

## Turmeric (curcumin): A widely used curry ingredient, can contribute to oxidative stress in Asian patients with acute vitiligo

Sir,

Vitiligo, an acquired skin disorder with the loss of native skin pigment, affects approx 0.5–1% of the world population.<sup>[1]</sup> Increased H<sub>2</sub>O<sub>2</sub> levels in the epidermis and in blood are one of the many hallmarks of this disease.<sup>[2–4]</sup> Elevated epidermal H<sub>2</sub>O<sub>2</sub> levels in the millimolar range inactivate epidermal and systemic catalase.<sup>[5,6]</sup>

Restoration of the skin color can be achieved after reduction of epidermal H<sub>2</sub>O<sub>2</sub> levels using topical pseudocatalase cream (PC-KUS).<sup>[3,7]</sup> Recently, we showed that epidermal catalase as well as other affected enzymes recover after treatment with this modality.<sup>[8]</sup> However, to our surprise, part of our Asian patient population showed only moderate improvement or no response at all. Since Asian cuisine uses a variety of spices, we asked the question whether turmeric (haldi), which is widely used in curries, could possibly contribute to the poor outcome of this treatment.

Besides serving as a spice, turmeric is still widely used for wound healing and skin lightening in Asia.<sup>[9]</sup> It is isolated from the rhizome of the plant *Curcuma longa* Linn. Its major active yellow pigment is curcumin (diferuloyl methane),<sup>[10]</sup> which has antioxidant, anti-inflammatory, and anticarcinogenic properties.<sup>[10–12]</sup> Curcumin's structure is shown in (Figure 1). The oxidation of the two methoxy groups (–OCH<sub>3</sub>) yields two catechol substituents. This reaction is mostly driven by cytochrome P<sub>450</sub>. The resulting two catechols are auto-oxidized to semiquinone radicals and finally to orthoquinones. This reaction pathway produces two molecules of H<sub>2</sub>O<sub>2</sub> for each oxidized curcumin molecule.

In the presence of low semiquinone radicals, curcumin acts as a free radical trap, explaining its antioxidant properties. However, in the presence of high concentrations, the reactive oxygen species (ROS) generation is over-riding.

In this context, it is of special interest that dietary curcumin reaches the skin in mice.<sup>[12]</sup> Consequently, we studied the effect of curcumin and its possible ROS generation in healthy skin and in patients with acute vitiligo using *in vivo* Fourier transform (FT)-Raman spectroscopy.<sup>[3]</sup> FT-Raman spectra were acquired by using a BRUKER® RFS 100/S spectrometer (Bruker, Karlsruhe, Germany) with a liquid-nitrogen-cooled germanium detector equipped with a fiber-optic cable.

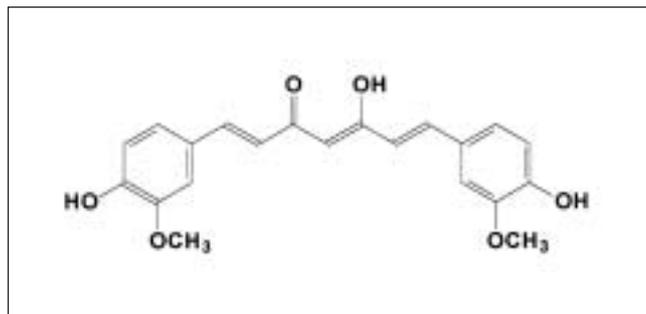


Figure 1: Structure of curcumin (diferuloyl methane), the major constituent of turmeric

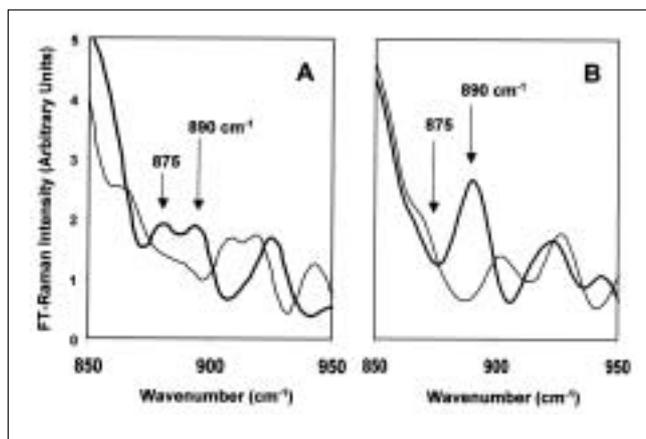
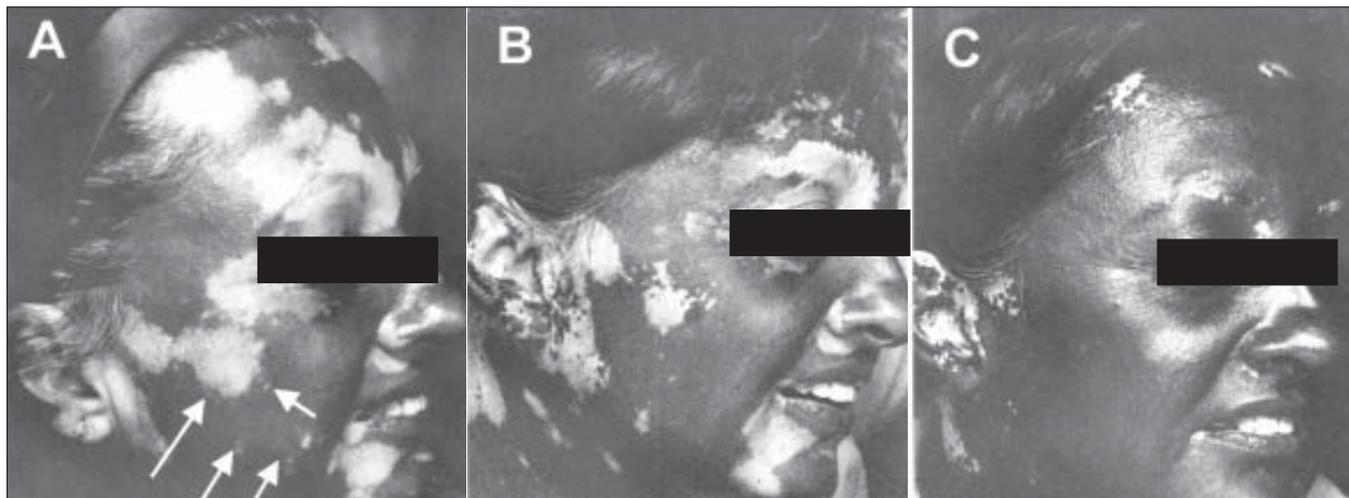


Figure 2: Generation of reactive oxygen species by curcumin in skin as detected by *in vivo* FT-Raman spectroscopy. (A) Healthy control; and (B) Asian patient with vitiligo—as one example before, 20 min after curcumin application (40 mmol/cm<sup>2</sup>, dissolved in absolute ethanol; Sigma, Poole, UK).



**Figure 3:** The influence of turmeric as a food ingredient on the repigmentation of facial vitiligo in one Asian patient. (A) After 6-month treatment with pseudocatalase PC-KUS using turmeric in the daily diet. Note the acute vitiligo indicated by arrows; (B) 2 months after avoiding turmeric; and (C) 6 months after avoiding turmeric (photos were taken under Wood's light).

Near-infrared excitation was produced with an Nd<sup>3+</sup>-yttrium aluminum garnet laser operating at 1064 nm. Each spectrum was accumulated over 5 minutes with 300 scans and a resolution of 4 cm<sup>-1</sup>. All spectra were obtained for the wrist area. The H<sub>2</sub>O<sub>2</sub> was visualised following the O–O stretch at 875 cm<sup>-1</sup>.<sup>[3]</sup> The organoperoxides/ROS peak was assigned at 890 cm<sup>-1</sup>.<sup>[13]</sup> This *in vivo* method was approved by the local Ethics Committees. Twenty minutes after topical curcumin application, ROS generation was detected in both normal controls (*n* = 3) and patients with acute vitiligo (*n* = 3) (Figure 2). However, the amount of ROS formation in the skin of the patients was significantly higher compared to controls. This result could be explained as owing to low epidermal catalase levels in acute vitiligo as demonstrated earlier.<sup>[5]</sup>

Based on these *in vivo* results, we evaluated 15 Asian patients with acute vitiligo, who consumed turmeric daily, and their response rate in facial repigmentation after topical application of low-dose UVB-activated pseudocatalase (PC-KUS) twice daily.<sup>[3,7]</sup> After 6 months, none of them showed any significant repigmentation.

Therefore, we advised eight of these patients to avoid turmeric in their diet and continue the application of PC-KUS twice daily. This led to a significant improvement in the response even after 2 months. After 6 months of treatment, six of the eight patients had

nearly complete facial repigmentation (Figure 3), whereas there was only minor-to-moderate or no response in the seven patients who continued using turmeric together with PC-KUS.

In summary, our *in vivo* results show that curcumin can contribute to the oxidative stress in acute vitiligo and prevent repigmentation. Dermatologists and other doctors treating patients with vitiligo should be aware of this possible problem.

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