

Life-Threatening Anaphylaxis to Kiwi Fruit and Prevalence of Kiwi Fruit Hypersensitivity in the United States

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ABSTRACT

Life-threatening anaphylactic reaction to the ingestion of kiwi fruit has not been previously reported. We present two patients who sustained such reactions, a 65-year-old female and a 3½-year-old boy. Subsequently, a collaborative study was undertaken with the assistance of 25 allergists; this study includes more than 30 patients with kiwi-fruit sensitivity.

Kiwi fruit is rapidly becoming a staple item in the food industry. Kiwi fruit not only is ingested fresh but also is used in jams, candies, ice cream, wines, and juices. Only two patients with kiwi fruit sensitivity have been reported in the world literature. Two patients presented here will be the first with a true life-threatening anaphylactic reaction. In addition, a collaborative study carried out with more than 25 allergists in the United States and one in Sweden on patients with kiwi fruit sensitivity will be presented.

HISTORICAL REVIEW

Kiwi fruit, new and exotic as it is to the present generation, was grown by the Chinese during the Tang dynasty in 600–900 A.D. It was known as “yang-

tao” and “mihoutao.” In 1930, the “Chinese gooseberry” was imported by New Zealand and was extensively planted; at present over 40,000 metric tons are exported all over the world. As a result of the increased trade with America and Europe, an enterprising entrepreneur changed the name “Chinese gooseberry” to kiwi fruit—the kiwi being the flightless bird that is the emblem of New Zealand. There are many species of kiwi fruit,¹ although the commercial kiwi fruit exported from New Zealand and also commercially grown in many parts of the United States are of the same species. This species is insect pollinated. It is of particular interest commercially because of its shelf life of over 6 months, its low caloric content (45 calories), and its rich content of vitamin C (300–400 mg/100 g of fruit). Kiwi fruit contains an active proteolytic enzyme, actiniden, related to papain, which is being investigated for its potential applications in industry.^{1–3}

Hypersensitivity to kiwi fruit was first reported in 1981 by A. J. Fine,⁴ who described a patient who upon exposure to the peelings of kiwi fruit, experienced itching of the eyes and ears, hives of the hands, and wheezing. She had a positive reaction with passive transfer testing of her serum.

In 1983, C. J. Falliers⁵ reported the first case of hypersensitivity to the ingestion of kiwi fruit. His patient, within 15 minutes after ingestion of two slices of kiwi fruit, developed pruritus, swelling and tearing of the eyes, and swelling of the tongue and lips but no wheezing. Scratch testing to the undiluted pulp of the

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kiwi fruit was markedly positive. Both of the above-mentioned patients were atopic.

CASE REPORTS

Case 1

The patient, a 65-year-old woman, over the years experienced increasing conjunctivitis and rhinitis in the spring and fall. Her history included a bowel resection for carcinoma of the colon 3 years prior to her anaphylactic reaction.

In August 1987 she ingested a combination of Brie and blue cheese on a wheat cracker topped with a slice of kiwi fruit. She previously had eaten kiwi fruit with impunity. At this time, however, she immediately felt a swelling and itching of her throat, burning of her nose and mouth, felt faint, began to sweat, vomited, experienced diarrhea, and collapsed. She was admitted to the Intensive Care Unit where appropriate treatment was administered, and she was discharged two days later. Several weeks after this episode, she challenged herself with the same cheeses and cracker without experiencing any difficulty. Challenge to kiwi fruit was not suggested, but scratch testing to the undiluted product of the Cuisinart-processed peeled kiwi fruit gave an immediate skin reaction with a 25 mm zone of erythema and 20 mm wheal with pseudopodia. RAST testing before the skin test gave a count of 13,007 (classified as Class IV) Table III, and three months later a count of 8400. She had also shown significantly positive skin tests to grass, trees, cat, alternaria, among others. Skin testing to papain was negative.

Case 2

A 3.5-year-old boy with allergic rhinitis and also anaphylactic reactions to peanuts ate kiwi fruit at eight months of age without reaction. In the summer of 1988, he ate kiwi fruit and immediately collapsed, lost consciousness, and vomited but had no further sequelae. Skin test with macerated fresh kiwi fruit was 4+ positive. RAST testing showed a markedly elevated count of 4962.

METHODOLOGY: THE COLLABORATIVE STUDY

Because of the paucity of data available regarding hypersensitivity to the ingestion of kiwi fruit, it was thought worthwhile to explore the prevalence of this sensitivity in the United States. An inquiry requesting information regarding kiwi fruit sensitivity was sent to the members of the American Academy of Allergy and Immunology. Thirty United States physicians participated in the study and in the collection of data. Dr. Sten Dreborg of Sweden contributed three patients as well as some valuable data pertinent to this study.^{6,7}

Each physician who acknowledged having a patient with kiwi fruit sensitivity was asked to present the history of the reaction, and to obtain RAST testing at the Clinical Immunology and Allergy Diagnostic Laboratory of Liberty, Missouri.⁸ All patients were then scratch tested to kiwi fruit, using the peeled, freshly macerated whole fruit as the antigen. Scratch testing at 1:20 dilution W/V and intradermal testing at 1:1000 W/V of grass, trees, cat, house mite, and ragweed antigens were also obtained.

Also tested with kiwi fruit were more than 20 atopic patients with a history of kiwi fruit ingestion who were not clinically sensitive to kiwi fruit (controls). More than 30 patients with kiwi fruit sensitivity were identified by responding physicians, but not all the patients were willing to complete testing. Thus, on Table I, incomplete data may be evident for several patients. All patients who agreed to participate did so with informed consent.

RESULTS

The results of the collaborative study are illustrated in Table I. A skin test showing at least a 10 mm zone of erythema and/or a 5 mm zone of induration was considered positive. The RAST testing was labeled 0 to 4+ according to the modified RAST score index on Table II. None of the more than 20 aforementioned controls had positive skin tests to kiwi fruit or papain.

Kiwi fruit sensitive patients were scattered across the United States. The age group ranged from 3.5 years to 81 years. Gender was represented by 19 females and 9 males. Two-thirds of the patients had positive history and/or skin-test sensitivity to indoor and outdoor allergens. Reactions to kiwi fruit, as perceived by contributing allergists, were evenly divided between local and systemic manifestations. Local reactions consisted of oral and pharyngeal itching and to edema of the oral and perioral areas as well as local urticaria. The generalized reactions were characterized by diffuse hives, flushing, diarrhea, tightness of the chest, and frank anaphylaxis. Of the 20 patients who completed their protocol (although 3 refused skin testing), there were 14 with positive RAST testing and six with negative RAST testing. The incidence of positive RAST reactors was 70%. Of the 16 patients with clinical kiwi fruit sensitivity who were skin tested, 11 had positive skin tests, and 5 had negative skin tests; this was an almost 70% incidence of skin test positive reactors.

DISCUSSION

Studies of food allergy by S. Dees,⁹ C. May,¹⁰ H. Sampson,¹¹ and others, have pointed out the fact that an impressive history of food allergy, as well as the presence of detectable antibodies, is not sufficient evidence in making a diagnosis of food allergy. They have

TABLE I

Total Patients with Kiwi Fruit Sensitivity (*n* = 30)

State	Age	Sex	HX/SK*	React	Signs and Symptoms	Kw-RAST†	Kw-Sk Tst‡
RI	65	F	+/+	S	Nose burn, swollen tongue, weak, dec. BP, inc. Pulse, Hosp. × 2 d, V+D	4+	+
CT	29	M	+/+	L	Sores on tongue	2+	+
TN	16	F	-	S	Urticaria, laryngeal edema	NA§	NA
MA	-	-	-	S	Tight throat	NA	NA
IL	45	F	+/+	S	Tight chest, swollen gums, itching and burning of throat	1+	+
CA	27	M	-	S	Tight chest, slurred speech	1+	+
IL	51	F	-/-	S	Nausea, vomiting, diarrhea, s.o.b., weakness, hypotension	0	neg
TX	50	F	+/+	S	Throat "closing," itching of mouth, incr. mucus	0	+
WA	35	F	+/+	?L	Difficulty swallowing	NA	NA
MO	37	M	+/+	S	Facial hives, tingling, swelling of mucous membranes, hoarseness	NA	NA
MI	34	F	+/?	?S	Swelling of oral pharynx, shaky, ears hot, flushed chest and face	NA	NA
MN	34	F	+/?	?L/S	Itching all over, red eyes, difficulty swallowing	1+	NA
MA	38	F	-	S	Urticaria	NA	NA
CT	15	M	+/?	?S/L	Tightness of chest, cough, inc. mucus	NA	NA
WA	44	M	+/+	?S	Edema of face × 3 days	3+	+
CA	50	F	-	?	Flushing, stomach cramps, erythema	0	NA
FL	81	M	-	L	Scratchy throat	NA	NA
TX	53	F	+/+	L	Oral swelling, itching of throat	2+	+
CT	20	F	+/+	L	Pharyngeal edema, itchy palate	0	neg
CT	34	F	+/+	L/S	Itching of throat, ears burn, throat "closing"	0	neg
SWED	22	M	0/0	S	Oral itching, lips, diarrhea	4+	?
SWED	51	F	0/0	L	Itching of ears and mouth	2+	+
LA	61	M	+/-	L	S.o.b., Tight throat, incr mucus	0	neg
IL	3.5	M	+/+	S	Choked, fell.? lost consciousness, vomited	3+	+
RI	30	F	-	L	Eyes swollen, throat discomfort	NA	NA
CT	27	F	+/+	L	Scratchy throat & ears	3+	neg
MI	41	F	+/+	S	Skin flush, pharyngeal edema, dyspnea, ? esophageal edema	2+	+
TX	57	F	+/+	L	Itching of mouth & tongue, ? laryngeal edema	1+	+
SWED	56	F	?	L	Itching of throat	1+	?
CA	45	F	0/-	S	Systemic pruritis; angioedema of eyes and face; nausea	3+	+

* HX/SK = history of atopy and skin testing to some indoor and outdoor allergens; † KwRAST = kiwi fruit RAST; ‡ KwSk Tst = kiwi fruit skin test; § NA = not available; || s.o.b. = shortness of breath.

TABLE II

IgE Modified RAST Interpretation*

Class	Count	Terminology
0	0-749	Below detection
1	750-1,599	Equivocal range
2	1,600-3,599	Increasing levels
3	3,600-7,999	of allergen-
4	8,000-17,999	specific IgE
5	18,000-39,999	antibody
6	40,000-above	

* Clinical & Immunology Diagnostic Laboratory, Liberty, MO.

emphasized that double-blind, placebo controlled food challenges are necessary. It is unfortunate that more open challenges were not done, but in view of the risk exposure this represented, both patients and their physicians were reluctant to undertake such procedures.

In Table III, patients have been classified into (1) an anaphylactic IgE-mediated group, (2) local reacting IgE-mediated group, and (3) a non-IgE mediated anaphylactoid or local reactor. IgG subgrouping on these patients was not obtained, although this modality of laboratory investigation is perhaps of some value with food classification.^{12,13} Perhaps of even more substantial value would be the elucidation of the chemical constituents and the molecular structure of kiwi fruit and its epitopes now being investigated in Auckland.¹⁴

TABLE III

Classification of Kiwi Fruit Sensitivity: Anaphylactic IgE-mediated, Local IgE-mediated, or Non-IgE-mediated Anaphylactoid or Local Reaction

State	Age	Sex	HX/SK*	React	Signs and Symptoms	Kw-RAST†	Kw-Sk Tst‡
Anaphylactic IgE Mediated							
RI	65	F	+/+	S	Nose burn, swollen tongue, weak, dec. BP, inc. Pulse, Hosp. × 2 d, V+D	4+	+
IL	45	F	+/+	S	Tight chest, swollen gums, itching and burning of throat	1+	+
CA	27	M	-	S	Tight chest, slurred speech	1+	+
TX	50	F	+/+	S	Throat "closing," itching of mouth, incr. mucus	0	+
WA	44	M	+/+	?S	Edema of face × 3 days	3+	+
SWED	22	M	0/0	S	Oral itching, lips, diarrhea	4+	?
IL	3.5	M	+/+	S	Choked, fell, ? lost consciousness few minutes, vomited	3+	+
CA	45	F	0/-	S	Systemic pruritis; angioedema of eyes and face; nausea	3+	+
Local Reactions IgE Mediated							
CT	29	M	+/+	L	Sores on tongue	2+	+
SWED	51	F	0/0	L	Itching of ears and mouth	2+	+
CT	27	F	+/+	L	Scratchy throat & ears	3+	neg
Non-IgE Mediated Anaphylactoid or Local Reaction							
IL	51	F	-/-	S	Nausea, vomiting, diarrhea, s.o.b.,§ weakness, hypotension	0	neg
CT	34	F	+/+	L/S	Itching of throat, ears burn, throat "closing"	0	neg

* HX/SK = history of atopy and skin testing to some outdoor and indoor allergens; † Kw-RAST = kiwi fruit RAST; ‡ KwSk Tst = kiwi fruit skin test; § s.o.b. = shortness of breath.

Kiwi fruit does not appear to be botanically related to any other vegetable or fruit,¹⁵ although one observer¹⁶ found a patient with avocado sensitivity who also had sensitivity to kiwi fruit. None of my patients, however, appeared to have cross-reactive avocado or papain sensitivity.^{6,7} Specific pollen sensitivity associated with kiwi fruit sensitivity was not evaluated, although atopy per se was certainly a prominent factor in those patients studied.

CONCLUSION

We have presented two patients with life-threatening anaphylaxis to kiwi fruit and a collaborative study of 25 more patients with kiwi fruit sensitivity in the United States and three from Sweden. We conclude there may be three categories of kiwi fruit sensitivity that can be recognized with aid of immunological studies, namely:

1. Anaphylactic IgE-mediated sensitivity
2. Local reaction IgE-mediated sensitivity
3. Anaphylactoid and local non-IgE-mediated sensitivity

It becomes quite clear that the increasing introduction of exotic fruit will bring with it the prevalence of allergic reaction to its ingestion. There is also the possibility of an anaphylactic reaction to the inhalation of its commercial by-products as has been seen with papaya.⁴

ADDENDUM

Dr. Conrad Perera and his associates of New Zealand and Australia, in a paper to be published this year in the *Journal of Food Sciences*, will present a study entitled "Calcium oxalate crystals: the irritant factor in kiwi fruit." This factor undoubtedly represents the cause of oral discomfort experienced by many of the patients in my study (Table I).

ACKNOWLEDGMENTS

Valuable contributors to this study were: Ms. Mickey Bock, P.A., Drs. Leonard Cohen, A. C. Dalton, Sten Dreborg, Carl Dubovy, Geraldine Feldman, Steven Robert Findlay, Paul F. Hintze, Reynold Karr, Richard Lee, Steven Matloff, Mark L. Menzel, Neida Q. Ogden, James H. Saker, Donald P. Schwartz, John Terry Smith, Paul Steinberg, Charles L. Swarts, W. W. Taylor, Paul P. Van Arsdel, Jr., and Steven F. Weinstein.

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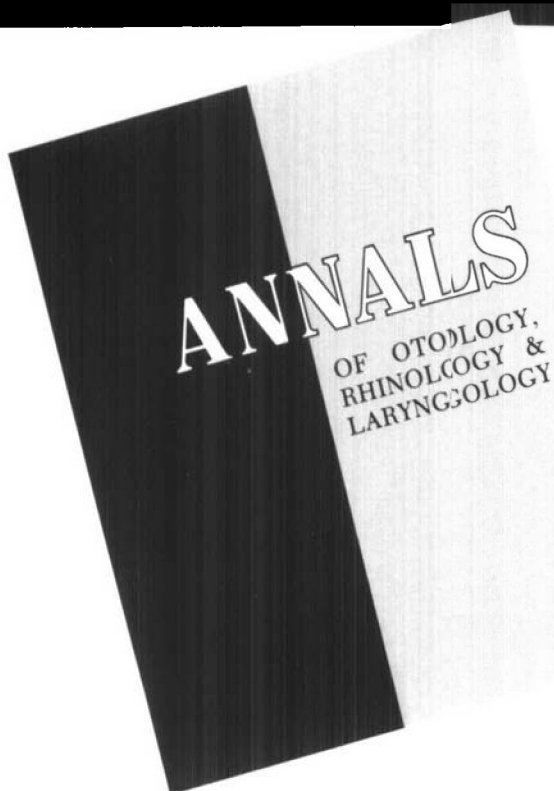
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