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File: ■ Turmeric (*Curcuma longa*)
■ Curcumin
■ Bioactivity

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RE: The Bioactivity of Curcumin – an Active Constituent of Turmeric

Witkin JM, Li X. Curcumin, an active constiuent [*sic*] of the ancient medicinal herb *Curcuma longa* L.: some uses and the establishment and biological basis of medical efficacy. *CNS Neurol Disord Drug Targets*. April 4, 2013;12(4):1-11. [epub ahead of print].

Turmeric (*Curcuma longa*) root is used around the world in a multitude of traditional medicine systems[1] and is reported to be used for digestive problems, as an anti-inflammatory, and topically.[1] In traditional Chinese medicine, turmeric is part of a combination used for the alleviation of stress and dyspepsia, among other conditions. Curcumin is the compound considered to be central to the bioactivity of turmeric. This review summarizes research on the bioactivity of curcumin.

Curcumin is thought to work via the inflammation, cell death, and oxidative stress processes. Previous studies have shown curcumin to have anticancer properties; it halts the growth of tumors and modulates secondary problems such as fatigue, depression, and sleep issues. Curcumin has also been shown to quench reactive oxygen species and to attenuate nuclear factor-kappaB (NF-κB), an immune and inflammatory signaling agent. In vivo, curcumin halted protein expression linked to the regulation of cell growth and survival, tumor proliferation, and angiogenesis, and induced apoptosis. The activation of signal transducer and activator of transcription 3 (STAT3), upstream of cancer growth, was also attenuated by curcumin. Additionally, damage caused by stroke has also been improved by curcumin.

Curcumin has been reported to be active in alleviating a host of inflammation-related conditions including multiple sclerosis, rheumatoid arthritis, psoriasis, and others. This is thought to be due to the modulation of cytokines, a class of inflammation signalers. Curcumin also attenuates glutamate production, the overexpression of which can be disruptive. Furthermore, curcumin has also been shown to prevent the buildup of amyloid-β plaques, which is correlated with Alzheimer's disease.

Other studies with acute and chronic curcumin administration in vivo have shown that curcumin has biological mechanisms of action against both stress and depression.

These mechanisms include the modification of neurotransmission, modulation of cell signaling, decrease of oxidative stress, and promotion of endogenous neuroprotection. Studies have also reported that curcumin modulates signaling upstream of mood problems; and that curcumin activates neurogenesis, which is a potential target for treating mood and depression. In vivo, curcumin also benefitted learning.

Curcumin has been investigated clinically for a variety of treatments in both healthy and unhealthy subjects. A dose of 8 g daily of curcumin caused no serious adverse side effects, with only nausea and diarrhea being reported; however, curcumin has demonstrated limited bioavailability when taken orally. A clinical study in patients with colorectal cancer reported benefits on body weight. When used along with standard medications in patients with inflammatory bowel disease, positive effects were seen in symptoms, and medication dosages were lowered or ended. In a study of patients with prediabetes, oral administration of curcumin prevented the onset of diabetes and improved β-cell function, insulin sensitivity, and inflammation markers, as compared to those in the placebo group.

The authors address the potential improvement of poor bioavailability of oral forms of curcumin as an important future research direction. In general, curcumin has little solubility in water, low absorption, and a brief half-life. Possible solutions to these problems are the production of analogs, the combination of curcumin with other compounds, and/or modifying the delivery of curcumin, such as using liposomal or phospholipid mixtures and incorporating nanoparticles. A combination of curcumin with other compounds found in turmeric (BCM-95® CG; Frutarom Health; Haifa, Israel) improved bioavailability by seven times above that of curcumin by itself.

In conclusion, curcumin has been found to have a range of bioactivity, both in vivo and clinically. Mechanisms of action for much of the bioactivity have also been elucidated. Further studies will ideally improve the oral bioavailability of curcumin, and additional clinical trials could confirm the usage of curcumin in treating myriad diseases and conditions.

—Amy C. Keller, PhD

Reference

[1]Blumenthal M, Goldberg A, Brinckmann J, eds. *Herbal Medicine: Expanded Commission E Monographs*. Austin, TX: American Botanical Council; Newton, MA: Integrative Medicine Communications; 2000.

The American Botanical Council has chosen not to reprint the original article.