



HEALTH BENEFITS OF CRUCIFEROUS VEGETABLES

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Introduction

Higher consumption of vegetables in general may protect against some diseases, including some types of cancer. Cruciferous vegetables have risen in popularity recently due to their apparent cancer-fighting properties. This group of vegetables was originally named for the four equal-sized petals in its flowers that could be viewed as forming a cross-like or crucifix shape. But many scientists are starting to favour the term "brassica vegetables" over "cruciferous vegetables" and the traditional name of this plant family in Latin, Cruciferae, is now being largely replaced by the Latin name Brassicaceae. This large group of plants is diverse, each providing strong, unique flavours. Cruciferous vegetables include cabbage, cauliflower, radish, turnips, broccoli, Brussels sprouts, arugula, kale etc.

Nutritional value

Cruciferous vegetables are low calorie and rich in nutrients, including several carotenoids (beta-carotene, lutein, zeaxanthin); vitamins C, E, and K; folate; and minerals. They also are a good fibre source. In addition, cruciferous vegetables contain a group of substances known as glucosinolates, which are sulphur containing chemicals. These chemicals are responsible for the pungent aroma and bitter flavour of cruciferous vegetables. During food preparation, chewing, and digestion, the glucosinolates in cruciferous vegetables are broke down to form biologically active compounds such as indoles, nitriles, thiocyanates, and isothiocyanates. Indole-3-carbinol (an indole) and sulforaphane (an isothiocyanate) have been most frequently examined for their anticancer effects. Indoles and isothiocyanates have been found to inhibit the development of cancer in several organs in rats and mice, including the bladder, breast, colon, liver, lung, and stomach. Various glucosinolates like Erucin, Glucoallyn, Glucobrassicinapin, Gluconapin, Gluconasturtin, Glucophanin, Iberin, Sinigrin, Progoitrin and 4-methoxyglucobrassicin are found in cruciferous vegetables and known for health benefits. Studies in animals and experiments with cells grown in the laboratory have identified several potential ways in which these compounds may help prevent cancer:

- They help protect cells from DNA damage.
- They help inactivate carcinogens.
- They have antiviral and antibacterial effects.
- They have anti-inflammatory effects.
- They induce cell death (apoptosis).
- They inhibit tumour blood vessel formation (angiogenesis) and tumour cell migration (needed for metastasis). Studies in humans, however, have shown mixed results.

Why we need to eat cruciferous vegetables?

We know that eating vegetables has profound health benefits. These are following several reasons to eat cruciferous vegetables regularly:

Cancer prevention

Researchers have investigated possible associations between intake of cruciferous vegetables and the risk of cancer. The evidence has been reviewed by various experts. Key studies regarding four common forms of cancer are described viz. (i) Prostate cancer: Cohort studies in the Netherlands, United States, and Europe have examined a wide range of daily cruciferous vegetable intakes and found little or no association with prostate cancer risk. However, some case-control studies have found that people who ate greater amounts of cruciferous vegetables had a lower risk of prostate cancer. (ii) Colorectal cancer: Cohort studies in the United States and the Netherlands have generally found no association between cruciferous vegetable intake and colorectal cancer risk. The exception is one study in the Netherlands “The Netherlands Cohort Study on Diet and Cancer” in which women (but not men) who had a high intake of cruciferous vegetables had a reduced risk of colon (but not rectal) cancer. (iii) Lung cancer: Cohort studies in Europe, the Netherlands, and the United States had varying results. Most studies have reported little association, but one U.S. analysis using data from the nurses ‘Health Study and the Health Professionals’ Follow-up, Study showed that women who ate more than 5 servings of cruciferous vegetables per week had a lower risk of lung cancer. (iv) Breast cancer: One case-control study found that women who ate greater amounts of cruciferous vegetables had a lower risk of breast cancer. An additional cohort study of women in the United States similarly showed only a weak association with breast cancer risk. A few studies have shown that the bioactive components of cruciferous vegetables can have beneficial effects on biomarkers of cancer-related processes in people. For example, one study found that indole-3-carbinol was more effective than placebo in reducing the growth of abnormal cells on the surface of the cervix.

Antioxidants

Cruciferous vegetables, especially broccoli, are a superior source of antioxidants. A study was carried out on young male smokers and at the end of treatment, of the many observations, decreases circulating CRP (C-reactive protein) concentrations were noted. This is significant because the measure of CRP indicates the level of inflammation in a body, and indirectly the oxidative stress status, with high levels of both being associated with long-term diseases. In 2015 broccoli sprout extract was again found highly effective in reducing of oxidative stress, in this case being observed to assist with healthy liver function.

Protection from and elimination of toxins

Cruciferous vegetables and their sulforaphane rich tissues can help, as noted in several studies. In 2014, a randomized clinical trial recruited 291 participants from a rural area of China, an area known for high levels of air-pollution. The non-placebo group consumed a broccoli sprout-derived beverage providing daily doses of 600 μ mol glucoraphanin and 40 μ mol sulforaphane over a 12-week period (So essentially they were given a concentrated extract of cruciferous vegetables for three months). Urine testing found “rapid and sustained, statistically significant” increases elimination of toxic substances in those drinking the beverage, over the placebo group. Studies have also shown sulforaphane assists in protection from and elimination of arsenic and pesticides. The detoxifying quality

of cruciferous is thought to be directly connected to sulforaphane's role in activation of Nrf2, which is known to have a critical role in the metabolism and excretion of toxic substances.

Relief from pain

There are some evidences that sulforaphane may have significant value in pain, or pain management. In 2000, a study on female fibromyalgia patients reported that the combination of ascorbigen (derived from Vitamin C) and broccoli powder “reduces pain sensitivity and improves quality of life” for patients suffering from this challenging condition. A 2016 publication also investigated the potential for sulforaphane via broccoli sprout extract, noting “significant” antinociception (pain blocking) results that bode well for further study into the pain relieving benefits.

✓ Relief from depression

Cruciferous vegetables may also have significant benefit for depression. An animal study published in 2015 found sulforaphane “has antidepressant and anxiolytic-like (anxiety reducing) activities in stressed mice model of depression, which likely occurs by inhibiting the hypothalamic.” In 2016, study found broccoli sprouts effective to “prevent or minimize the relapse by inflammation.” This same study found that the extracts of broccoli sprouts were so effective, they acted as a prophylactic that could “prevent the onset of lipopolysaccharide-induced depression-like behaviors” in the juvenile and adolescent mice they were testing, all the way into adulthood. lipopolysaccharide is a bacterially derived inflammatory factor known to cause a wide range of health issues. More research is being done on the phytochemicals of cruciferous vegetables and depression.

✓ Protection from heart diseases

Cardiovascular problems remain a top health concern, especially in India and United States. Cardiovascular disease is on the rise, with Ischemia-Reperfusion (I/R) injury (such as myocardial infarction (“heart attack”), stroke, and peripheral vascular disease) and hypertension being main components. Research is showing that sulforaphane helps with inflammation of the arterial walls, inhibits obesity, relieves hypertension, and other conditions that are part of or lead to cardiovascular diseases. With regard to hypertension, a 2012 study reported sulforaphane “decreases renal and vascular oxidative stress and inflammation as well as blood pressure”, thus assisting in hypertension.

✓ Diabetes and insulin resistance (IR) support

It's generally recognized that diet and exercise can profoundly assist with the prevention and treatment of Type II Diabetes. However, specific positive results have been seen with regard to sulforaphane and consuming cruciferous vegetables. In particular, IR is an aspect of Type II that can cause havoc in a body. A 2016 study investigated the effects of broccoli sprout powder, containing high concentration of sulforaphane, on IR in Type II diabetic patients. In a randomized trial, 81 patients received either the high concentration of sulforaphane powder or a placebo, over four weeks. The end results gave clear indications of lowered levels of insulin resistance.

✓ Alzheimer's applications

Studies suggest that cruciferous vegetables might be a promising therapeutic agent for cognitive enhancement in Alzheimer's disease. In 2015, researchers looked at the effects of sulforaphane compounds via the administration of broccoli sprout juices of varying

concentrations. They reported positive effects against the measures of two major factors implicated in the pathogenesis of disease, as well as upregulation in the intracellular glutathione content and the activity of antioxidant enzymes- both of which may contribute to improved tissue detoxification and function.

✓ **Anti-inflammatory benefits**

As anti-inflammatories go, sulforaphane is right up there with that king of all spices, curcumin (turmeric) giving our cruciferous vegetables the upper hand in the list of healing foods. “The consumption of broccoli sprouts modulated the excretion of biomarkers linked to inflammation and vascular reactions,” according to a 2015 study. A more recent cell-based study, published in 2016 reported, “clear evidence that pre-treatment with sulforaphane completely restored the antioxidant status and prevented inflammatory responses.” More and more data suggests that sulforaphane may be useful as a therapeutic agent for the treatment of inflammatory conditions and diseases.

References

- International seminar on oilseed brassica held at SIAM, Jaipur, during February, 23-27, 2017.
- <http://www.foodrevolution.org/>
- <http://www.healthline.com/>