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FILE: ■ **Onion (*Allium cepa*)**
■ ***Alliums***

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RE: Health Benefits of Onions

Griffiths G, Trueman L, Crowther T, Thomas B, Smith B. Onions — a global benefit to health. *Phytotherapy Research* 2002;16:603-615.

The authors discuss the genetic diversity and geographic distribution of onion (*Allium cepa*) varieties; horticulture and commerce importance; chemical composition, with emphasis on key health-related compounds; and therapeutic and medicinal uses. Figures illustrate the structure of major beneficial compounds found in onions, how onion flavors are generated, and how alkyl cysteine sulphoxide (ACSO) is synthesized; while tables list varieties of cultivated *Allium* species and the antioxidant and anthocyanin content of selected onion varieties.

Onions are found throughout the many altitudes, latitudes, and habitats of Europe, Asia, North America, and Africa. Onion (*A. cepa* var. *cepa*) is believed to have originated in central Asia, but is not now found in the wild and may have become extinct or be an ancient cultivated hybrid. Shallots (*A. cepa* var. *ascalonicum*) and other "multiplier onions," once regarded as separate species, are now seen as varieties of *A. cepa*. Related species include garlic (*A. sativum*), leek (*A. ampeloprasum* var. *porrum*), chives (*A. schoenoprasum*), and others. While generally found in temperate, dry environments, onions are widely adaptable, but a good yield requires adequate water. They are biennial plants, producing a large bulb in the first year. After vernalization by winter cold, they rapidly re-grow in spring, producing several tubular stalks, each with a single, spherical umbel of about 200 flowers. Each flower produces up to six seeds. The hollow stalks are easily damaged in contrast with wild *Alliums*, which generally have tough, wiry stems. Onions do not cross readily with other *Allium* species.

The use of *Alliums* for food can be traced to the ancient Egyptians. In ancient Greece, onions and garlic were fed to athletes to improve performance in Olympic events.

World onion production increased over 25% from 1992-2002 and is about 44 million tons annually, accounting for around 10% of world vegetable production. Markets include fresh bulbs, dehydrated onions for food processing, and green (immature) salad onions for fresh consumption. Special varieties have been developed: low pungency ("sweet") onions, onions for freezing, and others with high dry matter content ideal for dehydration. Bulbs remain dormant at both high and low temperatures.

Onions are rich in both flavonoids (antioxidants found in many fruits and vegetables) and ASCOs, two chemical groups with perceived human health benefits. ASCOs are flavor precursors, which, when cleaved by the enzyme alliinase (a glycoprotein with a carbohydrate content of about 4.6%, comprising about 6% of total soluble protein in bulb tissue), generate onions' characteristic taste and odor. In intact tissue, alliinase and ACSOs are stored in separate cellular compartments; tissue damage must occur for taste and odor to be produced, as well as the lachrymatory or "tear factor." ACSOs, thought to be plant defense mechanisms, also appear to act as storage peptides. Flavonoids occur in onions in two major groups, flavonols and anthocyanins. Antioxidant content of onions is markedly correlated with production of anthocyanins. Flavonols are concentrated in the onion's skin, where they give a yellow/brown color unless concealed by a red anthocyanin. Flavonols are also found in the fleshy scale tissue, where they give an ivory to yellow color depending on concentration. However, the flesh of peeled white onions, as well as garlic and leek, contains only trace amounts of flavonols. The greatest loss in flavonoids in onions takes place when they are peeled. Cooking has little effect on content.

In discussing the medicinal and therapeutic value of onions, the authors frequently compare and contrast them with garlic, which has been more thoroughly researched. While much more research remains to be done, it is clear that the two species are not interchangeable in terms of potential benefits. The chemistry of garlic is based on allicin and its derivatives, the breakdown products of an ACSO which the onion does not produce. In addition, as noted above, flavonoids are virtually absent from peeled garlic cloves.

Polyphenolic compounds such as flavonoids are important contributors to antioxidant activities and to other mechanisms with anticarcinogenic actions. A Chinese study on *Allium* consumption which included onion and other *Allium* species found a protective effect against esophageal and stomach cancers. Another Chinese study found an inverse relationship between onion consumption and brain cancer risk. French and Dutch studies had contrasting results regarding onion consumption and breast cancer, but the Dutch study also found a strong inverse relationship between onion consumption and stomach cancer.

A recent study on high flavonoid consumption involving onions and black tea (*Camellia sinensis*) revealed no significant effect on lipid peroxidation in humans. A cholesterol-lowering effect of garlic has been reported in several studies. Recent work has focused on the antiplatelet and antiatherosclerotic activity of onion extracts. Antiplatelet activity is strongly affected by genotype, growth environment, and storage time. Garlic is 13 times more potent than onion in inhibiting platelet aggregation and is more effective when eaten raw than when cooked; thus, the efficacy of either cooked garlic or cooked onion in preventing cardiovascular disease is questionable. The highest antiplatelet activity in onions is observed in more pungent cultivars. Recent culinary interest in low-pungency onions may not be a healthy development.

Compounds derived from onions, particularly thiosulphinaes and cepanes (χ -sulphinyl-disulphides), are antiasthmatics. Crude extracts of onion show antifungal properties and activity against gram-positive bacteria. These extracts inhibit the oral bacteria associated with cavity

formation. Onions with a higher percentage of dry matter store their non-structural carbohydrate as fructan, a fructose-based polymer. Many foods can be enriched with fructan dietary fiber without affecting taste. Fructans, including inulin, found in high levels in onion, leek, and garlic, stimulate growth of beneficial microflora in the colon. Onion also contains selenium, important for mental health, male and female fertility, and prevention of cancer and cardiovascular disorders. Growth environments of sulfur-rich vegetables, such as onions, can be manipulated for higher selenium content. Other potential health effects of onion are also under study. The authors mention research aimed at producing defined sulfur metabolites by genetic modification.

One downside to eating onions is their strong effect on breath odor. Some people also experience indigestion following onion consumption. However, while capsules may be useful in avoiding these problems, it should be recalled that a synergistic effect may occur between many components of an *Allium* species, as has been observed in other plants and herbs from which one or more "active components" have been isolated.

¾ Mariann Garner-Wizard

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