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REPORT

Curcumin Update

New Research on the Multiple Benefits of this Potent Health-Promoting, Disease-Fighting Agent

By Dale Kiefer

From powerful heart medications and antibiotics to simple aspirin, many modern pharmaceuticals have been derived directly from ancient plant and fungal sources that exhibit remarkable abilities to improve well being and intervene in disease processes at the molecular level. Scientists continue to discover medically useful plant compounds that demonstrate powerful anti-inflammatory, anticancer, antibiotic, and antiaging properties. Turmeric is a case in point. This tropical root delivers a smorgasbord of powerful health benefits. New research shows that turmeric—and its main bioactive compound, curcumin—has the power to block inflammation, stop cancer, kill infectious microbes, and improve heart health.



Turmeric is perhaps most familiar as the star ingredient in powdered curry mixes. Curcumin, a group of polyphenolic plant pigments, is responsible for turmeric's characteristic canary yellow color. Curry is the signature seasoning and fragrant dish of the Indian subcontinent.

India's relationship with turmeric, and thus curcumin, goes back thousands of years. Both ginger and turmeric have been cultivated in India and southeast Asia for millennia. India produces and consumes most of the world's turmeric. A cousin of ginger, turmeric was revered by the ancient Romans and Greeks, who valued its medicinal properties. Indeed, its English name derives from its Latin moniker, which roughly translates as "earth-merit."

Unlike their Western counterparts, most native Indians would probably not be surprised to learn that modern science has begun to investigate and catalogue turmeric's various health-promoting properties. Turmeric is familiar to Indians not only as a spice but also as an important element of folk medicine. In the ancient Indian system of Ayurvedic holistic medicine, turmeric is revered for its ability to quell inflammation and to treat a variety of maladies. Indeed, Ayurvedic medicine recommends mixing turmeric in a small amount of honey for the treatment of numerous ailments. It is taken orally at the first sign of the common cold, and the sticky paste is applied to the skin as a topical ointment for the treatment of skin infections and irritations.

Turmeric powder also is a popular remedy for stomach complaints throughout Asia. In Hawaii, it is reportedly used to treat swimmer's ear (infection) and sinus infections. Perhaps one of its most important applications is as an anti-inflammatory for the treatment of arthritis; it has been used as such in China and India for thousands of years.

Modern Science Meets Ancient Faith

Modern scientists have examined these largely faith-based claims and have subjected them to rigorous testing over the last 50 years. Although few large-scale human trials have been completed, hundreds of experiments conducted by researchers around the globe have demonstrated curcumin's ability to halt or prevent certain types of cancer,¹⁻²⁰ stop inflammation,²¹⁻²⁶ improve cardiovascular health,²⁷⁻³¹ prevent cataracts,³² kill or inhibit the toxic effects of certain microbes including fungi³³ and dangerous parasites,^{34,35} and protect, at least in the laboratory, against the damaging effects of heterocyclic amines (potentially carcinogenic compounds found in some cooked foods).³⁶ As one investigative team declared: "[Curcumin] has been proven to exhibit remarkable anticarcinogenic, anti-inflammatory, and antioxidant properties."³⁷

As if that were not enough, this hard-working spice shows promise as a potential treatment for multiple sclerosis,³⁸ and may ameliorate the damaging effects of long-term diabetes.³⁹ It is even being investigated as a topical treatment to speed diabetic wound healing.³⁷ Some researchers also have noted an exciting link between turmeric consumption and a dramatically decreased incidence of Alzheimer's disease, an effect that may well be related to curcumin's ability to block signaling pathways that lead to inflammation.^{40,41}



Cancer-Fighting Capabilities Documented

Numerous studies published in peer-reviewed medical journals detail curcumin's ability to protect against cancer. In addition to its capacity to intervene in the initiation and growth of cancer cells and tumors—and to prevent their subsequent spread throughout the body by metastasis—curcumin also has been shown to increase cancer cells' sensitivity to certain drugs commonly used to combat cancer, rendering chemotherapy more effective in some cases.¹⁻²⁰ Much research has focused on curcumin's anti-inflammatory properties, and some new research suggests that curcumin may protect the heart and circulatory system,²¹⁻³¹ and prevent the onset of Alzheimer's disease.^{40,41} Still other studies have examined curcumin's potential ability to counteract the effects

of fungal toxins in the food supply,³³ and to protect the eyes from cataracts³² and uveitis,⁴² an inflammation of a portion of the eye that may result in glaucoma.

As an anticancer agent, curcumin is promising enough to warrant serious attention from the National Cancer Institute (NCI). In its 2002 annual report, the Chemopreventive Agent Development Research Group, a subset of the NCI's Division of Cancer Prevention, details its efforts to encourage and support research on curcumin's utility in cancer prevention and treatment. Because curcumin is a non-patentable product (see sidebar), such support is crucial, especially for research involving all-important human trials, as other sources of funding are virtually nonexistent. At least one human trial, focusing on dosing, bioavailability, and pharmacokinetics (how curcumin is used, metabolized, and eliminated by the body), is under way at the University of Michigan Comprehensive Cancer Center. Other curcumin studies have been proposed to the NIC and are awaiting approval.

Test-tube and animal-model studies have demonstrated that curcumin exhibits significant anti-cancer activity. Numerous experiments have shown that curcumin inhibits the progression of chemically induced colon and skin cancers. In colon cancer, in particular, curcumin seems to significantly inhibit both the promotional and progression stages of the disease. Various studies have reported that curcumin reduces the number and size of existing tumors, and decreases the incidence of new tumor formation.

Much discussion lately has focused on the use of cyclooxygenase-2 (COX-2) inhibitors—such as the prescription medications Celebrex® and Vioxx®—as potential colon cancer preventive agents. This new approach arose from the observation that people who routinely take anti-inflammatory non-steroidal drugs (NSAIDs) are statistically less likely to develop cancer than those who do not. Unfortunately, NSAIDs are poorly tolerated by some and can even cause bleeding in the gastrointestinal tract. Regarding curcumin's potential benefits for the prevention and treatment of colon cancer, one research team commented: "Naturally occurring COX-2 inhibitors such as curcumin and certain phytosterols have been proven to be effective as chemopreventive agents against colon carcinogenesis with minimal gastrointestinal toxicity."¹⁸

Additionally, other studies using cancer cells grown in the laboratory in vitro have demonstrated curcumin's ability to prompt apoptosis, or programmed cell death, among leukemia, B lymphoma, and other cancerous cells. Curcumin has been used as a topical application to successfully induce apoptosis in skin cancer cells both in vitro and in animal models. Curcumin is under investigation as a preventive agent for increasingly common non-melanoma skin cancers, and as a potential preventive or treatment agent in breast, prostate, oral, pancreatic, and gastric cancers, among others.¹⁻²¹ One researcher understated the matter, noting, " .curcumin...should be considered for further development as [a] cancer preventive agent."⁴³

Curcumin also has been shown to enhance the effectiveness of certain anti-cancer drugs, and, amazingly, to potentially improve the effectiveness of anti-cancer radiation treatment by preventing tumor cells from developing radiation resistance.³³ Protein kinase C (PKC) has been suggested as a possible mechanism by which tumor cells develop resistance to radiation therapy. Curcumin's helpful effect may be due to its ability to inhibit radiation-induced PKC activity. Additionally, one study found that curcumin protected study animals from the tumor-producing effects of deadly gamma radiation,⁴⁴ while another found that it protects against damaging ultraviolet light, which is known to play a role in the development of skin cancer.⁸

Earlier this year, researchers at the University of Texas M.D. Anderson Cancer Center declared: " .curcumin has enormous potential in the prevention and treatment of cancer." They noted that curcumin has been found to be safe for human consumption, even in doses ranging as high as 10 grams per day.¹⁰ But other researchers have observed that more is not necessarily better. A recently published study out of India found that among rats fed a diet causing high blood sugar, those given low doses of

Turmeric Patent Granted and Revoked

Several years ago, two expatriate Indians associated with the University of Mississippi Medical Center filed for a US patent on turmeric. The patent was granted in 1995, but after an outcry from an Indian agriculture group, it was promptly revoked.⁵⁰ Protesters challenged the patent's validity on the grounds that turmeric is a previously available product that has been used medicinally in Asia for centuries. Since "novelty" is a condition of patent protection, it was determined that turmeric is not subject to such protection. The patent was revoked.



curcumin did not develop experimentally induced cataracts as often as control subjects. But rats receiving high doses of curcumin actually developed cataracts somewhat faster, possibly due to increased oxidative stress.³² The difference in dosing was extreme, but these findings underscore the importance of further inquiry into the uses of curcumin in humans for a variety of diseases and under a variety of conditions.

Contrary to the many remarkably encouraging reports on curcumin's anti-cancer benefits, at least one study reported that curcumin interfered with, rather than potentiated, the effects of anti-cancer chemotherapy.¹⁹ Another study found no significant therapeutic effect against prostate cancer,²⁰ a finding that stands in stark contrast to numerous other studies that have noted significant anti-prostate cancer activity by curcumin.^{12,13} This lack of consensus has led some experts to caution against taking curcumin during chemotherapy, except under an oncologist's supervision.

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Heart Health Benefits

Some of the most intriguing new research on curcumin's potential benefits involves its apparent ability to improve cardiovascular health. As with many of curcumin's protective actions, this ability to improve circulatory system function may be due to its powerful antioxidant activity. Late last year, several reports detailed curcumin's ability to protect test animals against a variety of conditions that model heart disease in humans.

Researchers in Egypt noted that curcumin protected rats from oxidative stress injury following experimentally induced stroke.⁴⁶ Stroke is a common result of thrombosis and/or atherosclerosis, which leads to clogging of the arteries that supply the brain with vital oxygen and nutrients. It is believed that such injury, known as ischemia/reperfusion (I/R) insult, is responsible for many of the deficits seen in stroke victims. Researchers concluded that curcumin protected the rats from I/R damage. They noted that when curcumin was administered at the highest levels, injury-related oxidants, believed to be responsible for the majority of I/R damage, were significantly reduced.⁴⁶

Among the Reactive Oxygen Species (ROS) whose levels or activities were reduced by curcumin were xanthine oxidase, superoxide anion, malondialdehyde, glutathione peroxidase, superoxide dismutase, and lactate dehydrogenase. As most readers of Life Extension already know, scientists attribute many of the undesirable effects of aging to the rogue activities of damaging free radicals, and antioxidants are crucial for their control. As noted previously, curcumin is a powerful antioxidant and many of its beneficial effects may be directly related to its ability to scavenge and neutralize these ROS.



Positive Effects on Cholesterol

In laboratory tests on animals and in vitro, scientists have shown that curcumin prevents lipid peroxidation and the oxidation of cellular and subcellular membranes that are associated with atherosclerosis.^{27,28,30,31,47} Moreover, curcumin acts to lower total cholesterol levels. Perhaps even more important, it prevents peroxidation of LDL ("bad") cholesterol. LDL peroxidation plays a key role in the development of atherosclerosis, so it follows that a substance that inhibits peroxidation should benefit cardiovascular health.



Atherosclerosis is a common disorder associated with aging, diabetes, obesity, and a diet high in saturated fat. It begins gradually, as cholesterol and other lipids deposit on arterial walls and form damaging plaques. Oxidized lipids are suspected of playing a particularly damaging role in the progression of atherosclerosis. As plaques grow, vessel walls may eventually thicken and stiffen, restricting blood flow to target organs and tissues. Atherosclerosis is a major cause of heart disease and may also lead to stroke. When atherosclerotic plaques restrict blood flow to the heart, depriving cardiac muscle of vital oxygen and nutrients, coronary tissue dies. Angina and heart attack are the result. Since curcumin is a naturally occurring, well-tolerated antioxidant that is capable of destroying the dangerous free radicals that lead to lipid peroxidation, it would appear that it holds enormous potential in the fight against heart disease.

Still more intriguing than its ability to limit peroxidation is the finding that curcumin raises HDL ("good") cholesterol levels, even as it reduces LDL levels. In a small study of human volunteers, researchers reported a highly significant 29% increase in HDL among subjects who consumed one-half gram (500 mg) of curcumin per day for seven days. Subjects also experienced a decrease in total serum cholesterol of more than 11%, and a decrease in serum lipid peroxides of 33%.⁴⁸ Further human studies are needed, but these preliminary findings are promising. As one research team noted: "Administration of a nutritional dose of *C. longa* extracts [curcumin]...may contribute to the prevention of effects caused by a diet high in fat and cholesterol in blood and liver during the development of atherosclerosis."²⁷

Although scientific investigation into the therapeutic properties of curcumin is ongoing, it seems clear that this plant pigment from a humble tuber has powerful healing potential. The data are occasionally conflicting, but it seems likely that adding curcumin to one's diet makes exceptionally good sense. Curcumin appears to prevent certain cancers, inhibit cardiovascular disease, and quell inflammation, and may even offer protection against Alzheimer's disease. Because it has been consumed safely by millions of people literally for millennia, the choice to supplement one's diet regularly with curcumin would seem to be a no-brainer. One word of caution, however: curcumin is poorly absorbed by the gut. Its absorption and bioavailability are significantly enhanced by

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