

Turmeric, Curcumin, and Curcuminoids: A Dermatologic Review



Curcumin, one of the active compounds of turmeric, exhibits anti-inflammatory, antimicrobial, antioxidant, anti-nociceptive, and antineoplastic properties.

BY LORI KIM AND PETER LIO, MD

>> Recognized by its characteristic bright yellow pigment, turmeric (*Curcuma longa*) is a spice from Southern Asia that has a centuries-long history of use in cooking, cosmetics, and in medicine. Especially in India, turmeric is commonly used for its medicinal properties as part of Ayurvedic medicine, a traditional medical system that relies on a holistic approach to physical and mental health. One of the ancient texts of Ayurveda, *Charaka Samhita* (dated to before the second century CE) states that turmeric can improve digestion, reduce obesity, and reduce inflammation of the GI tract and the skin.

Research has shown that curcumin, one of the active compounds of turmeric, exhibits anti-inflammatory, antimicrobial, antioxidant, anti-nociceptive, and antineoplastic properties. Specifically, curcumin has been shown to potentially play a role in type 2 diabetes mellitus by reducing lipid levels, in metabolic syndrome by increasing insulin sensitivity and production, in cardiac diseases by lowering C reactive protein, and even in major depressive disorder via its anti-inflammatory effects. Currently, it is being studied as a possible treatment for Alzheimer's disease.

Curcumin is thought to downregulate inflammatory targets, such as lipoxygenase, cyclooxygenase-2, and inducible nitric oxide synthase. It has also been shown to inhibit many inflammatory cytokines, including TNF, IL-1, 2, 6, 8, and 12. Moreover, curcumin has been hypothesized to suppress NF- κ B, which is a transcription factor that controls cyclooxygenase-2 and inducible nitric oxide synthase and regulates cellular proliferation.

These findings make curcumin a suitable candidate for treating skin conditions that are characterized by derangement of the inflammatory response. Additionally, an increasing number of patients are looking for natural and cost-effective skin care alternatives outside of conventional medications. According to the Global Cosmeceuticals Market Outlook 2018 Report, the fastest growing sector of

the personal care industry was the use of cosmeceuticals, natural remedies, and botanicals for dermatology, with an estimated \$40B market.

Despite these findings, turmeric has been difficult to use topically due to its bright yellow color and characteristic odor. But there is increasing research studying colorless turmeric extract, and clinical studies have shown its ability to significantly reduce the appearance of fine lines, wrinkles, and hyperpigmented macules.

Current research looks promising for the use of turmeric and curcuminoids for skin health.

COMMON SKIN DISEASES STUDIED

Acne. With its known anti-inflammatory and antimicrobial effects, curcumin is a natural contender for consideration to treat acne. In a study testing both ingested and topical turmeric, 53 subjects were divided into four groups: 1.) active oral tablet plus active topical gel; 2.) active oral tablet plus active topical cream; 3.) active oral tablet plus placebo topical; and 4.) placebo oral tablet plus placebo topical formula. Of these four groups, Group 2 showed the greatest improvement in treating acne. A limitation is that this study was conducted over four weeks, while most acne studies are conducted over an eight- to 12-week period. Another limitation is the small placebo group, which started with two participants, but only one completed the study. Future studies should increase comparison size and have a longer evaluation period.

Androgenetic Alopecia. Androgenetic alopecia is the most common type of hair loss in men, with progressive miniaturization of terminal hairs in a characteristic distribution on the scalp. In a six-month study, 87 men with androgenetic alopecia were divided into four groups: 1.) placebo hair tonic; 2.) 5% hexane extract of *Curcuma aeruginosa*; 3.) 5% minoxidil; and 4.) combination: curcuma

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plus minoxidil. Treatment efficacy was measured in terms of target hair count, photographic review, and patients' own assessment. In terms of photographic review, there was statistically significant improvement in the minoxidil group and the combination treatment group. In terms of patients' assessment, only the combination treatment group was statistically significant. These results suggested that *C. aeruginosa* did not result in improved hair regrowth.

Atopic Dermatitis (AD). In a four-week trial, 150 subjects with AD were given a combination herbal extract cream containing turmeric. All symptoms associated with AD, such as erythema, scaling, thickening, and itching significantly improved. The limitation was that there was no control group, making it impossible to know what was actually attributable to the turmeric.

Oral Lichen Planus. Oral lichen planus (OLP) is a chronic inflammatory disorder that affects the buccal mucosa and the gums. Two studies tested the efficacy of capsules of a curcumin preparation to treat OLP. In the first study, curcumin 2,000mg/day did not achieve statistical significance in improving clinical severity of OLP in 100 subjects. In the second similar study, curcumin 6,000mg/day was assessed in 10 men and 23 women with OLP, and there was statistically significant improvement. In a separate study, 33 subjects with OLP were given either 1.) prednisone for seven days plus 2,000mg/day curcumin capsules for seven weeks, or 2.) prednisone for seven days plus placebo capsules for seven weeks. Preliminary results did not show significant difference in the two groups, and the study was ended early. Currently available data suggest that curcumin doses of 6,000mg/day may be effective for treating OLP, but not the 2,000mg/day dose.

Pruritus. When 100 dialysis patients with uremic pruritus were given either three turmeric capsules daily or placebo starch capsules for eight weeks, there was statistically significant decrease in pruritus in the curcumin group compared to placebo. Moreover, curcumin was also shown to decrease inflammation by lowering high-sensitivity C-reactive protein (hs-CRP), further supporting the data.

In two other studies, 96 male patients with sulfur mustard-induced chronic pruritus were given either 1g/day of curcumin or placebo capsules for four weeks. A study looking at the concentrations of substance P, antioxidant enzymes, pruritus severity, and quality of life showed that the curcumin group had a significant decrease in substance P, a known mediator of pruritus. The curcumin group also showed a statistically significant increase in the antioxidant enzymes superoxide dismutase, glutathione peroxidase, and catalase in comparison to the placebo group. The second study focused on curcumin's role in inflammation by measuring serum IL-6, IL-8, hs-CRP, and CGRP in both curcumin-treated and placebo groups. Results showed that while IL-8 and hs-CRP were significantly reduced in both treatment and placebo groups, serum CGRP showed a statistical significant decrease only in the curcumin group.

A controlled study of curcumin for pruritus had patients use either a combination cream containing 16% turmeric along with saffron, sandalwood, and other ingredients or a bland moisturizer. Both groups showed statistically significant improvement in subjects' subjective rating of pruritus, and there was no significant difference between the two groups.

Psoriasis. In one study of 40 men, a topical alcohol gel formulation with 1% curcumin improved psoriasis by significantly decreasing phospholipase kinase activity, similar to the effects of topical vitamin D3 analogue.

In another study, eight patients were given a curcuminoid preparation orally for 16 weeks, and were evaluated based on Physicians Global Assessment score, Psoriasis Area and Severity Index (PASI), and safety endpoints. Two participants out of eight achieved 75% improvement in their PASI. In the future, it would be helpful to increase the sample size and have a control group to increase reliability of these findings.

Radiodermatitis. In one study, 50 subjects with radiodermatitis used a cream comprising turmeric oil and sandalwood oil or baby oil for seven weeks. There was a statistically significant decrease in radiodermatitis in the turmeric and sandalwood oil cream in comparison to the baby oil. Another study examined the effects of ingesting 6g/day of

TABLE: SUMMARY OF CLINICAL STUDIES USING CURCUMIN TO TREAT DERMATOLOGICAL CONDITIONS

Study	Type of Study	N	Intervention
Acne			
Lalla, et al.	Randomized, double-blind, placebo-controlled parallel clinical trial	53	Improvement seen in both tablet + cream and tablet + gel treatment group over placebo, but tablet + cream was found to be more efficacious than tablet + gel ($p=0.020$)
Androgenetic Alopecia			
Pumthong, et al.	Multicenter, randomized, double-blind, placebo-controlled study	87	Statistically significant photographic review improvement in the combination group of curcumin+ minoxidil, but not in the curcumin group ($p=0.067$)
Atopic Dermatitis			
Rawal, et al.	Open-label non-comparative trial	150	Statistically significant improvement in all symptoms assessed including erythema, scaling, thickening, and itching ($p<0.001$)
Facial Photoaging			
Sommerfeld, et al.	Randomized, placebo-controlled, double-blind, split-face study	28	Statistically significant improvement in skin firmness, improved clinical evaluation ($p<0.01$), and improvement in subjects' overall self evaluations ($p<0.02$)
Oral Lichen Planus			
Chainani-Wu, et al. 2007	Phase II randomized, placebo-controlled, double-blind clinical trial	100	No statistical significance between treatment and placebo groups; study ended early
Chainani-Wu, et al. 2012	Randomized, double-blinded, placebo-controlled clinical trial	20	Statistically significant improvement found at the higher curcumin dose of 6000 mg/day ($p<0.0078$)
Chainani-Wu, et al. 2010	Randomized, placebo-controlled, double-blind parallel-group trial	33	No statistical significance between treatment and placebo groups; study ended early
Pruritus			
Pakfetrat, et al.	Randomized, double-blind, placebo-controlled clinical trial	100	Statistically significant decrease in pruritus and hs-CRP in the curcumin group compared to placebo ($p=0.012$)
Panahi, et al. 2012a	Randomized, double-blind, placebo-controlled trial	96	Statistically significant reduction in substance P ($p<0.001$); and statistically significant increase in superoxide dismutase ($p=0.02$), glutathione peroxidase ($p=0.006$), and catalase ($p=0.001$) in the curcumin group compared to placebo
Panahi, et al. 2012b	Randomized, double-blind, placebo-controlled trial	96	Statistically significant decrease in serum CGRP in the curcumin group only ($p<0.001$); IL-8 and hs-CRP was significantly reduced in both treatment and placebo group ($p>.05$) but with greater decrease in curcumin group ($p<0.001$)
Chatterjee, et al.	Prospective, unicentric, open, randomized, controlled study	64	Both treatment and control group had statistically significant improvement in subjects' subjective rating of pruritus and well-being, as well as clinical assessment of severity ($p<0.005$), with no statistically significant difference in the two groups
Psoriasis			
Heng, et al.	Controlled clinical study	40	Statistically significant decrease in PhK in the curcumin group compared to placebo ($p<0.0001$)
Kurd, et al.	Phase II, open-label, two-stage clinical trial	8	Of the eight subjects in this study, there was only a 16.7% response rate based on intent-to-treat analysis; these two responders achieved a 75% improvement in their PASI
Radiodermatitis			
Palatty, et al.	Investigator-blinded random sampling study	50	Statistically significant decrease in radiodermatitis in the Turmeric cream (VTC) group compared to control group ($p<0.01$)
Ryan, et al.	Randomized, double-blind, placebo-controlled clinical trial	30	Statistically significant decrease in RDS score ($p<0.008$) and moist desquamation ($p<0.002$) in the curcumin group compared to placebo, but no significant difference in redness, pain, or symptoms
Vitiligo			
Asawanonda and Klahan, et al.	Blinded, controlled study	10	No statistically significant difference in repigmentation in the curcumin group vs. placebo

turmeric on breast cancer patients with radiodermatitis. There was a statistically significant decrease in radiation dermatitis severity score and moist desquamation in the curcumin group compared to placebo, but there was no significant difference in redness, pain, or symptoms.

Vitiligo. A study compared the effects of combination turmeric cream plus narrowband UVB phototherapy vs. UVB phototherapy alone on four males and six females with vitiligo. Subjective assessment of photographs showed repigmentation in both groups, with slightly better but not statistically significant repigmentation in the turmeric cream group. In the future, a study with greater sample size and a less subjective outcome measurement may help determine the effect of curcumin on vitiligo.

Other skin-related studies. Other less clinical studies point toward a favorable profile for the use of curcumin on the skin, as well. In an in-vitro model of psoriasis, curcumin was shown to significantly improve the skin barrier function by upregulating involucrin and filaggrin, which are known regulators of the skin barrier. This is promising for several diseases that are associated with deficient skin barrier function, including atopic dermatitis.

In another study, researchers investigated the effects of a hot water extract of curcumin on human keratinocytes. They found that this water extract of curcumin inhibits UVB-induced inflammation and also increases the water content of the facial skin. This suggests that curcumin might be useful in moisturizing the skin.

More research is also being conducted on oral turmeric-containing polyherbal combinations. Remarkably, two studies have shown the turmeric-containing polyherbal combination to have greater effects on the skin, compared to turmeric tablets alone and to placebo. One of the studies measured transepidermal water loss (TEWL) in subjects for four weeks and found that herbal combination tablets significantly decreased TEWL, whereas no significant changes were seen in the turmeric or the placebo groups. Another study measured facial redness reduction after taking the tablets by mouth twice daily for four weeks and found that only the herbal combination tablets showed statistically significant changes.

PRACTICAL CONSIDERATIONS

One of the core reasons why curcuminoids are favorable is that they are nontoxic, with research showing that even up to 8g/day of turmeric is not associated with any significant adverse effects. This is in comparison to conventional treatments for psoriasis, such as PUVA, corticosteroids, and even immunosuppressants, that are associated with

potential toxicity. For example, in a psoriasis patient study comparing treatment with curcumin extract with visible blue light vs. treatment with PUVA, the reduction in psoriasis was similar in both groups. Notably, adverse effects were rare in the curcumin group after 12 weeks of treatment, whereas the PUVA group subjects required sun protection and reported GI distress.

One limitation of curcumin is its poor bioavailability, due to its low solubility in water and low stability. It is thought to be extensively metabolized, leaving little curcumin to be absorbed. To overcome this limitation, current studies are investigating nanotechnology, such as liposomes-phospholipid, nanogels, nanostructured lipid carriers, nanoemulsions, polymeric micelles, and various polymeric nanoparticulate methods to deliver curcuminoids.

Numerous studies suggest benefits to using curcuminoids to treat skin diseases or as preventative measures. Future studies should include increased sample sizes of subjects being tested and always have a placebo control. This is a very promising area of research, due to curcumin's low cost, high tolerability, and the general public's interest in natural treatments instead of prescriptions. ■

Lori S. Kim is a third-year medical student at the UIC College of Medicine in Chicago. She holds a BA in Biological Sciences from Northwestern University.

Peter A. Lio, MD is a Clinical Assistant Professor of Dermatology and Pediatrics at Northwestern University Feinberg School of Medicine and a partner at Medical Dermatology Associates of Chicago.

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