and Charles A. Weisman, authors of *Flaxseed Lignan - The Power of SDG in Promoting Health*, lignans are weak phytoestrogens that have antiviral; antibacterial; anti-fungal; antioxidant; and immune-enhancing properties. They are noncarbohydrate dietary fiber that, along with polysaccharides, occur in the cell walls of plants.

References

1. Rohr AC, Wilkins CK, Clausen PA, Hammer M, Nielsen GD, Wolkoff P, Spengler JD. Upper airway and pulmonary effects of oxidation products of (=)- α -pinene, d-limonene, and isoprene in balb/c mice; *Inhalation Toxicology* 2002;14(7):663-684.
2. Nair P, et al. *American Journal of Clinical Nutrition* Oct. 1984;40(4 Suppl):927-30.
3. Vigushin DM, Poon GK, Boddy A, et al. Phase 1 and pharmacokinetic study of d-limonene in patients with advanced cancer, *Cancer Chemother Pharmacol* 1998;42:111-117.
4. www.molbio.princeton.edu/courses/mb427/1999/projects/9918/phyto.html.
5. Hayes KC, et al. *Exp Biol Med* March 1993;202:353-359.
6. Hertog MG, et al. *Lancet* Oct 23, 1993;342:1007-11.
7. Kinsella JE, et al. *Food Technology* April 1993;47: 85-90.
8. Murray RK, et al. *Harper's Biochemistry*, 23 ed. pp196. New York; Appleton and Lange, 1994.
9. Northrup C. *Women's Bodies, Women's Wisdom*. 305. New York; Bantam Books, 1994.
10. Huber LG, ND, Green tea catechins and L-theonine in integrative cancer care. *Focus* May 2003, p. 4.

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