COSMECEUTICAL CRITIQUE

Turmeric and Curcumin

Spices do more than season foods. Many of them are used as medicines, and some even play a role in preventing life-threatening conditions.

Turmeric (*Curcuma longa* L. Zingiberaceae) is best known as a seasoning in Asian and other cuisines, particularly in curry and prepared mustard. But it is also used in some traditional Indian communities as a topical burn treatment (Lancet Oncol. 2002;3:713). It has long been employed in Chinese and Ayurvedic medicine as an anti-inflammatory agent (Skin Therapy Lett. 2000;5:1-2,5), including as a treatment for sprains and edema resulting from injury (Phytother. Res. 2003;17:987-1000; Planta Med. 1991;57:1-7). The rhizome of the curcuma plant is the portion used for medicinal purposes.

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Samoans sprinkle the powdered rhizome on newborns to mend the belly button after severing the umbilical cord. They also use the powder to prevent diaper rash, to maintain skin softness and resilience, and as a paste or poultice to treat skin ulcers and eruptions (Phytother. Res. 2003;17:987-1000; J. Ethnopharmacol. 1982;6:294-5; Econ. Bot. 1974;28:8). The many dermatologic uses of turmeric and its principal active ingredient, curcumin, include the prevention and treatment of psoriasis, acne, wounds, burns, eczema, photodamage, and photoaging (Br. J. Dermatol. 2000;143:937-49; Phytother. Res. 2003:17:987-1000).

Curcumin (diferuloylmethane) is a small–molecular-weight phenolic compound that confers a distinctive flavor and yellow color in food. This important isolate exhibits significant wound-healing, anticarcinogenic, anti-inflammatory, and antioxidant properties (J. Trauma 2001;51:927-31). Antibacterial, antiparasitic, and anti-HIV activities have also reportedly been shown by turmeric or curcumin (Phytother. Res. 2003;17:987-1000; Biochem. Pharmacol. 1995;49:1165-70).

The preponderance of research on curcumin, however, relates to its anticarcinogenic characteristics, which are particularly well documented (Biochem. Pharmacol. 2000;59:1577-81; Phytother. Res. 1996;10:577-80; Cancer Res. 1991;51:813-9; Cancer Res. 1988;48:5941-6). Curcumin's antioxidant and antilipid peroxidation activity also is well researched (J. Trauma 2001;51:927-31; J. Ethnopharmacol. 2000;71:23-43; Pharmazie 1995;50:490-2; Food Chem. Toxicol. 1994;32:279-83; J. Pharm. Pharmacol. 1994;46:1013-6).

Anti-Inflammatory Action

Curcumin has shown great potency against acute inflammation (Skin Therapy Lett. 2000;5:1-2,5) and is associated with few toxic effects (Indian J. Med. Res. 1982;75:574-8). It reportedly has greater anti-inflammatory capacity than does ibuprofen (Skin Therapy Lett. 2000;5:1-2,5).

Known to possess antioxidant as well as anti-inflammatory properties, the compound has been studied exhaustively for its potential in conferring chemopreventive activity (Mutat. Res. 1999;428:305-27). In an examination of wound healing, investigators found that curcumin's antioxidant effects potently inhibited hydrogen peroxide–induced damage in cultured human keratinocytes and fibroblasts (J. Trauma 2001;51:927-31).

A recent study has concluded that curcumin has great potential as a therapeutic agent for wound repair, particularly in reducing healing delays caused by radiation and involving combined injuries (J. Wound Care 2004;13:107-9). In that study, researchers used Swiss albino mice to assess the effects on wound contraction of pretreatment with curcumin doses of 25, 50, 100, 150, or 200 mg/kg of body weight before exposure to 6 Gy of whole-body gamma radiation. While irradiation delayed wound healing, curcumin pretreatment was associated with a dose-dependent increase in wound contraction compared with controls, with optimal contraction noted at the 100-mg/kg dose.

The phytochemical isolate from turmeric has exhibited significant inhibitory activity against arachidonic acid–induced inflammation in vivo in mouse skin (Cancer Res. 1991;51:813-9), edema of mouse ears (J. Cell Biochem. Suppl. 1997;27:26-34), and epidermal lipoxygenase and cyclooxygenase in vitro (J. Cell Biochem. Suppl. 1997;27:26-34; Adv. Enzyme Regul. 1991;31:385-96).

Research on turmeric and curcumin shows that these substances have great potential in terms of anticarcinogenic and anti-inflammatory activities.

Tumors

Nearly 20 years ago, an ethanol extract of turmeric and an ointment containing curcumin as its active ingredient were shown to relieve pruritus associated with external cancerous lesions (Tumori 1987;73:29-31). More recently, topically applied curcumin has been shown to inhibit the initiation and promotion of tumorigenesis in animal models. Specifically, the compound inhibits growth of a broad range of tumors initiated by benzo[a]pyrene (B[a]P), as well as tumors induced or promoted in mouse skin by 12-O-tetradecanoylphorbol-13-acetate (TPA) (Oncogene 2004;23:1599-607; J. Cell Biochem. Suppl. 1997;27:26-34).

Low doses of topically applied curcumin have been found to mediate tumor promotion in the skin and TPA-induced oxidation of DNA bases in the epidermis (Carcinogenesis 1997;18:83-8). Pretreatment with curcumin has shown the same inhibitory effects on TPA-mediated dermatitis (Skin Pharmacol. Appl. Skin Physiol. 2001;14:373-85; Dermatology 1996;193:311-7). Topically applied curcumin also has potent inhibitory effects on TPA-induced tumor promotion and DNA synthesis, as well as on TPA-induced ornithine decarboxylase (ODC) activity and inflammation in mouse skin (Photodermatol. Photoimmunol. Photomed. 2001;17:71-8; Cancer Res. 1988;48:5941-6; Adv. Enzyme Regul. 1991;31:385-96), reversing the UVA-enhancing effects of ODC induction (Skin Pharmacol. Appl. Skin Physiol. 2001;14:373-85).

In vitro studies have shown that curcumin increases tumor cell apoptosis in a dose-dependent manner, slows cell growth, and lowers the number of clonogenic cells (Lancet Oncol. 2002;3:713).

Topical curcumin also has been demonstrated as one of the only safe therapies for radiation exposure; it appears to be one of the only chemicals known to protect skin after exposure to radiation or during radiotherapy (Lancet Oncol. 2002;3:713).

When researchers compared four nutraceuticals for their effectiveness against dimethylbenz[a]anthracene (DMBA)–initiated and croton oil–promoted skin tumors, they found that topical application of turmeric rhizomes 1 hour before the administration of croton oil resulted in a 30% incidence of tumors, an 87.2% decrease in number of tumors, and a 5-week delay in tumor formation, compared with the positive control (Nutr. Cancer 2002;44:66-70).

Other promising findings related to skin cancer include curcumin's demonstrated ability to potently inhibit glutathione S-transferase activity toward 1-chloro-2,4-dinitrobenzene in intact human IGR-39 melanoma cells (Chem. Biol. Interact. 1996;102:117-32) and its capacity to induce apoptosis in human basal cell carcinoma cells in a dose- and time-dependent manner (J. Invest. Dermatol. 1998;111:656-61).

Curcumin and its derivatives also have been shown to inhibit the progression of chemically induced colon and skin cancers in animal models. A study of curcumin's capacity both to inhibit the proliferation of primary endothelial cells in the presence and absence of basic fibroblast growth factor and to inhibit the proliferation of an immortalized endothelial cell line revealed that the compound imparts direct antiangiogenic activity in vitro and in vivo, which the researchers believe may account for its cancer-retarding effects in diverse organs (Mol. Med. 1998;4:376-83).

A dose- and time-dependent anticarcinogenic effect of dietary turmeric has been demonstrated on B[a]P-induced forestomach neoplasia and 7,12-DMBA-induced skin tumorigenesis in female Swiss mice (Nutr. Cancer 1992;17:77-83).

Molecular Action

The mechanism by which curcumin exerts its chemopreventive effects remains undetermined (Carcinogenesis 2003;24:1515-24), but recent research using female ICR-strain mice has shown that topical application is associated with suppression of cyclooxygenase-2 (COX-2) expression by inhibiting extracellular signal-regulated kinase (ERK) activity and NF-β activation. The researchers believe this molecular mechanism may explain the antitumorigenic effects of curcumin in mouse skin (Carcinogenesis 2003;24:1515-24).

I believe that this molecular action would make curcumin a helpful adjunct for preventing collagenase formation, in which the *ERK* and *JNK* (c-Jun N-terminal kinase) genes play important roles.

Bioavailability, it should be noted, is a determining factor in a compound's activity in vivo. Accordingly, some authors note the presumptive differences in tissue or cellular concentrations of curcumin, which is effective when applied topically or administered orally to treat the colon, but is ineffective in the lungs (Am. J. Clin. Nutr. 2005;81[1 suppl.]:284S-91S).

Products

Topical curcumin is safe and inexpensive (Lancet Oncol. 2002;3:713). Cosmetics containing the compound are available worldwide, particularly in India (Skin Pharmacol. Appl. Skin Physiol. 2001;14:373-85).

Given the undesirability of the yellow pigment for a topical product, however, there have been formulation challenges. Some authors think new technologies may soon remedy this problem (Skin Therapy Lett. 2000;5:1-2,5).

Conclusions

The body of research on turmeric and curcumin is increasingly impressive, showing that these substances have great potential in terms of anticarcinogenic and anti-inflammatory activities. The traditional dietary and medical uses of the curcuma rhizome provide additional evidence that researchers are moving in the right direction.

Of course, more research is necessary to determine how these promising findings may be applied effectively in the dermatologic armamentarium.

The data on turmeric's potential applications appear to have been sufficient to prompt some people to pay much more attention to their spice racks.

At this time, I think curcumin is best used as an oral agent because of its yellow color and smell, and the difficulty of formulating it into a cosmetically elegant product.

But let's not forget that turmeric is, after all, a spice. Luckily, a great new Indian restaurant just opened on Miami Beach! ■

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