Plant genomic resources for testing physiological effects of dietary carotenoids.

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Correlative evidence suggests that enhanced consumption of carotenoids may decrease risk of cancer. Lack of knowledge concerning how carotenoid structure and concentration affect uptake and biological activity in the human body limits the use of these compounds as functional foods. Variation in the concentration and isomeric structure of specific carotenoids exists within varieties of tomato, and modification of one carotenoid often affects related compounds in the biochemical pathway, thus it is difficult to separate the effects of one carotenoid from another. In order to develop genetic resources to test the physiological effects of dietary carotenoids in the food matrix, we used molecular-marker-assisted and classical selection to combine genes that affect both the biochemical synthesis of carotenoids and the structure of the chromoplast. We developed tomato lines with enhanced and altered concentration of carotenoids. The lines range in concentration from 0-132 µg/gm lycopene, 0-52 µg/gm β -carotene, 0-45 µg/gm δ-carotene, 0-52 µg/gm tetra-*cis* lycopene, and 0-62 µg/gm ζ-carotene on a fresh weight basis. When genes that affect chromoplast quantity (*dg*) are combined with genes that affect the conversion of tetra-*cis* lycopene (*t* and t^{v}) to lycopene, ζ -carotene concentration is also altered. This result emphasizes the important role of genetic interactions on the concentration of carotenoids in the tomato fruit. To evaluate the physiological significance of bioactive components in the food matrix will involve blending product from specific lines in order to control concentrations and ratios of the specific carotenoids under study as well as precursors that may impart biological activity.