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The Coming Age of Vege-Medicine

The International Journal of Cancer recently put I3C (indole-3-carbinol) on the fast track when researchers at the University of Maryland discovered that the vege-compound suppresses a protein that speeds up the growth of cancer cells.¹ The protein, known as MUC1, shows up in 90% of all breast, lung, pancreas, prostate, stomach, colon, and ovarian cancers.²

I3C suppressed the cancer-enhancer protein almost 80%. I3C is just one of the anti-cancer factors in broccoli and other cruciferous vegetables such as Brussels sprouts and cabbage. The MUC1 report is the latest that links cruciferous vegetables to significant health benefits. One serving of cruciferous vegetables may protect against cancer better than all the other fruits and vegetables on a person's plate combined.³



Unfortunately, Americans eat too few cancer-fighting vegetables. The top vegetables in America are iceberg lettuce, tomatoes, and French fries.⁴ This is so alarming to those knowledgeable about the food-cancer connection that one study involved calling people with “motivational reminders” to eat right and not relapse into dietary purgatory.⁵ The government’s “Healthy People 2000” has been extended another ten years in the hopes that the message will get through in another decade. The program has presidential medals for people who choke down bona fide vegetables.⁶ And, that’s not all—businesses are jumping on the diet/health bandwagon too. The people who brought us “Velveeta” are hard at work on an even better way to get people to eat broccoli. It’s devising ways to sneak the vegetable into snack foods.⁷

And, in spite of the fact that you may be a “health nut” who eats broccoli with cauliflower chasers three times a week, you may still not be getting enough nutrition from these important vegetables. A new study shows that up to 80% of the phyto-chemicals that make broccoli healthy (glucosinolates), along with 60% of the flavonoids and other such goodies are lost from the time broccoli is picked to the time it lands on your plate.⁸ That’s assuming you don’t let it age in the refrigerator a week, by which time you might as well take a picture of it and eat that—at least according to this study. Take heart, however, other studies give a better prognosis and it apparently doesn’t take much broccoli to get you where you need to go.

What are those benefits, anyway, and where do you need to go? There’s no short answer to that question, but wiping out cancer cells before you, or anyone else, ever knows they exist is a good start. As you may have heard, up to 90% of all cancer is caused by environmental factors, at least two-thirds of which a person can control.⁹

How can cruciferous vegetables help? Broccoli and other cruciferous vegetables manufacture dozens of phyto-chemicals to protect themselves against insects, worms, the sun, grazing animals, etc. The system is elaborate. These vegetables not only manufacture phyto-chemicals that discourage creatures, they also produce factors that encourage creatures. The result is a green grab bag of vegetable-based compounds possessing very sophisticated and complex actions. Researchers are investigating the effects in human cells, with the first priority being good-cells-gone-bad—cancer.

Eat Your Broccoli

“Population studies” (where many people are interviewed about what they eat) show that cruciferous vegetables protect against various types of cancer. A study from the University of Hawaii, for example, questioned 1,600 men, and found that cruciferous vegetables cut the risk of prostate cancer about 40%.¹⁰ People who eat four servings of broccoli a week slash their risk of colorectal cancer by more than 50% compared to people who never eat it,¹¹ and cruciferous vegetables may cut the risk of bladder cancer by 50%, according to a study from Harvard.¹² These kinds of studies are good indicators, but not completely reliable because people aren’t good at remembering what they eat.

Researchers at Vanderbilt did a new-and-improved version of this type of study. Instead of looking at Americans (who might eat broccoli once a year, or once every five years), they worked with researchers in China where people eat an abundance of cruciferous vegetables all the time. When they gave the usual questionnaire to women with newly-diagnosed breast cancer, vegetables did not link up to a lower cancer risk. However, when they measured actual cruciferous vegetable metabolites in the women themselves, it emerged that the women who ate the most cruciferous vegetables halved their risk of breast cancer.¹³ This shows how problematic questionnaire studies can be, but more importantly, it shows a strong association between eating certain vegetables and escaping hormone-related cancer.

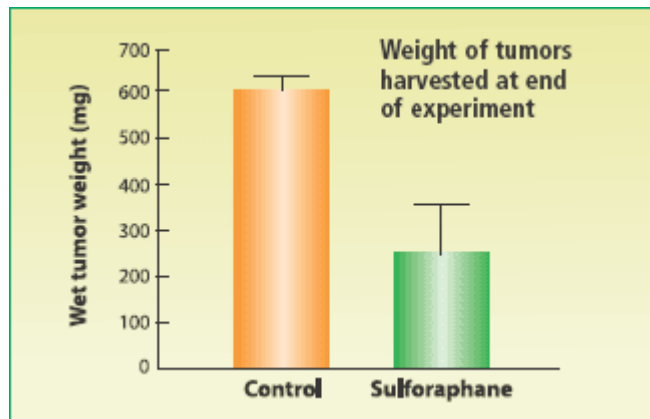
This sort of data is helpful, but researchers are not content with such generalities. They want to know what it is about cruciferous vegetables that prevent cancer, and how it works.

Can Vege-Compounds Kill Cancer Cells?

Researchers at the State University of New York recently compared the cancer cell killing effect of cruciferous compounds against two chemotherapy drugs in human breast cancer cells. Daunomycin and vinblastine were compared to several “isothiocyanates” from cruciferous vegetables.¹⁴ Isothiocyanates are a group of cruciferous compounds that form naturally when broccoli and other such vegetables are chewed or cut.

When they put the isothiocyanates on human breast cancer cells, the cells stopped growing and died within 48 hours. The effect was virtually identical to daunomycin at about the same amount. In a different study, the same isothiocyanates killed lung cancer cells 100% in five days.¹⁵

One of the isothiocyanates used in the chemo drug study was the cruciferous phyto-chemical, sulforaphane. Sulforaphane is undergoing tests at several universities for its ability to stop the growth of human cancers. When mice are transplanted with prostate cancer and then given sulforaphane as a supplement (or related isothiocyanate PEITC, or allyl isothiocyanate), tumors are 50-70% smaller (see figure).¹⁶⁻¹⁸ Cells stop growing and undergo cell death (apoptosis). The same thing happens with breast cancer.¹⁹ Human colon cancer cells also stop growing in the presence of sulforaphane,²⁰ and bladder cancer gives up within three hours (80% of cells stop growing and fall apart (apoptosis) after treatment with sulforaphane and other isothiocyanates).²¹



Vege-Compounds Detoxify Cancer-Causing Chemicals

In addition to killing cancer cells outright, cruciferous vege-extracts work behind the scenes to enhance cellular defenses, and prevent cancer from getting a toe-hold. Sulforaphane, PEITC, I3C, and related compounds work in two important ways: they detoxify cancer-causing chemicals (by activating phase II enzymes), and block those chemicals from turning into carcinogens in the body (by deactivating phase I enzymes). Detoxification includes scavenging free radicals, and upregulating the body’s natural antioxidant enzyme system.^{22,23} One of the features of the isothiocyanates is that they combine with NAC (N-Acetyl Cysteine), a sulfur-related antioxidant utilized by the body to create glutathione. Glutathione is crucial for the detoxification system to work.

Powerful Anti-inflammatory Action That Protects Cells

Besides their enzyme-modulating effects, cruciferous vegetable extracts also block inflammation. One of the beneficial effects is the crippling of cancer cells’ ability to multiply. In a study from Rutgers, sulforaphane and PEITC from broccoli; curcumin from a ginger-like root; and resveratrol from grapes stopped the growth of human colon cancer cells by inhibiting an inflammation-responsive protein, NFKB.²⁴ I3C also inhibits NFKB. In malignant and pre-malignant human breast cancer cells, it selectively inhibits the factor without disturbing healthy cells.²⁵

The natural, organic cancer-fighters in cruciferous vegetables also discourage cancer by stopping DNA damage. In a study on human cells exposed to hydrogen peroxide and a chemical from cigarette smoke, sulforaphane and another cruciferous compound, ICZ, reduced DNA damage by more than 80%.²⁶ Not only can these compounds protect DNA, I3C and three other vege-compounds (resveratrol, curcumin, and ellagic acid) can actually enhance the body’s DNA repair system—a discovery that surprised the researchers who were initially skeptical that plant compounds could have a significant DNA-protective effect, let alone control the system of repair.²⁷

Because most cases of cancer can be prevented through diet and lifestyle, and because anything that kills precancerous and cancerous cells is very desirable as cancer prevention, the science of broccoli is exploding. As the poster child for cruciferous vegetables, this vegetable is getting a lot of attention, or more precisely, what is in broccoli is getting a lot of attention. From cancer researchers to snack peddlers, to oncologists looking for chemo-enhancers, everybody wants a piece of the action. And action it is! The past two years alone account for about a third of all publications on broccoli-related topics. Researchers and clinicians alike seem to realize—this is the real deal. Even as we go to press, news of another important study has arrived. Stay tuned.

Practical Information

Be aware that if you take a cruciferous vegetable supplement more is not necessarily better when it comes to this type of vegetable nutrient. The phyto-compounds found in broccoli and other cruciferous vegetables are powerful. Remember, these are substances that can induce cancer cells to die within hours. Stick with the recommended dose.

Broccoli sprouts provide a more concentrated amount of beneficial phyto-nutrients than the mature plant. High-quality supplements are made from sprouts—not seeds (which may contain toxins). The amount of phyto-compounds varies widely, depending on the variety. The only way to be sure of a consistent dose of cancer-fighting vege-compounds day in, and day out, is

to take a standardized supplement that provides a consistent dose.

Beneficial Factors in Cruciferous Vegetables

Broccoli, cabbage, and other cruciferous vegetables take sulfur from the soil and convert it to glucosinolates and S-methylcysteine sulfoxide, two organosulfur phyto-chemicals. They break down into dozens of new compounds when the vegetable is cut, chewed, digested, cooked, or metabolized. Fourteen different glucosinolates have been identified in cruciferae. Seeds, sprouts, and mature vegetable contain different ratios of the various glucosinolates.

One of the glucosinolates is glucobrassicin, which is the source of I3C. When I3C hits stomach acid, it is converted to six new phyto-compounds (I3CA, I3A, ICA, DIM, Ltr, and HI-IM). Each of these different I3C products, plus I3C itself, shows up in different amounts in various organs at diverse times.³² Another glucosinolate, glucoraphanin, is found mostly in sprouts. It converts to sulforaphane and other phyto-compounds. In all, broccoli and other cruciferae are the source of dozens of sulfur-related compounds, along with vitamin C, selenium, and other phyto-compounds that have not yet been studied.

Broccoli Compounds Enhance Chemotherapy

A new chemotherapeutic drug called Yondelis (trabectedin) seems very promising for breast and ovarian cancer, melanoma, sarcoma, and others. However it proved to be toxic to the liver. So, researchers in Europe went looking for help. They found I3C.²⁸ Knowing that the vege-compound regulates critical liver enzymes, they decided to see if it could reduce toxicity. The results were remarkable. Rats with a very aggressive mammary cancer were tested in a study that utilized I3C as a part of the chemotherapy. When I3C was added to their diet before treatment with the drug, I3C protected against liver toxicity almost completely. Not only did I3C not interfere with the drug's ability to kill cancer cells, it almost doubled its efficacy. And that's not all. One of the side effects of the phyto-compound called in to save the liver was that it did almost as well as the drug (43% reduction in tumor weight versus 54%—combined 71% reduction in tumor weight). (Note: DIM was also tested, but did not have the same effect.) While this new study is the most dramatic one involving chemotherapy, it is not the only one.



Enlarge Diagram

Mitomycin C is a chemotherapeutic drug used to treat cancers such as gastric, breast, lung, and colorectal. After it is administered, it is activated by enzymes in the human body and in cancer cells themselves. But some cancer cells do not have much of the activating enzyme. Hence, mitomycin C does not work very well against those cancers.

After more than a dozen potential candidates were tested, sulforaphane emerged as the most potent enhancer of the necessary enzyme. It was able to more than double the amount in breast cancer cells.²⁹ Since the study was published, the group has done more research with a new study to be published soon.

Vege-compounds can also protect healthy tissue during chemotherapy. Indian researchers have shown that I3C protects bone marrow cells from the toxicity of another chemotherapeutic drug, cyclophosphamide.^{30,31}

Sulforaphane Eradicates Ulcer Bug and Cancer Along With It

Helicobacter pylori is one tough little bacterium. It evades the human immune system and assassinates some types of immune cells on sight. When it infects stomach cells, it produces a toxin that eats holes in the mucous lining, causing ulcerated, inflamed areas. When a person with *H. pylori* eats, food comes in contact with raw tissue, causing pain and distress. It causes stomach ulcers, gastritis and—if left untreated—stomach cancer. But, it is not easily eradicated. *H. pylori* can lie low during antibiotic treatment, and emerge later. It usually takes two or three antibiotics to kill it.

It has been known since at least the 1950s that cruciferous plants contain natural antibiotics. However, it was not until Johns Hopkins researchers did some investigating that this little-known fact was put to good use.

News about people with stomach ulcers who were getting well after eating broccoli sprouts led the researchers to look into the antibiotic potential of one of the plant's phyto-chemicals, sulforaphane. The results were published in the Proceedings of the National Academy of Sciences.³³

Sulforaphane, isolated from broccoli seeds, eradicated strains of *H. pylori* from 45 people, including strains resistant to antibiotics.

The effect of sulforaphane was much stronger than allixin from garlic, resveratrol from grapes, and EGCG from tea. In addition, when sulforaphane was given to rodents before and during a cancer-causing chemical, it reduced the number of stomach tumors by 39%. It works by activating phase II detoxification/antioxidant enzymes.

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