

Spice allergy: results of skin prick tests and RAST with spice extracts

A. NIINIMÄKI,¹ F. BJÖRKSTÉN,² M. PUUKKA,³ K. TOLONEN⁴ & M. HANNUKSELA¹

¹Department of Dermatology, Oulu University Central Hospital, ²Hospital for Allergic Diseases, Helsinki University Central Hospital, ³Department of Clinical Chemistry, Oulu University Central Hospital, and ⁴Faculty of Biochemistry, University of Oulu, Finland

Skin prick tests (SPT) with freeze-dried spices and 5% (w/v) spice extracts were performed on 50 patients with 2+ or stronger SPT reactions to spices *per se*, and RAST were performed on 10 of them. Freeze-dried extracts produced mostly equal or stronger SPT reactions than corresponding whole spices, but 5% (w/v) extracts produced weaker reactions and also remained totally negative in some patients. Positive RAST results were seen in all 10 patients tested. The correlation between the RAST and SPT results was good for mustard and paprika, but poor for cayenne, coriander, caraway and white pepper. Five patients with positive SPT and RAST for spices contracted rhinitis from powdered spices in their working environments, and one patient suffered from gastrointestinal pains caused by spiced food. The others had noticed no clinical symptoms caused by spices. The present results thus indicate that both SPT and RAST should include purified spice extracts.

Key words: food allergy; occupational rhinitis, spice allergy.

Accepted for publication 16 August 1988

CLINICAL ASPECTS

Positive SPT and RAST reactions to spices are common among patients allergic to birch or mugwort pollen, although spiced food seldom causes symptoms, and those that do occur are usually mild. Powdered spices may cause occupational allergic respiratory symptoms even in non-atopics.

Immediate allergy to spices has been reported to cause symptoms in the skin, mouth, nasopharynx and gastrointestinal tract. Spiced food has even been suspected of causing more serious complications, e.g. acute giant urticaria and anaphylactic shock (6, 10, 11). Inhalation of powdered spice may cause allergic rhinitis and irritation of the throat (12). Six per cent of 1,129 patients with asthma or allergic rhinitis had noticed symptoms from eating spices (4, 5). Patients allergic to mugwort pollen may develop symptoms and positive skin test/RAST reactions to various spices (celery-carrot-mugwort-spice syndrome) (13, 14).

In one of our previous studies, positive scratch test reactions to spices were seen almost exclu-

sively in atopics, and mostly in patients with birch pollen allergy (9); most of the positive reactions were induced by coriander, caraway, cayenne, mustard and paprika. The tests in that particular study were made with powdered commercial spices as such, which contain essential oils and other potential irritants. The nature of the reactions was therefore difficult to evaluate. In the present study, IgE-mediated spice allergy was further investigated by performing skin prick tests (SPT) and RAST with spice extracts.

MATERIAL AND METHODS

The series comprised 50 patients in whom spices as such provoked $\geq 2+$ SPT reactions.

The main indication for skin testing with spices was gastric pain caused by seasoned food in one patient, rhinitis caused by powdered spices in four, widespread atopic dermatitis in 13, and birch pollen allergy in 32 patients. The female:male ratio was 25:25, the mean age 16.2 (range 1–47) years.

Spice extracts from mustard, paprika, coriander, caraway, cayenne and white pepper were prepared from commercial powdered spices according to the method of Markussen et al. (8). Briefly, 10 g doses of powdered spices were extracted overnight in 100 ml of solvent, 0.125 M ammonium bicarbonate and 0.015 M sodium azide (pH 7.6). After filtration, the solutions were centrifuged twice for 60 min at 50,000 *g*. The supernatants were then dialysed twice against a 50-fold volume of 0.005 M ammonium bicarbonate and 0.015 M sodium azide and then once against water, each for 24 h at 5°C. A spectra/Por 3, Molecular Weight Cutoff 3500 membrane tube (Spectrum Medical Industries Inc., Los Angeles) was used for dialysis. Finally, the extracts were freeze-dried and stored at 5°C. Ten grams of each powdered spice yielded freeze-dried material as follows: mustard 0.648 g, paprika 0.596 g, coriander 0.224 g, caraway 0.360 g, cayenne 0.557 g and white pepper 0.023 g. The freeze-dried products were dissolved in a 50:50 mixture of glycerol and saline, with 4% phenol as a preservative, to make 5% (w/v = original amount of spice/final volume of test solution) test solutions.

SPTs were made on the volar aspect of the

forearm with 5% (w/v) glycerol-saline solutions of purified spice extracts, with commercial powdered spices and with freeze-dried extracts, mixing a 50 µl drop of saline and approximately 2 mg of powdered spice or freeze-dried material on the skin before piercing. One per cent histamine acid phosphate was used as the positive control test and glycerol-saline and saline as the negative control test. The reactions were graded from 1+ to 4+ according to the recommendations of the Northern Society of Allergology (2). Reactions of $\geq 2+$ were considered to be positive.

Total IgE, birch pollen, mugwort pollen and spice RAST were performed in the sera of 10 patients with suspected spice allergy or food allergy in general and with at least one $\geq 3+$ SPT reaction to some spice extract. The freeze-dried spice extracts were used for RAST.

The comparison series comprised groups of five consecutive patients with positive SPT to birch pollen, to other inhalant allergens, and to none of the 20 inhalant allergens in the standard series (total 15 patients) all of whom had atopic respiratory or skin symptoms but negative SPT to spices.

RESULTS

SPT results

Among 50 patients with a positive SPT reaction to at least one spice, white pepper produced fewer reactions than mustard, paprika, coriander, caraway or cayenne (Table 1).

Table 1

Skin prick test reactions to whole spices in 48 atopic and two non-atopic patients showing at least one $\geq 2+$ reaction to any spice

Spice	No. patients tested	Reactions				Total
		4+	3+	2+	1+	
Mustard	50	18	7	2	2	29
Paprika	42	8	6	6	2	22
Coriander	42	7	13	8	1	29
Caraway	41	9	13	6	3	31
Cayenne	41	4	9	5	2	20
White pepper	49	–	4	–	–	4

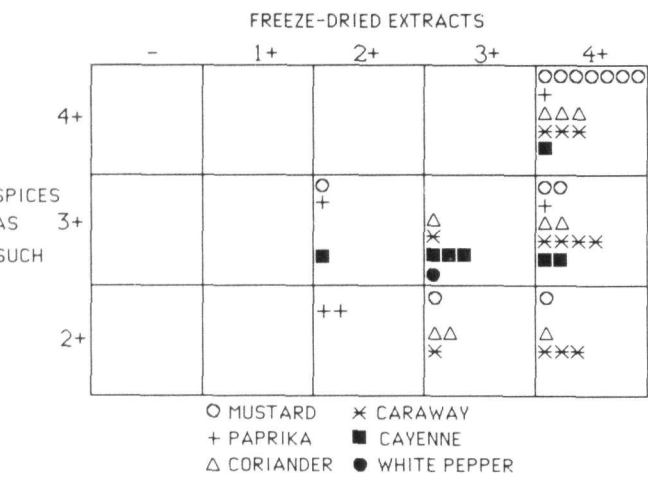


Fig. 1. Skin prick test results with freeze-dried spice extracts in patients with ≥ 2+ SPT reactions to whole spices.

Twenty-one of 50 patients were prick tested with freeze-dried spice extracts. These extracts produced mostly equal or stronger positive reactions than corresponding whole spices in all 21 patients tested (Fig. 1). Forty-one patients were tested with 5% (w/v) spice extracts. The overall response to these 5% extracts was weaker than the responses to whole spices, and in four patients 5% spice extracts elicited no reaction at all (Fig. 2).

RAST results

Positive (score 2 to 4) RAST results with spice extracts were seen in all 10 sera tested. The RAST and SPT correlation was good for mustard and paprika but poor for cayenne, coriander, caraway and white pepper (Table 2). Two children (patients 9 and 10 in Table 2) were RAST positive to all allergens tested. They had high total IgE values, 1,000 and 4,800 IU/ml.

Two of the 15 patients in the comparison series had positive RAST for spices, one with a score of 1 (0.4 PRU/ml) and the other with scores of 1 to 2 (0.5–1.4 PRU/ml). Both patients had high IgE values, 5,100 and 2,800 IU/ml. Total serum IgE was 1,600 IU/ml in one patient and varied from 6 to 390 IU/ml in the other 12 comparison patients.

RAST for human albumin was negative in all three patients with high IgE values and positive

(score of at least 1) to all allergens studied (one patient in the comparison series and patients 9 and 10 in Table 2).

Clinical data on patients with positive SPT or RAST to spice extracts

All but two of the 46 patients with positive SPT or RAST to spice extracts were atopic; 40 had positive SPT or RAST to birch pollen and 15 to mugwort pollen. Thirteen of the 40 birch pollen-positive patients reported allergy symptoms from raw fruits and vegetables. The symptoms appeared mostly in or around the mouth, in two patients also as contact urticaria on the hands.

Five patients had noticed rhinitis from powdered spices. Four of them (patients 1, 2, 3 and 4 in Table 2) worked in grills. Their jobs involved spicing meat and they had been sent for examination because of suspected occupational rhinitis. One pharmacy worker had experienced rhinitis when mixing powdered spice (pulv. fruct. capsic.) with other constituents to make a headache drug. One of the four grill workers also suffered from contact urticaria on his hands. Two of the grill workers had no other Type I allergies or other atopic symptoms.

One woman patient, herself a doctor, repeatedly contracted pruritus in her mouth, gastrointestinal aches and pain, facial swelling and a few urticarial lesions within 30 to 60 min of eating spiced food, especially sausages. She developed similar symptoms from raw fruits and vegetables. The symptoms disappeared when she was put on an elimination diet. Three patients had noticed pruritus and vesicopapules on the lips and hands after eating or handling raw paprika, but not after eating foods spiced with paprika.

The three youngest patients in the series (aged 1–1.5 years) with positive SPT reactions to mustard had never been given mustard orally. All three had been breast fed up to 11 months of age.

DISCUSSION

Reports of immediate allergy to spices are scarce in the literature (4, 5, 6, 10, 11, 12, 13, 14). However, positive skin test reactions to spices as well as to vegetables, are common

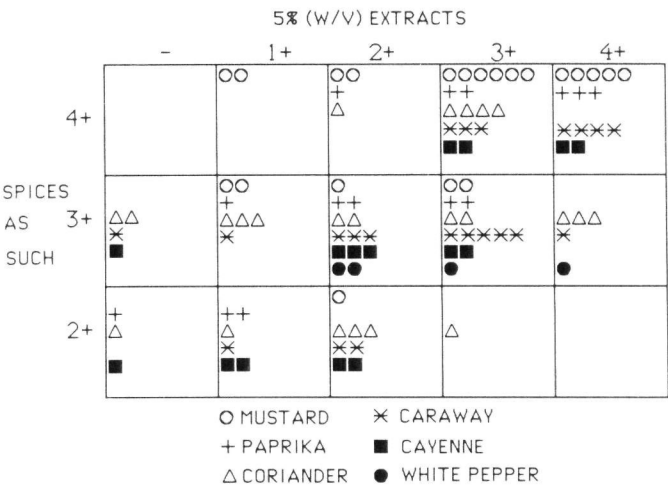


Fig. 2. Skin prick test results with 5% (w/v) purified spice extracts in patients with $\geq 2+$ SPT reactions to whole spices.

among patients allergic to birch or mugwort pollen (7, 9, 13, 14). Botanical relationships have been postulated as the cause of cross-allergies between certain spices and vegetables (13, 14). Of the spices used in the present study, coriander and caraway are members of the Umbelliferae family, cayenne and paprika of the Solanaceae family. Celery, carrot, parsnip and swede, which often provoke symptoms in patients allergic to birch pollen (7), belong to the Umbelliferae family, potato to the Solanaceae family.

In the present study, low molecular components were removed by dialysing spice extracts against 0.125 M ammonium bicarbonate and 0.015 M sodium azide (pH 7.6) twice and against water once, for 24 h each. When the SPT were performed with the dialysed fractions of spices, freeze-dried extracts mixed with saline on the skin caused stronger reactions than 5% (w/v) solution. This difference was obviously due to the difference in the actual final allergen concentration in SPT.

The present SPT and RAST results with dialysed allergens support our previous suggestion of cross-allergy between birch pollen and spices. On the other hand, positive RAST to all spices studied in altogether three patients suggest that spices may also have non-specific binding in RAST in patients with high total IgE (1, 3).

Only a few patients with positive SPT or RAST reactions to spices had noticed clinical symptoms caused by the spices. Five had contracted rhinitis from powdered spices, and one developed urticaria and gastrointestinal aches and pain from ingested spices. The five patients with rhinitis contracted their symptoms in their working environment, and rhinitis was the main indication for tests in four of them. Suhonen et al. (12) reported an analogous case of occupational allergy to coriander in a spice-packing factory. Occupational exposure may thus be strong enough to provoke allergic respiratory symptoms even in people without any other sign of Type I allergy or atopy.

To summarize, positive SPT and RAST reactions to spices are fairly common among patients allergic to birch pollen. The results suggest a cross-allergy between spices and birch pollen. Clinical symptoms caused by spiced food are infrequent and usually mild, but severe Type I allergic reactions are sometimes encountered. Powdered spices may cause occupational allergic respiratory symptoms even in non-atopics. Purified spice extracts are needed for both SPT and RAST. The final concentration of test materials for SPT should also be established.

ACKNOWLEDGEMENTS

This study was supported by grants from the Eemil Aaltonen Foundation and the Finnish Foundation for Allergy Research.

REFERENCES

1. Aalberse, R. C., Koshte, V. & Clemens, G. J.: Immunoglobulin E antibodies that crossreact with vegetable foods, pollen and Hymenoptera venom. *J. Allergy Clin. Immunol.* 68, 356-364, 1981.
2. Aas, K. & Belin, L.: Standardization of diagnostic work in allergy. *Acta Allergol.* 27, 439-468, 1972.
3. Barnetson, R. St. C., Merret, T. G. & Ferguson, A.: Studies on hyperimmunoglobulinemia E in atopic diseases with particular reference to food allergens. *Clin. Exp. Immunol.* 46, 54-60, 1981.
4. Eriksson, N. E.: Food sensitivity reported by patients with asthma and hay fever. *Allergy* 33, 189-196, 1978.
5. Eriksson, N. E.: Överkänslighet för kryddor hos patienter på en allergimottagning. En enkätstudie. *Näringsforskning* 27, 1-36, 1983.

Table 2
RAST results in sera of 10 patients with one or more $\geq 2+$ skin prick test (SPT) result to 5% (w/v) spice extracts

No.	Patient		IgE		Birch		Mugwort		Mustard		Paprika		Coriander		Caraway		Cayenne		White pepper	
	Age	Sex	SPT	RAST	SPT	RAST	SPT	RAST	SPT	RAST	SPT	RAST	SPT	RAST	SPT	RAST	SPT	RAST	SPT	RAST
1	36	F	4+	2* 2.1**	-	0	-	0	4+	3 7.2	-	0	-	0	4+	3 4.4	-	0	-	0
2	47	F	-	0	-	0	-	0	3+	2 0.8	-	0	-	0	3+	2 1.1	4+	1 0.4	-	-
3	26	F	-	0	-	1 0.5	-	0	3+	2 2.6	2+	2 0.9	3+	2 1.5	4+	3 3.7	-	0	-	-
4	22	M	-	0	-	0	-	0	4+	3 5.5	-	0	-	1 0.7	4+	3 3.9	-	0	-	-
5	30	F	4+	4 > 18	4+	4 > 18	-	0	-	0	4+	2 0.8	4+	0	-	0	3+	0	-	-
6	27	F	nt	3 14.5	nt	1 0.7	4+	2	-	0	4+	1 0.6	4+	0 2.1	-	2	-	0	-	-
7	8	F	3+	4 > 18	2+	0	4+	2 1.0	-	0	3+	0	3+	2 1.1	2+	0	-	0	-	-
8	1	F	-	0	-	0	3+	3 5.4	nt	0	nt	0	nt	0	nt	0	-	0	-	-
9	3	M	4+	3 14.8	-	2 0.9	3+ ^a	4 > 18	nt	2 1.1	nt	2 2.0	nt	2 1.1	nt	2 1.7	- ^a	2 1.0	-	-
10	5	M	2+	3 4.4	2+	2 1.8	4+ ^a	4 > 18	nt	2 1.1	nt	2 3.2	nt	2 1.5	nt	2 1.4	- ^a	2 0.9	-	-

Patients 1-4: grill workers with allergic rhinitis from powdered spices. Patient 5: gastrointestinal pain after ingesting spiced food. Patients 6-10: no clinical symptoms from spices.
nt: not tested; * RAST score; ** PRU/ml; ^a SPT made with freeze-dried extracts mixed with saline on the skin.

6. Hannuksela, M.: Results of food testing in atopic dermatitis. *Acta Derm. Venereol. (Stockh.)*, Suppl. 92, 87-90, 1980.
7. Hannuksela, M. & Lahti, A.: Immediate reactions to fruits and vegetables. *Contact Dermatitis* 3, 79-84, 1977.
8. Markussen, B., Løwenstein, H. & Weeke, B.: Allergen extract of horse hair and dandruff. Quantitative immunoelectrophoretic characterization of the antigens. *Int. Arch. Allergy Appl. Immunol.* 51, 25-37, 1976.
9. Niinimäki, A. & Hannuksela, M.: Immediate skin test reactions to spices. *Allergy* 36, 487-493, 1981.
10. Panconesi, E., Sertoli, A., Fabbri, P., Giorgini, S. & Spallanzani, P.: Anaphylactic shock from mustard after ingestion of pizza. *Contact Dermatitis* 6, 294-295, 1980.
11. Rowe, A. H. & Rowe, A. Jr.: Food allergy. Its manifestations and control and the elimination diets, pp. 585-586. Charles Thomas, Springfield, Ill., 1972.
12. Suhonen, R., Keskinen, H., Björkstén, F., Vaheri, E. & Zitting, A.: Allergy to coriander, a case report. *Allergy* 34, 327-330, 1979.
13. Wüthrich, B. & Dietschi, R.: Das "Sellerie-Karotten-Beifuss-Gewürz-Syndrom": Hauttest- und RAST-Ergebnisse. *Schweiz. Med. Wochenschr.* 115, 258-364, 1985.
14. Wüthrich, B. & Hofer, T.: Nahrungsmittelallergie: das "Sellerie-Beifuss-Gewürz-Syndrom". Assoziation mit einer Mangofrucht-Allergie? *Dtsch. Med. Wochenschr.* 109, 981-986, 1984.

Address:

Aila Niinimäki, M.D.

Department of Dermatology

University Central Hospital

90220 Oulu

Finland

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.