

Selenium and Cancer: A Geographical Perspective

Simone and colleagues¹ recently predicted that, by the year 2000, "cancer will emerge as the number one cause of death in the United States". They further pointed out that, not only is the incidence of many cancers rising, but that treatment, despite the introduction of radiation therapy, chemotherapy, and immunotherapy, is still largely ineffective. Indeed, these authors argued that the "success in the treatment of cancer plateaued in the 1970s, and no real advances have been made since then".

While Simone and co-workers are correct and the age adjusted mortality rate for cancer is soon likely to surpass that for diseases of the heart, this situation easily could have been prevented. In 1966, Dr. Raymond Shamberger² discovered that cancer patients displayed depressed selenium blood levels. Together with Dr. Douglas Frost,³ he then established that, in the United States, there was an inverse relationship between cancer incidence and mortality and selenium levels in soils and crops. Furthermore in 1977, Schrauzer and his colleagues⁴ discovered that, in the 27 countries they surveyed, cancer mortality was inversely proportional to the amount of selenium in the typical national diet. Since Shamberger's initial discovery, several hundred research projects have been conducted into the selenium-cancer relationship. These have included clinical prospective and retrospective studies, epidemiological and geographical research examining links between cancer and selenium blood levels, food content and soil status and more recently, therapeutic field trials. The vast majority of these studies have produced results which are consistent with the belief that selenium has anti-cancer properties. Indeed, Passwater⁵ has argued that "the evidence for a prophylactic role for selenium is without a doubt stronger than for any other factor, including the nutrient beta-carotene, dietary fibre, crucifers or any other food factor recommended as po-

tential cancer-preventative agents by the American Cancer Society, National Cancer Institute, and other organizations."

Obviously an editorial is not the place to review the massive literature that so clearly establishes selenium as a significant cancer prophylactic. However, three field trials warrant further comment. Linxian, a rural county located in north central China, has one of the highest mortality rates of cancers of the esophagus and gastric cardia in the world.⁶ Death rates from these cancers are some 100 times higher than in the United States, despite the fact that, in Linxian, tobacco and alcohol use is not excessive. Diet, in this area of China, however, is low in fruits and meats and probably as a result, blood micronutrient levels, including those of vitamins A, B, C and E are depressed in comparison to Western standards. In a study sponsored by the US National Cancer Institute, which began in March 1986, 29,584 adults in Linxian, aged between 40 and 69, received daily vitamin and/or mineral supplements or a placebo. To test the largest number of potentially preventative vitamins and minerals, participants receiving supplements were randomly assigned to one of four groups. The first of these received 5000 international units of retinol and 22.5 milligrams of zinc oxide and the second 3.2 milligrams of riboflavin and 40 milligrams of niacin. Group three was given daily doses of 120 milligrams of ascorbic acid and 30 micrograms of molybdenum yeast complex, while the final group received the antioxidants beta carotene (15 milligrams), 30 milligrams of alpha tocopherol and 50 micrograms of selenium yeast.

After five years and three months of such supplementation, the group taking beta carotene, vitamin E and selenium showed significant benefits, which had begun to appear less than two years into the trial. This group, for example, displayed a seven percent decline in expected cancer incidence, together with a four percent drop in mortality from esophageal cancer and a 21 percent fall in death from stomach cancer. Mortality from

stroke also dropped by 10 percent. After over five years of use, no other combination of supplements significantly reduced cancer risk.

The National Cancer Institute's official reaction to these results were that "The findings from Linxian are encouraging, but NCI cannot as yet recommend that Americans begin taking dietary supplements to reduce their cancer risk.⁷ This conservative message was repeated for stroke.

A further field trial recently has been conducted in certain low selenium states in the United States.⁸ Between 1983 and 1991, seven dermatology clinics recruited a total of 1312 patients, with a mean age of 63 years, who had a history of basal and/or squamous cell carcinoma. These took part in a randomized, double-blind, placebo controlled prevention trial, that utilized 200 micrograms of selenium in brewer's yeast tablets. It was discovered that, after a total following of 8271 person-years, selenium treatment did not significantly affect the incidence of basal or squamous cell skin cancer. However, patients in the group receiving selenium had a significant reduction in their total cancer mortality. In addition, this trace element was found to have produced significant reductions, in comparison to gender-matched controls, in the incidences of total cancer (41 percent), total carcinomas (46 percent) and in cancers of the prostate (69 percent), colon-rectum (64 percent) and lung (46 percent). These beneficial effects were consistent over time and between study clinics, clearly supporting the hypotheses that supplemental selenium had reduced cancer risk.

These results have caused a huge surge of interest in selenium within the conventional medical establishment. This is because they represent the first double blind cancer prevention trial, in a western population, that has shown a nutritional supplement can significantly lower the risk of cancer. As a consequence, at least seven countries are planning to participate in a major randomized control trial of the impact of selenium on

cancer.⁹ Currently, Finland, Norway, Sweden, Denmark, the Netherlands, the United Kingdom and the USA plan to participate. Each country intends to recruit and randomize some 7,500 subjects, equally divided by gender and aged between 60 and 74. These participants will receive either a placebo, or one of three daily dosages of selenium, 100, 200 or 300 micrograms. In total, there will be some 52,500 subjects involved in the trial, 75 percent of whom will be receiving a selenium supplement. The trial, therefore, will have the statistical power to detect at least a 10 percent reduction in total cancer with 90 percent power. It is expected to last for six years, cost \$30 million and begin in 1998.

I have no doubt that this major international field trial will provide further supporting evidence of the anti-cancer properties of selenium. However, one has to ask, "Why, given the enormous and increasing mortality from cancer, has it taken so long to reach this stage?" As early as 1978, Gerhard Schrauzer¹⁰ reported to a Workshop in Chemoprevention of Cancer, held at the National Cancer Institute, that "the key to cancer prevention lies in assuring the adequate intake of selenium, as well as other essential trace elements". Elsewhere,¹¹ in 1978 he argued that selenium's use as a supplement could cut cancer mortality in the USA by 80 to 90 percent, saving 200,000 to 225,000 lives annually. Nor was Schrauzer alone in his views, a poll of bioinorganic scientists attending an international meeting in San Diego, in the Spring of 1979, showed that a majority believed that available data was sufficient to show that supplementation of diet with 100 to 200 micrograms of selenium would reduce cancer incidence.¹² They supported a human field trial to test selenium's effectiveness and suggested that it should involve 10,000 to 15,000 individuals taking selenium and an equal number a placebo. Indeed, when I began my own research into the geography of cancer in 1983, it took me only a few weeks to reach the conclusion that selenium was a key cancer prophylactic and I immediately

began to take a daily selenium yeast supplement (100-400 micrograms).

There appear to be two reasons, at least, why conventional medicine is leading the selenium revolution from the rear. Dr. Hoffer frequently has written about the terrible suffering caused by the innate conservatism of the medical profession, which has demonstrated itself, for example, in delays in accepting that folic acid prevents spina bifida, or that niacinamide is helpful in osteoarthritis.¹³ Secondly, there is a widespread, unfounded belief that selenium, even at low levels, is toxic.

As Taylor¹⁴ recently pointed out, however, aborigines in northern Greenland have ingested from 600 to over 700 micrograms of selenium for extended periods of time, without any evidence of any ill effects. Similarly, in Enshi county, Hubei Province, South China,¹⁵ during the period 1961 to 1964, villagers were consuming as much as 38 milligrams of selenium daily, often for protracted periods. Those affected lost nails and hair and suffered skin lesions and abnormalities of the nervous system, but on leaving the area they subsequently largely recovered and now show no subsequent evidence that their life spans have been reduced. The evidence suggests, therefore, that selenium's toxicity is overestimated.

In conclusion, I feel obliged to quote Dr. Hoffer¹³ "Medical discoveries take at least forty years – two human generations – before they are generally accepted..." What a terrible waste of human comfort, happiness and health, not to forget costs." How long it will take the medical profession to realize that selenium-enriched garlic is a more effective anti-cancer agent than selenium-enriched brewer's yeast¹⁶ and that as in Senegal,¹⁷ the world's lowest cancer incidence occurs where diets are elevated, not just in selenium, but also in calcium, magnesium and vitamin E,¹⁸ is as yet, unclear.

–Harold D. Foster, Ph.D

References

1. Simone CB, Simone, NL, Simone, CB: Nutri-

- tional and lifestyle modification to augment oncology care: an overview. *J Orthomol Med*, 1997; 12(4): 197-206.
2. Shamberger R, cited by Passwater, RA: *Selenium as Food and Medicine*. New Canaan, Ct. Keats Publ. 1980; 18.
3. Shamberger R, Frost D: Possible protective effect of selenium against human cancer. *Can. Med Assoc J*, 1969; 100: 682.
4. Schrauzer GN; Cancer mortality correlation studies–III: Statistical associations with dietary selenium intakes. *Bioinorg Chem*, 1977; 7(1): 23-31.
5. Passwater RA: *Selenium against cancer and AIDS*. New Canaan, Ct. Keats Publ. 1980; 18.
6. National Cancer Institute: Supplements reduce deaths in a high-risk population in China. *Cancer Facts*, 1993: 1-9.
7. *Ibid.*, 7.
8. Clark LC, Combs GF, Turnbull BW, Slate EH et al: Effects of selenium supplementation for cancer prevention in patients with carcinoma of the skin: a randomized controlled trial. *JAMA*, 1996, 276(24): 1957-1963.
9. Clark LC: Recent developments in the prevention of human cancer with selenium. *The Bulletin of Selenium-Tellurium Development Association*, November 1997; 1-4.
10. Paper presented by Schrauzer G, at the Workshop on chemoprevention of cancer, National Cancer Institute, Bethesda, Maryland, February 2, 1978, cited by Passwater RA.; *Selenium as food and medicine*. New Canaan, Ct, Keats Publ. 1980; 15.
11. Schrauzer G: *Inorganic and nutritional aspects of cancer*. New York. Plenum Press: 1978; 336.
12. Passwater RA, 1980.
13. *J Orthomol Med*, 1997; 12(4): 195-196.
14. Taylor EW: Selenium and viral diseases: facts and hypotheses. *J Orthomol Med*, 1997; 12(4): 227-239.
15. Yang Guang-Qi: Research on selenium-related problems in human health in China in Combs GF, Spallholz JE, Levander OA, Oldfield JE. *Selenium in Biology and Medicine*. Van Nostrand Reinhold: New York, 1987; 9-32.
16. Ip C, List DJ, Stoewsand GS: Mammary cancer prevention by regular garlic and selenium-enriched garlic. *Nutrition and Cancer*; 1992; 17(3): 279-286.
17. Howe GM: International variations in cancer incidence and mortality in eds. Howe GM: *Global geocancerology: a world geography of human cancers*. Edinburgh, Churchill Livingstone: 1986; 3-42.
18. Foster HD: Reducing cancer mortality: a geographical perspective. *Western Geographical Series*, 1986; 23: 1-169.