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**File: ■ Turmeric (*Curcuma longa*, Zingiberaceae)
■ Curcumin
■ Medicinal Properties**

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RE: A Review of the Medicinal Properties of Turmeric with Specific Focus on Curcumin

Hewlings SJ, Kalman DS. Curcumin: A review of its' [sic] effects on human health. *Foods*. October 2017;6(10):E92. doi: 10.3390/foods6100092.

Turmeric (*Curcuma longa*, Zingiberaceae) is a perennial plant and the rhizome is used as a culinary spice and medicinally. Turmeric is the major source of curcumin, a polyphenol with numerous health benefits, but poor bioavailability. Turmeric has long been used medicinally and has antioxidant, anti-inflammatory, antimicrobial, anticancer, and antimutagenic properties. The purpose of this review was to summarize the effects of curcumin on human health.

Curcumin is an antioxidant and an anti-inflammatory. As an antioxidant, it works through superoxide dismutase (SOD), catalase, glutathione peroxidase (GSH), and lipid peroxides. It can also scavenge or neutralize free radicals, inhibit reactive oxygen species (ROS)-generating enzymes, and scavenge peroxy radicals. It further acts as an anti-inflammatory in multiple ways, including the partial blockage of NF-κB.

Curcumin has poor bioavailability. The addition of piperine from black pepper (*Piper nigrum*, Piperaceae) to curcumin increased curcumin's bioavailability by 2000%. The U.S. Food and Drug Administration (FDA) states that curcuminoids are "Generally Recognized as Safe" (GRAS), and clinical trials have reported that 4,000-8,000 mg of curcumin [alone] are safe with good tolerability.¹ [Note: It would have been useful to elucidate how the addition of piperine, and other compounds to increase bioavailability, affects the amount of curcumin that can be safely consumed. It would also be useful to delineate any concerns with the use of piperine, i.e., the long list of known prescription drug interactions]

The authors reviewed studies on "the anti-arthritis effects of curcumin in humans," and found reports that curcuminoid preparations improved pain, physical function, and stiffness, and decreased markers of oxidative stress and inflammation in populations with varying severity of osteoarthritis. Metabolic syndrome (MetS) is a cluster of conditions that increase the risk of cardiovascular disease and type 2 diabetes and has an inflammatory component. Curcumin may be useful in treating MetS, as it reportedly reduces elevated blood pressure, inflammation, and oxidative stress; improves insulin sensitivity, and inhibits fat cell maturation. There is also evidence that it reduces triglycerides and increases high density

lipoprotein cholesterol (HDL-c). In a study of 117 patients with MetS who received either 1 g curcumin with 10 mg piperine, or placebo with 10 mg piperine, for eight weeks, between-group comparison revealed a significantly ($P < 0.001$) greater decrease in the pro-inflammatory molecules tumor necrosis factor- α (TNF- α), interleukin-6 (IL-6), transforming growth factor- β (TGF- β), and monocyte chemoattractant protein-1 (MCP-1) in the curcumin group compared to placebo. The inflammatory cytokines IL-1 β ($P = 0.042$), IL-4, ($P = 0.008$), and vascular endothelial growth factor ($P = 0.01$) also decreased significantly after the curcumin intervention. The authors also report that curcuminoids were "more effective" than placebo in improving cholesterol, but not whether it was statistically significant. The curcumin group had a statistically significant improvement in SOD ($P < 0.001$), and reduction in malondialdehyde (MDA) ($P < 0.001$) and C-reactive protein (CRP) ($P < 0.001$). A meta-analysis within the same study found "a significant effect of curcuminoids vs. placebo in reducing circulating CRP concentrations." In a different randomized double-blind placebo-controlled crossover trial in 36 obese adults, triglycerides were significantly (P value not given) reduced after 30 days of taking 1 g curcumin plus 10 mg piperine.

In a study of 28 healthy subjects who took 400 mg/day of curcumin or placebo for two days before and four days after an exercise to produce muscle soreness, the curcumin group had significantly (P value not given) less elevation in creatine kinase, TNF- α , and IL-8. The authors suggest that curcumin "may help to decrease recovery time." In a study of 20 healthy, moderately active males randomized to placebo or a curcumin formulation, Phytosome (Meriva; Indena SpA; Milan, Italy) containing 200 mg curcumin, taken twice a day, the interventional group had significantly (P value not given) less pain and MRI evidence of injury in certain muscles, and lower IL-8 two hours after exercise. In a randomized, double-blind, cross-over trial in 30 obese adults who received placebo or curcuminoids 1 g/day for 30 days, the curcumin group had a significantly lower ($P = 0.03$) Beck Anxiety Inventory score.

Curcumin has a well-established record of safety with the European Food Safety Authority with an Allowable Daily Intake (ADI) of 0-3 mg/kg body weight. Nevertheless, in a dose response study, in a small number of participants, large doses (500-12,000 mg) reportedly produced diarrhea, headache, rash, and yellow stool 72 hours after ingestion. In a study where subjects received 0.45 to 3.6 g/day curcumin for one to four months, a few participants experienced nausea and diarrhea and increased levels of serum alkaline phosphatase and lactate dehydrogenase.

The authors conclude that curcumin has numerous health benefits, but agents such as piperine are needed to increase its bioavailability. There is evidence that it is beneficial in the treatment of metabolic syndrome, arthritis, anxiety, and hyperlipidemia, and may facilitate recovery from physical exertion. Low doses were also reported to "provide health benefits for people that do not have diagnosed health conditions."

The authors declare no conflict of interest.

—Heather Anderson, MD

Reference

¹Basnet P, Skalko-Basnet N. Curcumin: an anti-inflammatory molecule from a curry spice on the path to cancer treatment. *Molecules*. June 2011;16(6): 4567-98. doi: 10.3390/molecules16064567.

Referenced article can be accessed at <http://www.mdpi.com/2304-8158/6/10/92>.

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