

Immediate reactions to fruits and vegetables

MATTI HANNUKSELA AND ARTTO LAHTI

Departments of Dermatology, University Central Hospitals, Oulu and Helsinki, Finland

Common fruits and vegetables were tested as such with the "scratch-chamber" method in 388 patients with various atopic disorders. Of the patients with hypersensitivity to birch pollen, 36 % showed immediate positive responses to these natural, fresh materials. Apple, carrot, parsnip and potato elicited reactions more often than, e.g. swede, tomato, onion and parsley. On the basis of clinical data, the relevancy of the results of the skin tests was 80-90 %. Both "false positive" and "false negative" responses were seen.

Itching and tingling with or without oedema of the lips, mouth and tongue were the most common complaints after eating raw fruits and vegetables. In addition, laryngeal and abdominal disturbances, rhinitis and hand dermatitis were recorded.

Among patients without allergy to birch pollen, reactions to fruits and vegetables were rare.

The nature of the allergens could not be determined.

Key words: Angioneurotic oedema - chamber test - contact dermatitis (immediate) - immediate allergy - scratch test - urticaria.

Received for publication November 15, 1976

Allergy to fruits, edible roots and vegetables has been well known for decades. Oranges, tomatoes, strawberries and melons are said to be the most common such allergens (Hansen 1957, Tuft & Mueller 1970). Reactions to potatoes, carrots and celery have been reported to be quite common but reactions to other roots very rare (Hansen 1957). Legumes are allergenically more active than other vegetables. However, asparagus, onion, chive, cabbage and sauerkraut are also found among allergenic vegetables (Török 1928, Kogoj 1962, Hanhart 1957, Tuft & Mueller 1970).

The reactions are usually immediate, appearing within minutes after the ingestion of these foods. Urticaria is probably the most common, but anaphylactic shock, gastrointestinal symptoms and a worsening of

atopic dermatitis are also frequently seen (Hanhart 1957, Tuft & Mueller 1970, Storck 1973, Warin & Champion 1974). The handling of foods may produce chronic hand eczema. Tuft & Mueller (1970) considered this type of allergy to be very rare. Maibach (1976) reported a patient with immediate skin reactions to several foods, and Hjorth & Roed-Petersen (1976) found immediate contact dermatitis to be fairly common among kitchen personnel.

Many patients with atopic disorders complain of allergic-type symptoms from raw fruits, edible roots and vegetables. However, the frequency of such reactions has not been studied. The aim of this study was to investigate the usefulness of the "scratch-chamber" test in detecting immediate reactions to some fruits and vegetables.

Material and Methods

Patients with various atopic disorders sent for routine scratch and intracutaneous test series (25 allergens) were chosen for this study. Allergic rhinitis and atopic eczema were the most common complaints (Table 1), and 20 % of the patients were suffering from bronchial asthma. Forty per cent of the cases had two or more atopic symptoms. Moreover, only patients with positive responses to two or more allergens of the routine test series were included in the series. Thus, a total of 388 patients took part in this study. Some clinical data of these patients are listed in Table 1.

A careful inquiry concerning the patients' symptoms when eating or handling various foods was undertaken in 152 cases of birch pollen allergy.

The tests were made using raw fruits, roots and vegetables. In most cases fresh material was used, but in sporadic cases deep-frozen materials were also used. Potato, carrot, apple and swede were tested in every case. Parsnip, celery, onion, parsley and tomato were tested in about half the cases.

Table 1. Clinical data of 388 patients with atopic disorders

Age	No. of cases	%
0-15	59	15
16-30	214	55
31-45	79	20
46-	36	9
Sex		
female	211	54
male	177	46
Atopic symptoms		
allergic rhinitis	247	71
atopic eczema	266	69
asthma bronchiale	78	20
2-3 atopic symptoms	154	40

The test method was a modified scratch test, the "scratch-chamber" test. Scratches approximately 5 mm long were made on the skin of the upper back or of the arms. A small amount of test material (about 20 µg) was put into an aluminum epicutaneous test chamber (Finn Chamber, Epitest Ltd OY, Fredrikinkatu 61, SF-00100 Helsinki 10). The chambers were fixed with porous tape (Scanpor®, Norgesplaster A/S, Oslo, Norway). The chambers and test materials were removed after 15 min, when the test results were read. Histamine 1:1000 (scratch test) was used as a positive control, and physiological saline as a negative control. Reactions of at least half of the area produced by histamine were regarded as positive, but minor reactions as negative.

Some experiments were made in order to examine the stability of the capacity of the test materials in producing positive reactions. Juices made in a juice centrifuge were used immediately after preparation, and after 2-7 days kept at +4°C. Fresh fruits and vegetables were stored at room temperature, at +4°C and at -16°C for 3-4 months or until spoiled. Tests were made weekly or after shorter intervals. Cooked fruits and vegetables were also tested in some patients with positive reactions to fresh materials.

Results

A negative result with all the fruits and vegetables tested was obtained in 64 % of the patients with hypersensitivity to birch pollen. In the remaining 36 % of the cases, positive reactions were seen, most often to apple, carrot, parsnip and potato (Table 2). Thus, the patients reacted to several fruits and vegetables (on average to four of those tested) if they reacted on the whole.

Positive reactions were rare in atopics not allergic to birch pollen (Table 2). Only seven patients reacted to at least one fruit or vegetable tested (on average to three of

Table 2. Immediate reactions to fruits and vegetables in scratch-chamber tests. Group I: 230 patients allergic to birch pollen. Group II: 158 patients not allergic to birch pollen

Fruits and vegetables	Allergic to birch pollen			Not allergic to birch pollen		
	No. tested	No. positive	%	No. tested	No. positive	%
Parsnip	148	40	27	49	2	4
Apple	230	59	26	158	3	2
Potato	230	52	23	158	4	3
Carrot	230	46	20	158	4	3
Celery	148	26	18	49	2	4
Parsley	148	20	14	49	3	6
Onion	148	19	13	49	2	4
Tomato	148	16	11	104	4	4
Swede	230	18	8	158	0	0

those tested). Three of these seven patients were hypersensitive to grass pollens, two patients to epithelia, one patient to flower pollens (Compositae) and to some epithelia, and one patient to moulds.

The inquiry in 152 cases of birch pollen

allergy revealed some clinical symptoms found when handling or eating various fruits and vegetables. In fact, most of the patients had no idea whether or not symptoms were caused by swede, parsley, celery or parsnip because they handled these sub-

Table 3. Correlation between clinical symptoms and the results of scratch-chamber tests with apple, potato, carrot, and tomato in patients allergic to birch pollen

Fruit/vegetable	Clinical symptoms	Results of the scratch-chamber test		Agreement between clinical symptoms and test result *
		Positive No.	Negative No.	
Apple	present	39	13	86
	absent	8	92	
Potato	present	15	6	83
	absent	20	111	
Carrot	present	20	5	91
	absent	8	119	
Tomato	present	7	16	83
	absent	9	116	

* The agreement percentage has been calculated as follows:

$$\frac{\text{No. of cases with positive skin test result and with clearcut clinical evidence of fruit/vegetable allergy} + \text{No. of cases with negative skin test result and without any clinical evidence of fruit/vegetable allergy}}{\text{Total no. of cases tested}} \times 100$$

Thus, the percentage for apple was: $\frac{39 + 92}{152} \times 100 = 86$

stances very seldom. The symptoms caused by onions were very confusing because no differentiation could be made between the irritating and possibly allergic properties of this vegetable. Thus, the clinical relevancy of the "scratch-chamber" tests could be estimated only from the findings for apple, potato, carrot and tomato.

Of the 152 cases, 52 had complaints from apples (Table 3). Itching and tingling of the lips and/or of the mouth with or without slight oedema of the lips/tongue were recorded in 48 cases. Hoarseness and irritation of the throat (5 cases), slight or moderate colic in the upper abdomen (4 cases), itchy dermatitis of the palms after handling apples (4 cases), and rhinitis/conjunctival irritation (2 cases) were also noted by the patients, nine of whom had symptoms in two shock organs.

Peeling potatoes caused symptoms in 19 out of 152 cases (Table 3). Itching and/or urticaria-like oedema of the hands were noticed by 17 patients, and five patients had rhinitis and a flow of tears resembling that caused by onions. In addition, two patients had swelling of the lips and tongue after eating raw potato. Thus, five patients had noticed some kind of irritation from raw potato in more than one shock organ.

Peeling and eating raw carrots elicited itching/swelling of the lips or tongue in 22 patients, three of whom had also suffered from angioneurotic oedema after ingesting 3-5 raw carrots. Itching and dermatitis of the hands were recorded in six cases and gastrointestinal disturbances in one case.

Itching of the lips and slight dermatitis in the perioral area were the most common complaints (19 cases) after eating tomatoes. The symptoms were, however, vague in most of them. Three additional patients suffered from aches and pain in the stomach and one patient from rhinitis after ingestion of tomatoes. Handling of these fruits caused hand eczema in one case.

Other vegetables were found to cause anaphylactic-type symptoms in sporadic cases only. Anaphylactic shock after eating salad containing raw celery was the most severe symptom recorded. Swede produced itching and dermatitis of the hands in two cases.

Tests performed using fresh juices made in a juice centrifuge elicited very few reactions. Apple juice was the only one that produced clearly positive reactions, and both carrot juice and potato juice gave only insignificant responses. Apple juice lost its allergenicity in 2 days both at +4°C and at room temperature.

Apple lost its capacity to produce positive reactions very quickly when stored at -16°C. Vegetables kept their allergenicity in a deep-freeze for some weeks. Tomato lost its consistency at -16°C, and therefore could not be stored deep-frozen.

Stored at +4 to 6°C, raw fruits and vegetables were fit for use until spoiled.

Cooking destroyed the allergenic properties of all the fruits and vegetables tested.

Discussion

Food allergy was examined especially during the first four decades of this century. Since then the role of food allergy as a cause of dozens of symptoms has attracted very little attention. The lack of proper test methods has limited the possibility of diagnosing hypersensitivity to various foods. In their extensive book on food allergy, Rowe & Rowe (1972) considered the scratch test with soluble or dry food allergens superior to other test methods, e.g. Black's cytotoxic test, the skin window technique, the determination of the leukopenic index, tanned red cell haemagglutination, and the gel-diffusion test. Challenge tests and elimination diets are often needed to confirm suspected allergy and to show the clinical relevancy of the skin test results.

Fruits and vegetables cause a variety of symptoms. In the present series, itching and tingling of the lips, mouth and tongue were the most common complaints. Handling of fresh natural products caused urticarial wheal and flare responses, itching and tingling, and contact-type eczema in the hands. Other symptoms including gastrointestinal disturbances and rhinitis/conjunctivitis were rarer.

Fresh natural products were used for tests in this study. The allergenicity was very readily destroyed by heating, and even freezing altered the allergenic properties within a couple of weeks. Fresh, unheated juices proved to be nearly useless for skin testing. These findings are in accordance with those of Tuft & Blumstein (1942) and Ancona & Schumacher (1950). Positive skin test results are obtained clearly more often with fresh products than with allergens available commercially (Tuft & Blumstein 1942, Ancona & Schumacher 1950, Rowe & Rowe 1972, Maibach 1976). The fact that cooking destroyed the allergenicity of the fruits and vegetables tested in this study has been also noted clinically. In most cases cooked potatoes and celery do not produce harmful effects although raw vegetables may cause very severe reactions (Rowe & Rowe 1972). None of our patients had any complaints regarding cooked potatoes and carrots.

The clinical relevancy of scratch-chamber tests was found to be good. While no challenge tests were made, the exact number of true positive reactions could not be calculated. Also the number of false negative test results might have changed if a more extensive clinical examination with elimination diets had been performed. However, anamnestic data suggesting food allergy indicate skin tests and often also elimination diets and challenge tests.

A noteworthy aspect of the present results was that fruit and vegetable allergy was connected with hypersensitivity to birch

pollen clearly more often than with other immediate allergies. This finding is of great importance especially in occupational medicine. To prevent occupational hazards we should direct persons with an atopic predisposition to occupations in which they need not handle any kind of food or other products containing proteins. According to the findings of Hjorth & Roed-Petersen (1976) even persons without any evidence of atopy may develop immediate type reactivity to protein-like materials.

By using the usual Prausnitz-Küstner technique, Tuft & Blumstein (1942) showed that specific reagins are present in the sera of the patients with immediate reactions to fresh fruits. Despite many attempts, the exact nature of the allergens in fruits and vegetables has not yet been clarified. Hjorth & Roed-Petersen (1976) suggested that these allergens might be proteins or protein-like substances. Maibach (1976) believed that the causative substances are large, possibly proteinaceous molecules which can pass through damaged skin better than through undamaged skin. Enzymes have also been suspected to be responsible for such reactions (Tuft & Mueller 1970). The extreme lability of the allergens in fruits and vegetables speak in favour of the view that these substances are either enzymes or more likely macromolecules. Cross-reactivity between various vegetables and fruits has been stressed by Rowe & Rowe (1972). This finding also came forth in this study. It also seems obvious that birch pollen and various fruits and vegetables contain substances which can cause cross-reactivity. These substances, however, remain to be investigated.

Acknowledgement

This study was supported by a grant from the Foundation for Allergy Research, Finland.

References

- Ancona, G. R. & Schumacher, I. C. (1950) The use of raw foods as skin testing material in allergic disorders. *California Medicine* 73, 473-475.
- Hanhart, E. (1957) Vererbung und Konstitution bei Allergie. In *Allergie*, ed. Hansen, K., pp. 169-198. Stuttgart: Georg Thieme Verlag.
- Hansen, K. (1957) Exposition. In *Allergie*, ed. Hansen, K., pp. 199-243. Stuttgart: Georg Thieme Verlag.
- Hjorth, N. & Roed-Petersen, J. (1976) Occupational protein contact dermatitis in food handlers. *Contact Dermatitis* 2, 28-42.
- Maibach, H. (1976) Immediate hypersensitivity in hand dermatitis. *Archives of Dermatology* 112, 1289-1291.
- Kogoj, Fr. (1962) Urticaria, Strophulus, Prurigo, Pruritus. In *Handbuch der Haut- und Geschlechtskrankheiten, Ergänzungswerk, Vol. III/1, Entzündliche Dermatosen I*, ed. Miescher, G. & Storck, H., pp. 475-544. Berlin, Göttingen, Heidelberg: Springer Verlag.
- Rowe, A. H. & Rowe, A. Jr. (1972) *Food Allergy. Its manifestations and control and the elimination diets*, 1st ed., pp. 23-40 and 534-593. Springfield: Charles C. Thomas.
- Storck, H. (1973) *Allergie. Theorie und Praxis*. Bern: Verlag Hans Huber.
- Török, L. (1928) Urticaria. In *Handbuch der Haut- und Geschlechtskrankheiten, Vol. VI/2*, ed. Jadassohn, J., pp. 145-215. Berlin: Verlag von Julius Springer.
- Tuft, L. & Blumstein, G. I. (1942) Studies in food allergy II. Sensitization to fresh fruits: Clinical and experimental observations. *The Journal of Allergy* 13, 574-581.
- Tuft, L. & Mueller, H. L. (1970) *Allergy in Children*, pp. 128-154. Philadelphia, London, Toronto: W. B. Saunders Company.
- Warin, R. P. & Champion, R. H. (1974) *Urticaria*. Philadelphia, London, Toronto: W. B. Saunders Company.

Address:

Matti Hannuksela, M.D.
Department of Dermatology
University Central Hospital
SF-90220 Oulu 22
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.