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Curcumin, the golden spice from Indian saffron, is a chemosensitizer and radiosensitizer for tumors and chemoprotector and radioprotector for normal organs.

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Abstract

Curcumin (diferuloylmethane), the yellow pigment in Indian saffron (Curcuma longa; also called turmeric, haldi, or haridara in the East and curry powder in the West), has been consumed by people for centuries as a dietary component and for a variety of proinflammatory ailments. Extensive research within the last decade in cell culture and in rodents has revealed that curcumin can sensitize tumors to different chemotherapeutic agents including doxorubicin, 5-FU, paclitaxel, vincristine, melphalan, butyrate, cisplatin, celecoxib, vinorelbine, gemcitabine, oxaliplatin, etoposide, sulfinosine, thalidomide, and bortezomib. Chemosensitization has been observed in cancers of the breast, colon, pancreas, gastric, liver, blood, lung, prostate, bladder, cervix, ovary, head and neck, and brain and in multiple myeloma, leukemia, and lymphoma. Similar studies have also revealed that this agent can sensitize a variety of tumors to gamma radiation including glioma, neuroblastoma, cervical carcinoma, epidermal carcinoma, prostate cancer, and colon cancer. How curcumin acts as a chemosensitizer and radiosensitizer has also been studied extensively. For example, it downregulates various growth regulatory pathways and specific genetic targets including genes for NF-κB, STAT3, COX2, Akt, antiapoptotic proteins, growth factor receptors, and multidrug-resistance proteins. Although it acts as a chemosensitizer and radiosensitizer for tumors in some cases, curcumin has also been shown to protect normal organs such as liver, kidney, oral mucosa, and heart from chemotherapy and radiotherapy-induced toxicity. The protective effects of curcumin appear to be mediated through its ability to induce the activation of NRF2 and induce the expression of antioxidant enzymes (e.g., hemeoxygenase-1, glutathione peroxidase, modulatory subunit of gamma-glutamyl-cysteine ligase, and NAD(P)H:quinone oxidoreductase 1, increase glutathione (a product of the modulatory subunit of gamma-glutamyl-cysteine ligase), directly quench free radicals, and inhibit p300 HAT activity. These preclinical studies are expected to lead to clinical trials to prove the potential of this age-old golden spice for treating cancer patients.

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