

## CRANBERRY AND CANCER PREVENTION

### Background

Cancer is the second leading cause of death in the United States, second only to heart disease. Lung and colorectal cancers are responsible for the first and third most cancer-related deaths in men and women. Breast cancer in women and prostate cancer in men rank second (1). Mounting scientific evidence supports the claim that a diet rich in fruits and vegetables can reduce the risk for many chronic diseases, including cancer (2,3). In recognition of the health benefits of fruits and vegetables, the National Cancer Institute launched its well-known “5-A-Day for Better Health” program in 1991. There are thousands of naturally occurring components in fruits and vegetables that can help promote health and reduce risks for many common diseases. With regard to cancer prevention, the potential benefits of cranberry’s rich flavonoid profile have, understandably, received additional attention.

Studies have shown that flavonoids isolated from cranberries can inhibit bacterial adhesion, the mechanism by which cranberry juice helps maintain urinary tract health (4), and possibly even help in the prevention of periodontal disease (5) and the formation of certain ulcers (6). Compounds in cranberries may also help prevent the progression of atherosclerotic plaques that lead to cardiovascular disease (7). Compared with 20 common fruits tested, cranberries have the highest fresh-weight content of flavonoids and related phenolic acids (8), making this berry a powerful source of potentially anti-cancer phytonutrients and antioxidants. While findings linking cranberry’s components to a decreased risk of cancer are preliminary, *in vitro* studies suggest cranberries contain components that can inhibit carcinogenesis.

### Anticarcinogenic Properties

Bomser et al (9) screened the fruit extracts from four *Vaccinium* species (lowbush blueberry, bilberry, cranberry and lingonberry) for anticarcinogenic compounds. Testing extracts against their ability to induce or inhibit two enzymes involved in the initiation or proliferation of cancer cells, researchers found varying beneficial effects for the extracts from each fruit. The polymeric proanthocyanidin fractions from lowbush blueberry, cranberry and lingonberry exhibited the greatest anti-carcinogenic activity. Other researchers found a proanthocyanidin-rich phenolic fraction from the American cranberry (*Vaccinium macrocarpon*) demonstrated the most significant anticarcinogenic activity (10). Of the seven flavonoids in high abundance in this active fraction, oligomeric proanthocyanidins, quercetin and myricetin were identified.

Several laboratory studies have also investigated the role of the phenolic antioxidants ellagic acid and resveratrol, present in grapes and berries (such as cranberries) at high levels, in the inhibition of human cancer cells. Researchers found both compounds inhibited the growth of certain cancer cells, specifically colon and prostate cancer cells, by interfering with the expression of a number of genes required for cell growth and activating apoptotic-specific proteins that can trigger cell death (11-13). Acknowledging oxidative stress can induce DNA strand breaks that may lead to cancer, Festa et al (14) found ellagic acid markedly reduced chemically-induced DNA damage. Separate research showed quercetin, a prominent cranberry flavonoid (15), inhibits the development of chemically-induced mammary and colon cancer (16).

A recent study by Guthrie (17) explored the *in vitro* effects of cranberry products on human breast cancer cell growth. Two of the four products tested inhibited growth of two types of breast cancer cells, both an estrogen receptor-negative (MDA-MB-435) and an estrogen receptor-positive (MCF-7) cell line.

#### Key Points:

- Diets high in flavonoid rich fruits and vegetables are associated with a decreased risk of cancer and cancer mortality.
- Compared with other common fruits, cranberries have one of the highest concentrations of antioxidant polyphenols, which include flavonoids and related phenolic acids.
- While findings linking cranberry’s components to a decreased risk of cancer are preliminary, *in vitro* studies suggest cranberries contain components that can inhibit carcinogenesis.



While highly preliminary, these data suggest specific cranberry products may be useful in preventing certain cancers *in vivo*.

## Conclusions

The relationship between food and health, while complex, is strongly supported by a large number of epidemiologic studies. The continued high mortality rate and complex etiology of cancer requires extensive and on-going study, especially as it relates to the ingestion of specific dietary components. Flavonoids in particular appear to possess significant anticarcinogenic effects worthy of further exploration. Compositionally, cranberries are one of the richest sources of dietary flavonoids, nutrients also known for their antioxidant properties, and may help reduce cancer risk when part of a diet consisting of five to nine fruits and vegetables a day, as recommended by the National Cancer Institute.

## References:

1. Leahy, M., Roderick, R., Brilliant, K. The cranberry – promising health benefits, old and new. *Nutrition Today*. 2001;36(5):254-265.
2. Block, G., Patterson, B., Subhar, A. Fruit, vegetables and cancer prevention: A review of the epidemiological evidence. *Nutr. Cancer*. 1992;8(1):1-29.
3. Ames, B.N., Shigenaga, M.K., Hagen, T.M. Oxidants, antioxidants, and the degenerative diseases of aging. *Proc. Natl. Acad. Sci. U.S.A.* 1993;90:7915-7922.
4. Howell, A.B., Vorsa, N., Der Mardarian, A., Foo, L.Y. Inhibition of the adherence of P-fimbriated *Escherichia coli* to uroepithelial-cell surfaces by proanthocyanidin extracts from cranberries. *N. Engl. J. Med.* 1998;339(15):1085-1086.
5. Weiss, E.I., Lev-Dor, R., Sharon, N., Oftek, I. Inhibitory effect of high-molecular-weight constituent of cranberry on adhesion of oral bacteria. *Crit. Rev. Food Sci. Nutr.* 2002;42(Suppl.):285-292.
6. Burger, O., Itzhak, O., Tabak, M., Weiss, E.I., Sharon, N., Neeman, I. A high molecular mass constituent of cranberry juice inhibits *Helicobacter pylori* adhesion to human gastric mucus. *Fed. Euro. Microbiol. Soc.* 2000;29:295-301.
7. Reed, J. Cranberry flavonoids, atherosclerosis and cardiovascular health. *Crit. Rev. Food Sci. Nutr.* 2002;42(Suppl.):301-316.
8. Vinson, J.A. Cranberry: a fruit with an unusually rich in antioxidants. *FASEB J.* 2001;15:A287.
9. Bomser, J., Madhavi, D.L., Singletary, K., Smith, M.A. Anti-cancer activity of cranberry extracts. *Planta Medica*. 1996;62:212-216.
10. Kandil, F.E., Smith, M.A., Robers, R.B., Pepin, M.F., Song, L.L., Pezzuto, J.M., Seigler, D.S. Composition of a chemopreventive proanthocyanidin-rich fraction of cranberry fruits responsible for the inhibition of 12-O-tetradecanoyl phorbol-13-acetate (TPA)-induced ornithine decarboxylase (ODC) activity. *J. Agric. Food Chem.* 2002;50(5):1063-1069
11. Narayanan, B.A., Narayanan, N.K., Stoner, G.D., Bullock, B.P. Interactive gene expression pattern in prostate cancer cells exposed to phenolic antioxidants. *Life Sciences*. 2002;70:1821-1839.
12. Narayanan, B.A., Re, G.G. IGF II down regulation associated cell cycle arrest in colon cancer cells exposed to phenolic antioxidant ellagic acid. *Anticancer Res.* 2001;21:359-364.
13. Narayanan, B.A., Geoffrey, O., Willingham, C.M., Re, G.G., Nixon, D.W. p53/p21<sup>(WAF1/CIP1)</sup> expression and its possible role in G1 arrest and apoptosis. *Cancer Lett.* 1999;136:215-221.
14. Festa, F., Aglitti, T., Duranti, G., Ricordy, R., Perticone, P., Cozzi, R. Strong antioxidant activity of ellagic acid in mammalian cells *in vitro* revealed by the comet assay. *Anticancer Res.* 2001;21(6A):3903-3908.
15. Bilyk, A., Sapers, G.A. Varietal differences in the quercetin, kaempferol, and myricetin contents of highbush blueberry, cranberry, and thornless blackberry fruits. *J. Agric. Food Chem.* 1986;34:585-588.
16. Verma, A.K., et al. Inhibition of 7,12-dimethylbenz(a)anthracene- and N-nitrosemethylurea-induced rat mammary cancer by dietary flavonol quercetin. *Cancer Res.* 1988;48(20):5754-5758.
17. Guthrie, N. Effect of cranberry juice and products on human breast cancer cell growth. *FASEB J.* 2000;14(4):A771.



**THE  
CRANBERRY  
INSTITUTE**

[www.cranberryinstitute.org](http://www.cranberryinstitute.org)

