Re: Selenium and Vitamin E: Interesting Biology and Dashed Hope

The contrast between the highly optimistic results seen in the Nutritional Prevention of Cancer Trial (NPC Trial) (1) showing a 63% lower incidence of prostate cancer in individuals taking selenium and the negative result from the Selenium and Vitamin E Cancer Prevention Trial (SELECT) (2) has astonished many scientists. The contrast lead Klein (3) to conclude in his editorial that new scientific-based arguments are needed. The fact that selenium was ineffective in preventing prostate cancer in SELECT could be due to the type of selenium used. In SELECT, 200 µg of l-selenomethionine was chosen on the basis of weak scientific evidence, expert opinions, and voting, whereas in the NPC Trial, the 200 µg of high-selenium yeast contained only 20% of l-selenomethionine (ie, 40 µg). Other selenium-based compounds used in this trial supplement were selenocysteine, Se-methylselenocysteine, selenoethionine, selenoglutathione, selenodiglutathione, and selenite (representing another 40 µg) (4).

A meta-analysis of 20 epidemiological studies reported an inverse association between cancer and the plasma selenium levels for prostate cancer. All of these studies were based on the assessment of daily food intake and not on food supplements (5). Uptake of selenium from food and possibly also from high-selenium yeast differs from that of l-selenomethionine.

In animal studies, antitumorigenic activity has been observed in metabolites of naturally occurring forms of selenium (ie, selenomethionine, selenocysteine, methylselenocysteine, and inorganic selenium salts, selenite and selenate), which were metabolized to selenodiglutathione (6). This antitumorigenic activity has been confirmed in human cancer cell lines but not in human populations. It has been reported (7) that one single intravenous dose of 200 µg l-selenomethionine can circulate in the plasma and in peripheral tissue for up to 400 days. Therefore, we assumed that it is likely that plasma concentrations of l-selenomethionine from supplements cannot reach a steady state. Furthermore, when men are deficient in methionine, a greater percentage of l-selenomethionine can be incorporated nonspecifically into body proteins instead of methionine because Met-tRNA is not able to distinguish methionine from selenomethionine and so the antitumorigenic activity of l-selenomethionine is compromised by being randomly inserted into various proteins instead of entering the metabolic pathway (Figure 1) (4).

If l-selenomethionine is not the active agent in the chemoprevention of prostate cancer, the active agent may be the high-selenium yeast itself. This possibility should be the subject of future investigations.

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References


Notes

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Figure 1. Flow of selenomethionine and other Se-containing compounds in the selenium metabolic pathway. β-lyase = “the enzyme” β-lyase.
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