

Turmeric: The Yellow Allergen

Abstract

Turmeric is the dried rhizome of *Curcuma longa* Linn which is extensively used in Indian culture. Curcumin is its most active pharmaceutical component. Turmeric use is very closely related with the socio-religious life of the population. Topical application of turmeric is a very common practice in the daily lives and auspicious occasions in South India. However, the allergenic potential of this commonly used spice is mentioned in various case reports and studies. The dermatologists and patients should be aware of the possible allergic reactions of this widely used herb. The purpose of this review is to give a brief overview of allergenic potential of this commonly used spice.

Keywords: Contact dermatitis, curcumin, turmeric

Introduction

Turmeric (Synonyms – Curcuma; Rhizoma curcumae; Saffron Indian) is the dried rhizome of *Curcuma longa* Linn (L.) belonging to the family Zingiberaceae. *Curcuma longa* L. is a rhizomatous monocotyledonous perennial herb native to southern Asia and is cultivated extensively in temperate regions.^[1] Turmeric (*Curcuma longa* L.) is a fundamental part of Asian culture, cuisine, and traditional medicine since centuries.^[2] The purpose of this review is to give a brief overview of allergenic potential of this commonly used spice.

Contents of Turmeric

Turmeric contains curcuminoids (5%) which gives it the characteristic yellow color and essential oils (6%) which provide aromatic taste and smell.^[1,2] Curcumin (diferuloylmethane, E100, Natural Yellow 3), a polyphenolic compound, is the most active pharmaceutical component of turmeric. It is an orange-yellow crystalline powder, insoluble in water.^[3] The composition of turmeric rhizome is mentioned in the Table 1.^[1,3]

Topical Application of Turmeric

In India, turmeric is very closely related with the socio-religious life of the population. It is considered to be sacred,

auspicious, and a sign of prosperity. Topical application of turmeric is a very common practice in the daily lives and auspicious occasions in South India. Smearing turmeric over the entire body of the bridegroom and bride on the wedding ceremony eve is a tradition in the Hindu community. On auspicious occasions, as well as every evening in certain communities, it is applied on the forehead, cheeks, and neck.^[2] Nuptial string (Mangalsutra) worn by the married Indian women is made up of turmeric dyed thread with a piece of turmeric. Many Indian women apply turmeric over their body and mangalsutra before taking bath.^[4]

Turmeric is believed to decrease hair growth over skin, reduce acne, and impart a shiny yellow color to women's skin which is considered to be attractive, hence traditionally applied by South Indian women.^[2,5] It is also used in fur and hair dye.^[6] It is applied over perineal laceration after labor (to aid wound healing) and over severed umbilical cord of newborns (as antiseptic) in India.^[2]

The topical application of turmeric have been reported to be effective in the treatment of acne, boils, bruises, eczemas, wounds, ulcers, insect bites, hemorrhages, pemphigus, herpes zoster, and parasitic infestations.^[7] Nano-capsulated curcumin is useful in cosmetics as face masks, in lip balms, and in sunscreens.^[8]

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Vijayasankar Palaniappan, Kaliaperumal Karthikeyan

Department of Dermatology,
Venereology and Leprosy,
Sri Manakula Vinayagar
Medical College and Hospital,
Pondicherry, India

Address for correspondence:
Dr. Vijayasankar Palaniappan,
Department of Dermatology,
Venereology and Leprosy,
Sri Manakula Vinayagar
Medical College and Hospital,
Pondicherry - 605 107, India.
E-mail: vijayasankar
palaniappan@gmail.com

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Table 1: Composition of turmeric rhizome

Curcuminoids in turmeric		
Curcumin	Compound	Content
Curcumin I	Curcumin	70%
Curcumin II	Demethoxycurcumin	17%
Curcumin III	Bis-demethoxycurcumin	3%
Curcumin IV	Cyclocurcumin	10%
Essential oils in turmeric		
Zingiberene (25%)		
α-phellandrene		
Sabinene		
Turmerone		
Arturmerone		
Borneol		
Cineole		
β-tolylmethyl carbinol		
α- and β-pinene		
Camphene		
Limonene		
Terpinene		
Terpinolene		
Caryophyllene		
Linalool		
Isoborneol		
Camphor		
Eugenol		
Curdione		
Curzerenone,		
Curlone		
AR-curcumenes, β-curcumene, γ-curcumene.		
α- and β-turmerones		

Traditionally, kumkum (Synonyms – Sindoor; Vermillion) is prepared by mixing turmeric powder with a small quantity of slaked lime, to impart red color to it. However, nowadays it is more commonly mass produced by incorporating various dyes and chemicals, such as coal tar dyes, erythrosine, toluidine red, lithol red calcium salt, lead oxide, tragacanth gum, parabens, fragrances, cananga oil, groundnut oil, and sandalwood.^[9] Kumkum is applied on the forehead as “bindi” in between eyebrows or as “sindoor” over hair parting region as a symbol of their marital status and to prevent loss of spiritual energy.^[4,10]

Turmeric as an Allergen

Babu studied patch test among 50 patients of allergic contact dermatitis (ACD), who were using turmeric. Among them, 44 (88%) patients were found to be positive for turmeric. Most of the cases belonged to 31-40 years of age. Patch tests were positive with raw turmeric paste (14 patients), commercially available turmeric preparation (2 patients), ethanol extract of turmeric (17 patients), sediment

after ethanol extract (11 patients), and also with kumkum (9 patients).^[11]

Thilak *et al.*,^[12] studied patch test among 300 cases of allergic contact dermatitis. In their study, kumkum was positive in 17 (5.7%) cases and turmeric in 11 (3.7%) cases. Sadagopan *et al.*,^[13] conducted patch tests among 358 cases of allergic contact dermatitis in a tertiary centre. Among 12 patients of turmeric contact allergy, 6 patients showed positive patch test for turmeric. Babu *et al.*,^[14] studied patch test among 50 clinically suspected cases of allergic contact dermatitis over forehead (glabella) and hair parting region. Among them, 20 (40%) patients were positive for turmeric and kumkum, and 12 (24%) patients positive for turmeric, kumkum, nickel, and sticker bindi.

Seetharam *et al.*,^[15] studied patch test with condiments commonly used in kitchen in patients with fingertip dermatitis (exposed patients) and those with no dermatitis but exposed to substances in the past (exposed controls). The results were three positive (among six exposed patients) and eight positive (among 15 exposed controls) for turmeric. Futrell *et al.*,^[16] conducted patch tests among 50 patients with suspected ACD to spices. Among them, two patients exhibited positive reaction to turmeric. Annabathula *et al.*,^[17] studied patch test on 18 patients of suspected kumkum-induced allergic contact dermatitis, among whom positive patch test to curcumin was identified in four patients.

Few cases of ACD to turmeric have been described in occupational contexts. The first case of allergic contact dermatitis to turmeric was reported in India. Goh *et al.*,^[5] reported a spice miller who had developed dermatitis over his hands, forearms, and dorsum of feet following contact with *Curcuma longa* and curry powder. It is speculated that sensitization occurred through airborne exposure created during the milling process. His patch test was positive to *Curcuma longa* 25% in petrolatum. ACD to turmeric have been reported among workers who dye animal fur. A pasta worker developed ACD over his hands and forearms following handling curcumin containing pasta. Her patch test showed positive for curcumin (1%, 0.01%, 0.001% in petrolatum).^[18]

Hata *et al.*,^[19] reported a patient who developed ACD following the application of a Chinese herbal topical medicament named “Chuu-ou-kou” which had *Curcuma longa* as one of its contents. Her patch test was positive for curcumin (0.1%, 0.5%, and 1% in petrolatum). Similarly, another patient has developed generalized dermatitis after “Chuu-ou-kou” application.^[20]

A married woman had developed itching, dermatitis, and pigmentation over the sites of contact of her nuptial thread. The patient had history of applying turmeric over her mangalsutra (nuptial thread) on auspicious occasions. She had also developed pigmented contact dermatitis over her

forehead corresponding to kumkum application. Patch test showed positive (+) reading to both turmeric and kumkum.^[4]

Fischer *et al.*,^[6] reported ACD in two patients following skin disinfection by yellow colored chlorhexidine solution prior to their surgeries. The concentration of curcumin in chlorhexidine was found to be 0.05%. Patch test reading was positive for curcumin. Lal *et al.*,^[21] reported a 43-year-old female who developed ACD following the application of kumkum over her center of forehead. Patch test was positive to turmeric present in kumkum. It is found that boiled and subsequently air-dried turmeric is non-allergenic in nature. However by doing so, it lost its adhesiveness making its usage difficult.

A female patient had developed ACD following the application of massage oil containing turmeric powder. Patch test showed sensitivity to turmeric.^[22] Two cases of ACD to tetrahydrocurcumin following usage of sun-block cream have been reported. Tetrahydrocurcumin is a hydrogenated derivative of naturally occurring yellow curcuminoids, commonly found in cosmetics (as antioxidant ingredient) such as skin lightening agents, sunscreens, and anti-aging agents.^[23,24]

Liddle *et al.*,^[25] reported two cases of contact urticaria to curcumin. Among them, one patient was employed in a nutrition supplement production company. She was involved in mixing a variety of ingredients before incorporating into each capsule. Prick test with curcumin was positive. She had non-immunological form of contact urticaria. The other patient had immunological contact urticaria. Huber *et al.*,^[26] reported a case of erythema-multiforme like ACD, a non-eczematous clinical variant following the topical application of a turmeric essential oil.

A 32-year-old female had applied curcumin-based gel over her lips (previously sutured site). After two to three applications, she had developed erythematous rashes over her oral mucosa which later on progressed to multiple ulcers. Patch test done after two weeks revealed curcumin positivity.^[27]

We have observed a few cases of ACD to turmeric in our department [Figures 1-3]. It is more commonly seen during summer season (author's personal observation). The excessive sweating during summer could lead to excessive leaching of the allergen, thereby increasing the percutaneous absorption. Friction, heat, decreased humidity, and disrupted barrier function enhance ACD in previously sensitized individuals.^[28] An increased caution should be observed when applied over sun-exposed areas due to the potential photosensitizing nature of curcumin.^[29] Systemic contact dermatitis to turmeric is rarely reported.^[30]

The products that have been used for many years can still result in dermatitis either as a result of sensitization to the product over time or due to change in product formulation.^[31] The high degree of sensitization to turmeric

in Indian population is due to frequent topical use in various cosmetics, medicines, religious purposes and in cooking.^[11]

Although turmeric is widely used in day-to-day lives of South Indian population, ACD secondary to it develops only in few individuals. This could be explained by the regular use of turmeric for prolonged period resulting in either individual susceptibility or hyposensitization. As the heat and cooking process may cause deterioration of the allergens in turmeric, the chances of developing severe ACD to turmeric are low.^[4] The patterns of ACD to turmeric are mentioned in the Table 2.



Figure 1: Lichenoid contact dermatitis to turmeric smeared over the thread

Table 2: Morphological patterns of allergic contact dermatitis to turmeric

Erythematous papulo-vesicular lesions
Eczematous reaction
Lichenoid dermatitis
Pigmented contact dermatitis
Generalized dermatitis
Immunological contact urticaria
Non-immunological contact urticaria
Erythema-multiforme
Oral ulcers



Figure 2: Allergic contact dermatitis to turmeric



Figure 3: Allergic contact dermatitis over the turmeric smeared site

Investigations

The history and clinical picture are not sufficed to identify the causative allergen, and patch test is necessary.^[32] [Figure 4] Although the patch test is more than 100 years old, it is still considered as a standard diagnostic aid in diagnosing ACD.^[33] As the turmeric allergens are not included in our Indian standard series of allergens, it is important to perform a patch test with patient's own products. To find a non-irritant concentration, most chemicals can be tested with three concentrations 10%, 1%, and 0.1% in aqueous solution or in petrolatum. A positive reaction should not be accepted allergic unless at least 20 controls are negative. Curcumin, the active ingredient, can be extracted by dissolving the turmeric in ethanol followed by evaporation of the solvent.^[14,28] In patch test, curcumin have been reported to cross-react with other spices which possess similar chemical structure such as ginger, cinnamic aldehyde, and cinnamic alcohol.^[18] Repeated open application test has the advantage of stimulating exposure pattern to an allergen like turmeric used daily and products can be tested as a whole. The other tests to diagnose ACD are open patch test and usage test.^[28]

Management

With proper guidance from the physician, and good compliance by the patient, the prognosis of ACD to turmeric

is good. Awareness should be created regarding the ACD to turmeric. The patient should be educated about the risk of relapse which persists throughout the life. Pre-placement screening should be carried out in industries involved in the commercial turmeric production. The principles involved in the prevention of turmeric ACD are mentioned in Table 3.

Dermatologists must be aware of the local cultural practices in which turmeric is used, helping them in providing better counseling and treatment options. The cornerstone of management of ACD is avoidance of the allergens.^[34] The acute phase can be managed with astringent soaks, topical corticosteroids, and antihistamines. Topical corticosteroids are typically required for two to three weeks to prevent rebound. In chronic phase, in addition to topical steroids, emollients are used.^[28,31,34,35]

Conclusion

The dermatologists and patients should be aware of the possible allergic reactions of this widely used herb. In spite of wide socio-cultural beliefs and growing evidence of efficacy of turmeric, the risk of developing allergic contact dermatitis should be kept in mind when applied directly on the skin. Many women continue to apply turmeric in spite of their dermatitis, since it is inevitable in our population due its rich socio-cultural values. Hence, it is the need of the hour to make turmeric non-allergenic. Also, due to the



Figure 4: Positive patch test reaction to raw turmeric and ethanol extract of turmeric in a patient with allergic contact dermatitis over neck

Table 3: Prevention of allergic contact dermatitis to turmeric

Proper health education from the dermatologist
Should be given both verbal and written instructions
Educating about lifestyle modification
Should be taught the various synonyms of allergen
Patient should be given a complete list of sources of curcumin
Proper labeling of contents in all commercial products
Should be instructed to read the label in all products
Should be educated about the possible cross-reacting substances
Applying petrolatum prior to turmeric application
Advise to use turmeric alternatives
Using boiled and air-dried turmeric if needed
Good compliance from the patient

increasing trend of ACD to turmeric, its inclusion in Indian standard series should be considered.

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Conflicts of interest

There are no conflicts of interest.

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