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Study finds broccoli could block cancers

Compounds amplify body's defences

The New York Times and Associated Press

WASHINGTON – Yes, broccoli is as good for you as it's chopped up to be. Likewise for cauliflower, Brussels sprouts, cabbage and other members of the cruciferous family of vegetables.

Offering new proof for the protective benefits of chemicals found in many plant foods, scientists have shown that a compound isolated from broccoli, called sulphoraphane, blocks the growth of tumours in mice treated with a cancer-causing toxin.

Dr. Paul Talalay, Dr. Gary Posner and their colleagues at Johns Hopkins University in Baltimore report on sulphoraphane in today's issue of *The Proceedings of the National Academy of Sciences.*

Dr. Talalay said yesterday that sulphoraphane and some related compounds are apparently able to amplify the body's own defences against chemicals that can lead to cancer.

"Most cancer-causing chemicals are themselves innocuous until they enter cells where they are converted to enzymes which are highly reactive and are capable of initiating tumour formation."

Sulphoraphane and its chemical cousins, he said, cause the body to produce another type of enzyme that blocks the cancer-causing action of the first enzyme.

"The second family of enzymes tends to detoxify the effects of the other enzymes," said the researcher. He called the results "quite dramatic."

The scientists injected 29 mice with either a low or high dose of a synthetic version of sulphoraphane, and then followed up with a shot of dimethyl benzanthracene, a toxin known to cause mammary tumours. For comparison, 25 mice were injected with DMBA without the benefit of a sulphoraphane pretreatment.

While 68 per cent of the group that did not receive sulphoraphane came down with breast cancer, only 35 per cent of the mice receiving the low dose and a mere 26 per cent of the rodents given the high dose of sulphoraphane contracted cancer. What is more, sulphoraphane delayed the onset of the cancer, and kept the number and size of any resulting tumours camparatively small.

In a related development, researchers may have discovered why cancer cells are able to reproduce endlessly, a finding that could lead to drugs that would attack disease cells directly, without harming healthy tissue.

Calvin Hartley, who directed the research at McMaster University in Hamilton, said his group has found in cancer cells an enzyme that permits the unlimited replication of new cells. The enzyme is absent in normal body cells.

This suggests, Dr. Hartley said, that the enzyme, called telomerase, is what allows cancer cells to become "immortal," a laboratory term for the ability of a cell line to grow new cells endlessly through the division of old cells.

Dr. Hartley said yesterday that normal cells are able to reproduce only a finite number of times, limited by the condition of the tip of the chromosomes in a cell. This tip, called the telomere, contains a cap of identical genes that protect the rest of the gene structure. It works rather like an aglet, the plastic tip that prevents a shoelace from fraying.

When cells divide, some of the telomere genes are lost. Since each cell line started with only about 1,000 of the telomere genes, the number of daughter cells that can be produced is limited. When the cell line runs out of telomere genes, the cell line dies, a phenomenon called cell senescence. This is a strong contributing factor to aging and death.

Cancer cell lines, however, seem to be able to replicate endlessly and without control.

Dr. Hartley said his study suggests that this is because, for unknown reasons, cancer cells produce telomerase, an enzyme that is able to repair the telomere by replacing the genes that were lost. Since the telomere is constantly repaired, cancer cells have no senescence.

A drug that would block telomerase, he said, would limit the ability of cancer cells to reproduce, but would have little or no effect on normal cells. Since cancer cells would not be able to reproduce, the cell line would eventually die and tumours would shrink.

REFERENCES: Zhang, Y., Kensler, T.W., Cho, C.-G., Posner, G.H. and P. Talalay: Anticarcinogenic activities of sulforaphane and structurally related synthetic norbornyl isothiocyanates. *Proc. Natl. Acad. Sciences USA* **91**(#8): 3147-3150 (1994). [DC Library call number: PER Q11.N26]

Counter, C.M., Hirte, H.W., Bacchetti, S. and C.B. Hartley: Telomerase activity in human ovarian carcinoma. *Proc. Natl. Acad. Sciences USA* **91**(#8): 2900-2904 (1994).

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