

Skin contact reactions to spices. A review.

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SUMMARY

Spices and food ingredients relatively often trigger skin reactions of delayed or immediate type. Both professionals, like chefs, caterers, as well as general population may be affected. Clove, Jamaica pepper, garlic, paprika, vanilla and other spices are frequent causes of delayed type, while mustard, coriander, celery, are the most common causes of the immediate type skin allergy. The above mentioned problems are reviewed in details.

1. Introduction

Skin is the most frequently affected organ of systemic IgE-mediated allergy to foods (1,2). However, contact with food may cause a localized "contact" reaction, either at the direct site of skin contact or upon contact with the lips and oral mucosa (oral allergy syndrome), or a more generalized skin reaction (systemic contact dermatitis). Skin contact reactions to foods and spices may occur in both the workplace and at home. It is well known that chefs, caterers, farmers, food handlers and preparers are occupationally exposed to foods and spices (F&S), but the list of jobs in which exposure to F&S allergens may occur is extensive. Spices are also used in cosmetics, perfumes, and medicaments, and allergic contact dermatitis may be caused by these products (1). Contact dermatitis to vanilla was recognized

more than a century ago (1), and since then, numerous reports on skin reactions from F&S have been published (1,2). Skin contacts with F&S may result in irritant contact dermatitis, allergic contact dermatitis (ACD), contact urticaria (CU), protein contact dermatitis (PCD), chemical photosensitivity (phototoxic and photoallergic reactions), and systemic ACD. These reactions can result from contact with a natural food or spice, and food additives such as preservatives, flavorings, stabilizers, emulsifying agents, enzymes and antioxidants, respectively.

Often a combination of factors will contribute to skin contact reactions. An individual with hand dermatitis who works as a chef may have both irritant contact dermatitis from wet work and frequent hand washing, and ACD caused by garlic or onion, as well as a *Candida* (3) or protein contact paronychia (4). The most common

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clinical picture of contact dermatitis to F&S is hand eczema. However, eczema and CU can also localize to the fingers and palms with extension up the arms and involvement of the face and mouth (5). Protection and good skin care helps to prevent some of the symptoms. Atopic individuals are genetically predisposed to hand dermatitis, and they have a greater incidence of irritant contact dermatitis and type I allergic reactions (5). Patch testing and prick testings are necessary to identify or rule out the possibility of causative allergens.

The present chapter is based on several recent book chapters or reviews on contact skin reactions caused by foods and spices (1, 6-14). Much data in contact dermatitis is based on case reports and many of the original references can be found in the above articles.

2. What are spices?

Spices are the aromatic parts of plants such as the seeds, fruits, roots, buds, flowers and barks. The boundary between spices, vegetables and aromatic plants is vague. For example, garlic, cayenne and paprika might be regarded as either vegetables or spices. The term herb is used of aromatic plants whose dried or fresh leaves or shoots are used. The flavoring constituents of spices are usually found in their ethereal oils. The main components of these are often known. Spices may cause delayed-type contact allergy, and/or immediate allergy (13-16). Spice oils and their constituents are also used in perfumery. Spice oils contain substances, which may both irritate and cause type IV allergy (Table 1). Spices also contain proteins, which may cause immediate allergy.

3. Delayed allergy to spices

Clove, Jamaica pepper (allspice), garlic, cinnamon, nutmeg, paprika, vanilla and ginger are the most frequent causes of ACD (13-21). Other causes of ACD are laurel (bay leaf) (22), cardamom (23), turmeric (24) and mustard (25). There is a correlation between allergies to perfumes and spices due to their identical or related substances. Therefore, on patch testing with the standard series, fragrance mix and balsam of Peru may detect contact allergy to e.g. clove, nutmeg, cinnamon, and cayenne pepper (21).

Some pure allergens of spice oils are available from patch test allergen suppliers (Table 1). Patch tests can also be performed with ethereal oils of spices. In patch tests, dry powders of spices are put in Finn Chambers® on a moistened filter paper (13). Garlic, mustard and cayenne are too irritant to be tested as such (Table 1). At the Finnish Institute of Occupational Health, we patch

test both garlic and mustard at 10% in water, and at 25% in petrolatum. Patch tests with other native spices may also elicit irritant reactions (13, 26) and dilution tests may be needed.

Cinnamon is made from the bark of the cinnamon or cassia tree. Oil of cinnamon contains the allergens cinnamic aldehyde and eugenol (Table 1, refs. 13, 27). Cinnamon is a common flavor enhancer, found in toothpaste (28), chewing gum, tobacco, aperitifs and bitters, vermouth (29), and cola beverages. In addition, it is commonly used as an odor enhancer, and is found in perfumes, after-shave lotions (15), and air deodorizers (30). An ACD can occur in exposed individuals, particularly bakers (31), candy makers, and cooks. Sensitization to balsam of Peru can result in cross-sensitivity to cinnamon (1).

Cayenne pepper, or *Capsicum frutescens*, from which the oleoresin of capsicum is derived, is a powerful irritant and is used in tear gas (1). Ginger ale and liqueurs flavored with capsicum can produce an ACD (7).

The nutmeg tree (*Myristica fragrans*) produces both nutmeg and mace, which are extensively used in flavoring foods. The fatty oils of nutmeg are found in soaps and perfumes and may be the cause of allergic dermatitis (21).

The clove (*Syzygium aromaticum*) is the unexpanded flower bud of the tree. Oil of cloves is rich in essential oils, especially eugenol and vanillin. Eugenol is both a primary irritant and sensitizer and is also found in cinnamon oil and many toothpastes, perfumes, soaps, and mouthwashes. Indians use cloves to flavor the betel nut. It is also used in dental preparations such as cement, impression pastes, and surgical packings. It can cause stomatitis and allergic eczematous eruptions in dental personnel (32). Cross-reactions to balsam of Peru can be seen. Patch testing can be done with a 10% solution in olive oil or a 5% solution in petrolatum. Oil of clove can be used as a 1-2 % alcoholic solution (13, 18).

Vanilla is an extract made from the pod of the vanilla plant, *Vanilla planifolia*. Vanillin is a benzaldehyde, which is the fragrant constituent of vanilla. Clinically, contact dermatitis occurs in individuals who are exposed through cultivation, trade, or industry. Symptoms can include edema, erythema, rhinitis and asthma. Synthetic vanilla is a different compound, and individuals can be sensitized to the natural spice and not the synthetic compound, and vice versa. For patch testing, a 10% vanillin in petrolatum or a 10% alcoholic extract of vanilla in acetone can be used (18).

The sweet bay or bay tree, *Laurus nobilis*, is native of the Mediterranean and Asia Minor. The usual allergen is laurenobiolide, which can cross-react with similar chemicals in the Compositae family and with magnolia

Table 1. Patch test materials for some spices (see 13, 20, 27).

Native (powdered) spices *	Ethereal oils of spices †;	Known allergens of spice oils ‡
Basilica	Oil of basil 4 %	Linalool (2-30%)
Bay (laurel) leaf	Oil of sweet bay 4 %	Costunolide 0.055%), eugenol (1-5%), pinene (1-15 %)
Caraway	Oil of caraway 4%	Dipentene (limonene)(1-2%), carvone (2 %, 5 %)
Cardamom	Oil of cardamom 4 %	Dipentene (1-2%)
Capsicum frutescens **	-	-
Cayenne pepper (see Capsicum frutescens)	-	-
Cloves	Oil of clove 2 %	Eugenol (1-5%), vanillin (10%)
Cassia (Chinese cinnamon); cinnamon of Ceylon	Oil of cassia 4 %; oil of cinnamon, Ceylon 8 %	Cinnamic aldehyde (cinnamal), (1-2%), eugenol (1-5%)
Cinnamon, see cassia		
Coriander	Oil of coriander 6 %	Linalool (2-30%)
Garlic **	-	Diallyldisulphide (1-5%)
Ginger	Oil of ginger 4 %	Phellandrene (5 %), citral (2 %)
Jamaica pepper (allspice, pimenta)	Oil of pimenta 8 %	Eugenol (1-5%)
Laurel (see bay leaf)		
Mace. The nutmeg tree (<i>Myristica fragrans</i>) produces both nutmeg and mace. See nutmeg		
Marjoram	Oil of marjoram 6 %	-
Mustard (seeds of white and black mustard) **	Allyl isothiocyanate 0.1 %	-
Nutmeg	Oil of nutmeg 8 %	Eugenol (1-5%), dipentene (1-2%), geraniol (1-5%), pinene (1 -15 %)
Oregano	Oil of organum 2 %	-
Paprika (<i>Capsicum annuum</i>) **	-	-
Spearmint	Oil of spearmint 2 %	Dipentene(1-2%), carvone (2 %, 5 %), pinene (1 %, 12 %, 15 %)
Vanilla	-	Vanillin (10%)

* All may irritate when tested as such. In doubtful cases, 25 % and 10 % dilutions in petrolatum may be used (13).

** Not suitable to be tested as such. Dilutions (in petrolatum) may be used: cayenne as 0.5 % (27), paprika as 25 % (13), garlic and mustard as 10 % (20).

† The presented concentrations do not irritate and are considered safe for patch testing (27).

‡ The test concentrations are given in parentheses. These concentrations are based on the reports of de Groot (27) and Niinimäki (13).

(1, 33). Laurel oil is also used in the textile industry to improve the luster of felt hats, and can produce a hatband dermatitis. Laurel leaves, or bay leaves, are used in cooking for their flavor and antioxidant properties, and are found in meat and fish preservation, pickled

gherkins, condensed soups, and spiced sauces. Extensive exposure and use have caused sensitization (34,35). Patch testing may be performed with a 2% concentration in petrolatum or 4-5% concentration of essential oil in alcohol (13,18).

PLANT PRODUCTS	
Fruits	
Apple	Lime
Apricot	Mango
Apricot stone	Melon
Banana	Orange
Grapefruit	Peach
Kiwi	Pineapple flesh
Litchi	Plum
Lemon	Strawberry
Lemon peel	Watermelon
Fungi	
Mushrooms	Salami casing molds
Grains	
Buckwheat	Rice
Flour	Wheat
Maize	Wheat bran
Malt	
Nuts	
Almond	Peanuts
Brazil	Peanut butter
Seeds	
Sesame seeds	Sunflower seeds
Vegetables	
Asparagus	Lettuce
Beans	Mustard
Cabbage	Onion
Carrot	Parsley and parsley root
Castor bean	Parsnip
Cauliflower	Potato
Celery	Rapeseed
Chives	Rocket
Coffee bean (green)	Rutabaga (Swede)
Coriander	Shallot
Cucumber	Soybean
Dill	Spinach
Endive	Stock (<i>Matthiola incana</i>)
Garlic	Tomato
Green pepper	Watercress
Leek	Winged bean
FLAVORINGS AND FRAGRANCES	
Balsam of Peru	Cinnamic acid
Benzaldehyde	Cinnamic aldehyde
Benzoic acid	Menthol
Cassia (cinnamon) oil	Vanillin
SPICES	
Cayenne pepper	Curry
Caraway	Paprika (<i>capsicum annuum</i>)
Cinnamon	Thyme
Coriander	

Table 2. Plants and spices causing contact urticaria. For references see Amin et al. (8), Ale and Maibach (11).

4. Immediate allergy to spices

Paprika, mustard, coriander, caraway, cayenne, anis, dill, fennel, mustard, celery seed and parsley are the most common causes of type I skin allergy (13,19), but the list of vegetables and spices causing immediate allergy is extensive (Table 2).

Cross-reactions between spices and other vegetables and fruits are common (2,13, 36-39). Positive type I skin reactions to spices and elevated spice-specific serum IgE values (RASTs) have been seen especially in subjects with birch or mugwort pollen allergy (13,19). The term "celery-carrot-mugwort-spice syndrome" has been proposed (2, 38, 39), as these subjects also frequently react to fresh fruits and vegetables.

Prick tests can be performed with native spices as such. The selection of spices used in tests depends on the individuals' exposure history. Prick tests are performed with native spices as follows: a small amount (2-5 mg) of powdered spice and a drop of saline are first mixed on the skin and then pricked into the skin. The reactions are read after 15 minutes. Reactions with a diameter of at least 3 mm larger than the negative control (saline) are regarded as positive (13). In cases of fresh materials, prick-prick tests or scratch-chamber tests (13) can be used. The prick tests (size of the wheal) are easier to evaluate than the scratch tests. Determination of spice-specific IgE may also be used when evaluating the clinical significance of the reactions. RAST may be negative in prick test positive cases (40).

5. Treatment and prevention

Identification and avoidance of the causative allergen is critical. General principles to treat contact dermatitis should be used (41). However, some studies have shown that despite detection of the allergen and removal of the causative agent from the environment, not all patients will clear (5). This may be caused by the multifactorial origins of many eruptions, which can include components of irritant and allergic reactions, endogenous eczema, and unknown factors.

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