The Relative Efficacy of Lycopene and β-Carotene in Inhibiting Experimental Metastasis of Human Hepatoma SK-Hep-1 Cells in Athymic Nude Mice

Dear Editor,

In a recent issue of The Journal of Nutrition, Huang et al. (1) reported that lycopene inhibits experimental metastasis of human hepatoma SK-Hep-1 cells in athymic nude mice. In that study, lycopene or β-carotene-treated mice were injected with human hepatoma SK-Hep-1 cells via the tail vein. At the end of the experiment, lycopene-treated mice had a lower number of tumors and decreased tumor cross-sectional areas in the lung than the control mice. Lycopene treatment also decreased the rate of proliferating cell nuclear antigen, level of vascular endothelial growth factor, and protein expression of proliferating cell nuclear antigen, level of vascular endothelial growth factor, and metalloproteinase. Similar results were found in mice treated with β-carotene. Based on the data presented, β-carotene appears to be more effective than lycopene in attenuating the lung metastasis and related indices examined. However, except for the Methods and Results sections, this equally interesting finding regarding β-carotene is barely addressed in this article.

A unique feature of the study is the measurement of lycopene and β-carotene concentrations in lung tissues. This information allows for a direct and closer comparison of the relative efficacy of these 2 compounds in situ. Based on the extent of the inhibition of experimental tumor metastasis and attenuation of factors associated with tumor invasion, proliferation, and angiogenesis, the authors concluded that the efficacy of β-carotene treatment lies between that of high-dose and low-dose lycopene. However, as shown in Table 5, lycopene concentration in the lung increased from $<1$ nmol/g to $58 \pm 7$ and $332 \pm 181$ nmol/g following treatment with 1 and 20 mg/kg body weight, respectively. On the other hand, β-carotene treatment ($20$ mg/kg body weight) raised the lung concentration from $13 \pm 5$ to $35 \pm 4$ nmol/g: a net increase of only $22$ nmol/g. Therefore, if a comparison is made based on either the net increase or actual tissue concentration, β-carotene is far more effective than lycopene in terms of the endpoints studied.

β-Carotene has also been shown to inhibit lung metastasis induced by B16F-10 melanoma cells in mice (2), downregulate inducible nitric oxide synthase gene expression and induce apoptosis by suppressing bcl-2 expression and activating caspase-3 and p53 genes in B16F-10 melanoma cells (3), and downregulate the steady-state and heregulin-α-induced COX-2 pathways in colon cancer cells (4). A number of observational epidemiologic studies have shown that individuals who consume more carotenoids and/or have higher levels of serum β-carotene have a lower risk of cancer and other chronic diseases. However, the results obtained from human trials with β-carotene are inconclusive or contradictory (5,6). The tissue uptake and retention of a compound is determined not only by the amount treated or administered but also by other factors. The inclusion of target tissue concentration before and after treatment, such as the lung lycopene and β-carotene concentrations reported in this study, is likely to provide a better understanding of the role of carotenoids in the etiology of human cancer.

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Literature Cited


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