Dynamic Chiropractic

VITAMINS / SUPPLEMENTS

Quercetin Queries

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Phytonutrition refers to the consumption of certain bioactive plant chemicals (phytochemicals) that have significant positive health effects. Most phytonutrients are not essential for life, but more and more appear to be essential for optimal health and longevity. Therefore, they may now properly be classified as micronutrients, along with vitamins and minerals. The technical classification of the major groups of phytonutrients found in our diets includes: terpenes, amines, organosulfurs, phenols, polysaccharides, and organic acids. The presentation herein concerns the polyphenol-flavonoid flavonol called quercetin, a major dietary flavonoid.

The Phenol Flavonoids

Phenols are a class of chemical compounds consisting of a hydroxyl group (-OH) attached to an aromatic hydrocarbon group. The simplest of the class is phenol (C6H5OH). Multiple chains of phenols are called polyphenols. Phenols protect plants and humans from oxidative damage. They block specific enzymes that cause inflammation and allergies, and modify the prostaglandin pathways, thereby protecting platelets from clumping.[1] Phenols also help the liver detoxify and inhibit specific enzymes such as the angiotensin-converting enzyme (ACE), which raises blood pressure.[2]

Once lumped together as "vitamin P," science has now discovered well over 1,500 phenol flavonoids! They are perhaps best known for their ability to enhance the effects of ascorbic acid. Along with vitamin C, flavonoids are well-known for their ability to protect the vascular system by strengthening, maintaining and repairing capillaries.[3]

Quercetin Qualities

Quercetin is a member of the class of flavonoids called flavonols. It is widely distributed in the plant kingdom in rinds and barks. Especially rich sources of quercetin include green apple skins, onions, red wine, green tea, St. John's wort and seed pods of the Brazilian shrub "fava d´anta" (*Dimorphandra mollis*).

Quercetin has anti-allergy, anti-inflammatory, immune modulating, anti-viral, anti-cancer, lipid antioxidant and gastro-protective properties. It also may be active in preventing secondary complications of diabetes and in treating category III chronic prostatitis (nonbacterial chronic inflammatory prostatodynia).[4] Let's make a closer examination of the physiology behind two of these properties.

The better known anti-allergy effects of quercetin likely relate to its inhibition qualities:

- mast cell, basophil and neutrophil degranulation;
- tyrosine kinase and nitric oxide synthase while modulating NF-kappaB, the inflammatory mediator;
- the release of histamine and other mediators of allergic reactions, possibly by stabilizing cell membranes so they are less reactive to allergens; and

- inhibiting formation of inflammatory prostaglandins and leukotrienes.[5,6]

In relation to its putative activity in preventing the secondary complications of diabetes (microvascular damage to the insulin-independent retina, kidney and nerves), quercetin inhibits aldose reductase, the first enzyme of the "sorbitol-aldose reductase pathway" (aka, polyol pathway). Hyperglycemia enhances the flow rate of this pathway, which has been linked to diabetic complications such as cataracts, retinopathy, neuropathy and nephropathy.[7]

To explain briefly, cells use glucose for energy. Glucose not used for energy enters the sorbitol-aldose reductase pathway. Aldose reductase reduces glucose to the sugar-alcohol sorbitol, which is oxidized into fructose, which is returned to the normal glycolysis pathway for energy production. In uncontrolled diabetics, who have more blood sugar than liver glycolysis can handle, this patho-physiology ultimately favors the production of too much sorbitol. The resultant overabundance of sorbitol may then glycate the nitrogens on proteins, like collagen, causing a degradation of proteins known as "cross-linking." These "cross-linked proteins" are known as advanced glycation endproducts (AGEs). Excessive activation of the sorbitol-aldose reductase pathway also increases pro-oxidant levels and depletes endogenous antioxidant reserves.[8]

Quercetin Questions: What About Bioavailability?

In nature, quercetin typically exists as a carbohydrate conjugate. Pure quercetin itself is an "aglycone" or "aglucon," meaning that it does not possess a sugar moiety in its structure. Regarding the bioavailability of these quercetin conjugates, the main determinant of absorption of quercetin is the nature of the sugar moiety. For example, quercetin from apples and tea contains predominantly poorly absorbed galactoside, rhamnoside and arabinoside conjugates, while onion contains mainly the much more bioavailable glucosides.[9,10,11,12]

Supplemental quercetin usually is derived from the flavonoid rutin extracted from the seed pods of the Brazilian shrub "fava d´anta" (*Dimorphandra mollis*). This is treated with acid to obtain quercetin as a very thin powder of a greenish, yellow color. This commonly found supplemental form of quercetin, however, is poorly absorbed from the gastrointestinal tract. Bromelain and papain often are added to the formula to increase absorption.[13] Fortunately, scientists have developed a proprietary procedure for conversion of the inactive precursors in *Dimorphandra mollis* to the biologically absorbable and therefore highly bioactive form, called "isoquercitrin" (aka, isoquercetin/rutin 50/50). Isoquercetin/rutin 50/50 is much better absorbed due to this proprietary conversion to the more bioavailable glucoside carbohydrate portion of the molecule. This more effective form, though more expensive, is now available for use in supplements and functional foods.

These facts underline the importance of compiling food and supplement composition tables with individual glycosides listed. Manufacturers, doctors and consumers of quercetin-containing products need to know they are using the most bioavailable forms of quercetin.

An ingested dose of quercetin is absorbed from the small intestine and is then transported to the liver via the portal circulation, where it undergoes significant first-pass metabolism. Quercetin and its metabolites are distributed from the liver to various tissues in the body. Quercetin is strongly bound to albumin in the plasma. Peak levels of plasma quercetin occur from 0.7 to seven hours following ingestion, and the elimination half-life of quercetin is approximately 25 hours.[14]

Quercetin Qualifiers

Quercetin has no known contraindications and is generally well-tolerated. Fears that quercetin might be carcinogenic have not been supported by recent research. Adverse effects reported with oral quercetin include gastrointestinal effects, such as nausea, and rare reports of headache and mild tingling of the extremities. There are no reports of over-dosage with oral quercetin. Doses of quercetin used range from 200 milligrams to 1,200 milligrams daily.[15] The more bioavailable isoquercetin/rutin 50/50 may demonstrate efficacy at even lower dosages.

References

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11. Day AJ, Bao YP, Morgan M, Williamson G. Conjugation position of quercetin glucuronides and effect on biological activity. *Free Radic Biol Med,* 2000;29:1234-43.
12. Quercetin glycone conjugates include rutin and thujin. Rutin is also known as quercetin-3-rutinoside. Thujin is also known as quercitrin, quercetin-3-L-rhamnoside, and 3-rhamnosylquercetin. Onions contain conjugates of quercetin and the carbohydrate isorhamnetin, including quercetin-3,4'-di-O-beta glucoside, isorhamnetin-4'-0-beta-glucoside and quercetin-4'-0-beta-glucoside. Pure quercetin itself is practically insoluble in water. The quercetin carbohydrate conjugates have much greater water solubility than quercetin.
13. Shoskes DA, et al., *op cit.*
14. PDR Health
15. Ibid.

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