

Scientific review

Broccoli

It is now well known that some fruits and vegetables can help in the prevention of cardiovascular, inflammatory and chronic diseases such as diabetes. They can also prevent bacterial and viral infections.

A diet rich in antioxidant and phenol compounds is a natural approach that helps prevent the development of illnesses. The antioxidants have the ability to inhibit the cancer cell growth at an early stage.

Nutra Canada extracts are natural, accessible and affordable. They are a great solution to increase bioactive compounds intake and benefit from their protection.



Cancer cell growth inhibitor

Strong antioxidant power

Cardiovascular risk reduction

Antibiotic properties

Broccoli health benefits

Broccoli, which is a good source of vitamin C and folic acid (mean value of 0.11 mg/100 g), is among the few plants that provide high intakes of vitamin K (0.17 mg/100 g). It also contains a high concentration of phenolic compounds (average 6.38 mg / g dry weight) and several sterols.

Broccoli and broccoli extract have a high antioxidant power. In *in vitro* studies, broccoli extract inhibit liver and breast cancer cell proliferation. A compound extracted from broccoli, sulforaphan, is also efficient for cancer prevention.

A study with rats showed a decreased of prostate cancer cell proliferation by a diet rich in broccoli powder. Furthermore, consumption of broccoli had a protective effect on rat's heart. Consumption of broccoli extract sulforaphan has been associated with cardiovascular disease prevention in rats and suppression of prostate cancer cell growth in mice. Sulforaphan also has antibiotic properties against *Helicobacter pylori*, bacteria involve in stomach ulcers.

Several positive effects of eating vegetables from the Brassica family, including broccoli, have been reported, including lower the risk of cancer. Indeed, regular consumption of broccoli has been associated with lower risk of colorectal, stomach, prostate, lungs, as well as breast cancer in pre-menopausal women. Finally, broccoli consumption by menopausal women might reduce the risk of death from cardiovascular disease.

« *The vegetable of your heart* »

Cancer cell growth inhibitor

Rose, P., Huang, Q., Ong, C.N., Whiteman, M., Broccoli and watercress suppress matrix metalloproteinase-9 activity and invasiveness of human MDA-MB-231 breast cancer cells. *Toxicology and Applied Pharmacology* 209 (2005) 105-113.

Clarke, J.D., Dashwood, R.H., Ho, E. Multi-targeted prevention of cancer by sulforaphane. *Cancer Letters* 269 (2008) 291-304.

Cornblatt, B.S., Ye, L., Dinkova, Kostova, A., Erb, M., Fahey, J.W., Singh, N.K., Chen, M.-S. A., Stierer, T., Garrett-Mayer, E., Argani, P., Davidson, N.E., Talalay, P., Kensler, T.W., Visvanathan, K. Preclinical and clinical evaluation of sulforaphane for chemoprevention in the breast. *Carcinogenesis* 28 (2007) 1485-1490.

Canene-Adams, K., Lindshield, B.L., Wang, S., Jeffery, E.H., Clinton, S.K., Erdman, J.W. Jr. Combinations of tomato and broccoli enhance antitumor activity in dunning R3327-H prostate adenocarcinomas. *Cancer Res.* 67 (2007) 836-843.

Myzak, M.C., Tong, P., Dashwood, W.-M., Dashwood, R.H., Ho, E. Sulforaphane retards the growth of human PC-3 xenografts and inhibits HDAC activity in human subjects. *Exp. Biol. Med.* 232 (2007) 227-234.

Kim, M.K., Park, J.H.Y. Cruciferous vegetable intake and the risk of human cancer: epidemiological evidence. *Proceedings of the Nutrition Society* 68 (2009) 103–110.

Kristal, A.R., Lampe, J.W. Brassica vegetables and prostate cancer risk: A review of the epidemiological evidence. *Nutrition and cancer* 42 (2002) 1-9.

Hara, M., Hanaoka, T., et al. Cruciferous vegetables, mushrooms, and gastrointestinal cancer risks in a multicenter, hospital-based case-control study in Japan. *Nutr. Cancer* 46 (2003) 138-147.

Lin, H.J., Probst-Hensch, N.M., et al. Glutathione transferase null genotype, broccoli, and lower prevalence of colorectal adenomas. *Cancer Epidemiol. Biomarkers Prev.* 7 (1998) 647-652.

Park, E.J., Pezzuto, J.M. Botanicals in cancer chemoprevention. *Cancer Metastasis Rev.* 21 (2002) 231-255.

Joseph MA, Moysich KB, Freudenheim JL, Shields PG, Bowman ED, Zhang Y, Marshall JR, Ambrosone CB Cruciferous vegetables, genetic polymorphisms in glutathione s-transferases m1 and t1, and prostate cancer risk. *Nutr. Cancer* 50 (2004) 206–213.

Spitz MR, Duphorne CM, Detry MA, Pillow PC, Amos CI, Lei L, de Andrade M, Gu XJ, Hong WK, Wu XF Dietary intake of isothiocyanates: evidence of a joint effect with glutathione S-transferase polymorphisms in lung cancer risk. *Cancer Epidemiol. Biomarkers Prev.* 9 (2000) 1017–1020.

Ambrosone, C.B., McCann, S.E., et al. Breast cancer risk in premenopausal women is inversely associated with consumption of broccoli, a source of isothiocyanates, but is not modified by GST genotype. *J. Nutr.* 134 (2004) 1134-1138.

Antioxydant power

Web site www.Aprifel.com

Chu, Y.H., Sun, J., Wu, X., Liu, R.H. Antioxidant and antiproliferative activities of common vegetables. *J. Agric. Food Chem.* 50 (2002) 6910–6916.

Borowski, J., Szajdek, A., Borowska, E.J., Ciska, E., Zieliski, H. Content of selected bioactive components and antioxidant properties of broccoli (*Brassica oleracea* L.). *Eur. Food Res. Technol.* 226 (2008) 459–465.

Normén, L., Johnsson, M., Andersson, H., van Gameren, Y., Dutta, P. Plant sterols in vegetables and fruits commonly consumed in Sweden. *Eur. J. Nutr.* 38 (1999) 84–89.

Gülçin, I., Sat, I.G., Beydemir, S., Küfrevioğlu, Ö.I., Evaluation of the in vitro antioxidant properties of broccoli extracts (*Brassica oleracea* L.). *Ital. J. Food Sci.* 1 (2004) 17-30.

Zhang, D., Hamazu, Y. Phenolics, ascorbic acid, carotenes and antioxidant activity of broccoli and their changes during conventional and microwave cooking. *Food Chem.* 88 (2004) 503–509.

Piao, X., Kim, H.Y., Yokozawa, L.Y.A., Piao, X.S. Cho, E.J. Protective effects of broccoli (*Brassica oleracea*) and its active components against radical-induced oxidative damage. *J. Nutr. Sci. Vitaminol.* 51 (2005) 142–147.

Nilsson, J., Olsson, K., Engqvist, G., Ekvall, J., Olsson, M., Nyman, M., Akesson, B. Variation in the content of glucosinolates, hydroxycinnamic acids, carotenoids, total antioxidant capacity and low molecular weight carbohydrates in Brassica vegetables. *J. Sci. Food Agric.* 86 (2006) 528–538.

Kurilich, A.C., Jeffery, E.H., Juvik, J.A., Wallig, M.A., Klein, B.P. Antioxidant capacity of different broccoli (*Brassica oleracea*) genotypes using the oxygen radical absorbance capacity (ORAC) assay. *J. Agric. Food Chem.* 50 (2002) 5053-5057.

Cardiovascular disease risk reduction

Mukherjee, S., Gangopadhyay, H., Das, D.K. Broccoli : a unique vegetable that protects mammalian hearts through the redox cycling of the thioredoxin superfamily. *J. Agric. Food Chem.* 56 (2008) 609-617.

Wu, L., Ashraf, M.H.N., Facci, M., Wang, R., Paterson, P.G., Ferrie, A., Juurlink, B.H. Dietary approach to attenuate oxidative stress, hypertension, and inflammation in the cardiovascular system. *Proc. Natl. Acad. Sci. USA* 101 (2004) 7094–7099.

Yochum, L., Kushi, L.H., et al. Dietary flavonoid intake and risk of cardiovascular disease in postmenopausal women. *Am. J. Epidemiol.* 149 (1999) 943-949.

Antibiotic properties

Fahey, J.W., Haristoy, X., Dolan, P.M., Kensler, T.W., Scholtus, I., Stephenson, K.K., Talalay, P., Lozniewski, A. Sulforaphane inhibits extracellular, intracellular, and antibiotic-resistant strains of *Helicobacter pylori* and prevents benzo pyrene-induced stomach tumors. *Proc. Natl. Acad. Sci. USA.* 99 (2002) 7610-7615. *Prev. 9* (2000) 1017–1020.

Broccoli nutrition facts

Compound	Concentration
Protein (g/100g) ¹	3.0
Fat (g/100g) ¹	0.3
Carbohydrate (g/100g) ¹	5.2
Fibre (g/100g) ¹	2.4
Vitamin	
Vitamin C (mg/100g) ¹	93.0
Mineral	
Potassium (mg/100g) ¹	325
Calcium (mg/100g) ¹	48
Magnesium (mg/100g) ¹	25
Phosphorus (mg/100g) ¹	66
Iron (mg/100g) ¹	0.9
Total Flavonoids (mg/dry kg) ²	197.0
Quercetin (mg/dry kg) ²	60.0
Myricetin (mg/dry kg) ²	62.5
Luteolin (mg/dry kg) ²	74.5

¹ Brault Dubuc, M., Caron Lahaie, L. Valeur nutritive des aliments, Ed. Société Brault-Lahaie, 8e édition, 1998.

² Mian, K.H., Mohamed, S. Flavonoid (Myricetin, Quercetin, Kaempferol, Luteolin, and Apigenin) Content of Edible Tropical Plants, *J. Agric. Food Chem.* 49 (2001) 3106-3112.





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