CASE REPORT

Anaphylaxis Following Ingestion of Mango Fruit

VL Hegde and YP Venkatesh

Department of Biochemistry and Nutrition, Central Food Technological Research Institute, Mysore, India

Abstract

Allergic reactions to fresh fruits and nuts have become increasingly common. Mango (*Mangifera indica*) is a popular fruit eaten all over the world. We report the case of a 43-year-old woman who experienced oropharyngeal itching, swelling of the face and other parts of the body, and difficulty breathing within a few minutes of eating ripe mango fruit. The woman had no history of pollen or latex allergy. However, she reported instances of milder food allergic reactions to Indian dill and cashew apple. Skin prick tests using mango fruit pulp, Indian dill, and cashew apple extracts were positive. Prick tests with a panel of common grass and weed pollen extracts were negative. Enzyme-linked immunosorbent assay for mango-specific serum immunoglobulin (Ig) E was positive. A specific protein allergen in mango could not be detected by immunoblotting. Based on the strongly positive clinical history and results of allergy testing, it was concluded that the woman had IgE-mediated anaphylactic reactions to mango fruit.

Key words: Anaphylaxis. Anacardiaceae. Angioedema. Food allergy. Immediate hypersensitivity. Mango.

Resumen

Cada vez son más comunes las reacciones alérgicas a los frutos secos y a las frutas frescas. El mango (*Mangifera indica*) es una fruta popular que se come en todo el mundo. Presentamos el caso de una mujer de 43 años de edad que experimentó picor orofaríngeo, tumefacción de la cara y otras partes del cuerpo, así como disnea al cabo de unos minutos de haber comido mango maduro. La mujer no había tenido alergia al polen ni al látex. No obstante, informó haber tenido reacciones alérgicas alimentarias leves al eneldo indio y al anacardo. Las pruebas cutáneas, para las que se utilizaron extractos de pulpa de mango, de eneldo indio y de anacardo, fueron positivas. Las pruebas cutáneas con un grupo de extractos de polen de hierbas y gramíneas comunes fueron negativas. El enzimoinmunoanálisis de adsorción con anti-IgE fue positivo para mango. No se pudo detectar por inmunotransferencia un alérgeno proteico específico del mango. Basándonos en la historia clínica claramente positiva y en los resultados de las pruebas , concluimos que la paciente presentaba reacciones anafilácticas al mango, mediadas por IgE.

Palabras clave: Anafilaxia. Anacardiaceae. Angioedema. Alergia alimentaria. Hipersensibilidad inmediata. Mango.

Introduction

Severe food allergies to fruits and nuts have become increasingly common and represent a growing clinical problem. Mango (*Mangifera indica* Linnaeus), popularly known as the "king of fruits," is the second most frequently cultivated tropical fruit worldwide. It belongs to the poison ivy family (*Anacardiaceae*) and is native to southern Asia, especially Burma and eastern India. Pistachio and cashew are other notable members of this family. All these foods can cause severe anaphylactic reactions [1-4]. Although mango is a very popular fruit in India, cases of hypersensitivity to consumption of mango have not been reported previously from this part of the world.

Case Description

We report the case of a 43-year-old woman who had experienced severe allergic reactions after eating ripe mangoes

at least 6 or 7 times since the age of 7. The symptoms were oropharyngeal itching, angioedema on the face and other parts of the body, and respiratory distress within minutes of eating ripe mango fruits. The patient also reported tiredness and dizziness within an hour of eating the fruit. She received emergency care and was treated with antihistamines and corticosteroids by injection for 5 days after such severe adverse reactions. She also recollected having isolated instances of allergy to cashew apple, Indian dill, eggplant, papaya, and sesame, with symptoms ranging from mild oral itching to swelling of the face and hands. The patient had no history of allergic rhinitis, asthma, atopic eczema, or latex allergy. The family history was negative for atopic diseases. An allergy study was conducted after obtaining approval from the institutional ethics committee and informed consent from the allergic subject and healthy volunteers.

To prepare mango extract for use in skin prick tests, ripe mangoes of the Pairi cultivar were obtained from a local store. A 50% w/v extract of mango pulp (50 g) was prepared by blending in 100 mL phosphate-buffered saline (PBS). The extract was stirred at 4°C for 16 hours and then centrifuged at 8000 rpm at 4°C for 10 minutes. The supernatant from this step was filtered through Whatman number 1 filter paper and used in the study. The protein content of the extract was 0.5 mg/mL as determined by Bradford assay [5]. Allergenic extracts from Indian dill and cashew apple were also prepared similarly.

SPT was performed on the allergic subject and 10 healthy volunteers according to standard procedures by placing a drop of glycerinated (50%) allergenic extract on the volar side of the forearm and gently pricking the skin underneath with a sterile prick lancet (Prick Lancetter, Bayer Pharmaceutical Division, Spokane, USA). Glycerinated PBS (50%) and histamine dihydrochloride (10 mg/mL) in glycerinated PBS were used as negative and positive controls, respectively. Wheal and flare diameters were measured after 20 minutes. SPT was considered positive if the wheal diameter was greater than 3 mm when compared with the negative control. The allergic subject was also tested by SPT for a panel of common inhalant pollen allergens. Southern grass pollen mix (ref 1651, Bayer Corp, Spokane, USA) contained pollens from Bermuda, Johnson, Kentucky Blue, Orchard, Redtop, Sweet Vernal, and Timothy grasses. Grass pollen mix (ref P28, Greer Laboratories, Lenoir, USA) contained pollens from Bermuda, Johnson, Kentucky Blue, Orchard, Redtop, Timothy, Sweet Vernal Meadow, Fescue, and Perennial Rye grasses. Common Weed Mix (ref P15, Greer Laboratories, Lenoir, USA) contained pollens from Cocklebur, English Plantain, Lamb's Quarter, Rough/Redroot Pigweed, and Russian Thistle.

SPT with mango extract was positive in the allergic subject (table). Both dialyzed and undialyzed mango extracts (50% w/v) gave SPT results of 5 mm and 20 mm for wheal and flare reactions, respectively. Prick tests were also positive for Indian dill, *Anethum sowa* Roxb (5 mm wheal and 30 mm flare), cashew apple, *Anacardium occidentale* Linnaeus (5 mm wheal and 15 mm flare), and a commercially available mango juice. Results of SPT for these food samples were negative (wheal diameter, 0-2 mm) in 10 normal subjects. SPT for a panel of common inhalant allergens including grass and weed pollens were negative in the allergic subject.

Serum allergen-specific immunoglobulin (Ig) E to mango was detected by enzyme-linked immunosorbent assay (ELISA) [6] using Maxisorp 96-well microtiter plates (Nunc, Roskilde, Denmark). Briefly, the wells were coated with mango extract dialyzed against bicarbonate buffer (pH 9.6) overnight at 4°C (50 μg protein per well). The plates were blocked by incubation with PBS containing 0.05% Tween-20 (PBS-T) and 1% bovine serum albumin. After blocking, the wells were incubated with allergic or control serum diluted 1:3 in blocking buffer. Serum from 3 volunteers without any history of allergy was pooled and taken as the control serum. Horseradish peroxidase-conjugated goat anti-human IgE (Sigma-Aldrich Co, St. Louis, USA) was used as the secondary antibody (diluted 1:5000 in PBS-T). Wells were washed 3 times with PBS-T between each incubation step. Finally, the color development was done by adding 100 μL per well of *o*-phenylenediamine (0.5 mg/mL in 0.2 M phosphate buffer, pH 7.0). The reaction was stopped by adding 3M HCI solution (40 μL/well), and the absorbance at 492 nm was read on an ELISA plate reader.

Serum from the mango-allergic patient showed more than 2-fold higher ELISA units when compared with that of normal serum, indicating the presence of mango-specific IgE in the allergic subject (table).

The clinical history and results of the allergologic tests showed that the patient had IgE-mediated anaphylactic reactions to mango fruit. She was advised to strictly avoid mango, Indian dill, and cashew apple and to be aware of hidden allergens related to mango in processed foods.

To assess the presence of specific protein antigens, mango extract was subjected to 12% sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) [7]. Protein samples were prepared in Laemmli sample buffer containing 0.6 M β-mercaptoethanol and denatured by boiling for 3 minutes before loading. Protein bands were visualized by staining the gel with Coomassie brilliant blue R-250. For immunoblot analysis, proteins separated by SDS-PAGE were blotted by electrotransfer onto a nitrocellulose membrane [8]. After transfer, protein bands were visualized using Ponceau S stain (1% in glacial acetic acid). After destaining with water, the membrane was blocked with 2% gelatin in tris-buffered saline containing 0.05% Tween-20 (TBS-T) to prevent nonspecific binding. The membrane was then probed with allergic or control serum (diluted 1:3 in TBS-T) at 4°C for 16 hours, followed by incubation with a peroxidase-conjugated goat anti-human IgE secondary antibody (1 mg/mL in TBS-T) at 37°C for 2 hours. The membrane was washed with TBS-T 4 or 5 times between steps. Finally, specific protein bands were visualized with diaminobenzidine in the presence of hydrogen peroxide.

SDS-PAGE of mango extract showed 2 major protein bands of 24 and 28 kilodaltons (kd) and several minor protein bands (see panel A in figure). Upon transfer of these proteins to a nitrocellulose membrane, immunoblot analysis was performed to detect specific allergenic proteins in mango. The 2 major protein bands could be seen in immunoblots using both normal and allergic serum (see panel B in figure). It was found by extensive analysis that these 2 protein bands (most likely lectins or lectin-like proteins) appeared in the immunoblots due to their binding to glycans of peroxidase in the secondary

Results of Skin Prick Test and Enzyme-Linked Immunosorbent Assay With Mango*

Sample	SPT†	ELISA Units ‡	
		NS	AS
Glycerinated PBS§	1/0		
Histamine dihydrochloride ll	9/20		
Mango extract	5/20	0.215	0.591
Commercial mango juice	4/10	0.020	0.187

*SPT indicates skin prick test; ELISA, enzyme-linked immunosorbent assay; NS, normal serum; AS, allergic serum; PBS, phosphate buffered saline.
†SPT result is indicated as wheal/flare diameter in mm. ‡ELISA units (Abs450) are the mean values of triplicate determinations. §Negative control. ll Positive control

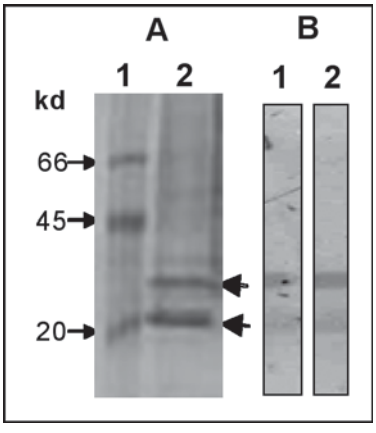
antibody conjugate (data not shown). No specific IgE-binding bands could be detected in the immunoblots developed with allergic serum (see panel B in figure).

Discussion

Severe allergic reactions to the ingestion of mango are rare. Only 3 cases of anaphylactic reactions to ingestion of mango fruit have been reported in the literature [1-3]. Recent studies on immediate-type food allergy to mango identified several allergens in mango fruit [9,10]. The incidence of mango fruit allergy may be high in subjects with "celery-mugwort-spice syndrome" or latex allergy [10] due to possible cross-reactive allergens, although this observation has not been confirmed by double-blind placebo-controlled food challenge. Besides food hypersensitivity to the fruits, sensitizations to mango pollen [11] and seeds [12] have also been described.

In the present case, immediate hypersensitivity to mango fruit was established based on positive case history, positive SPT, and the presence of mango-specific IgE in the serum. However, repeated attempts to detect specific protein allergens in mango by immunoblot analysis failed. This might suggest the presence of a low molecular weight nonproteinaceous allergen that could escape detection by immunoblotting. However, the presence of a highly labile protein allergen that is degraded during SDS-PAGE immunoblotting analysis or a low molecular weight allergenic peptide (<10 kd) in mango can not be ruled out.

The allergic patient presented here had no history of i nhalant allergy and did not respond to a panel of common pollen allergens in SPT, indicating that sensitization was not due to a cross-reactive allergen found in both pollen and mango fruit. Nevertheless, positive history and positive SPT with cashew apple (another member of the poison ivy family) and Indian dill (*Umbelliferae*) indicate that the allergen responsible for severe IgE-mediated mango allergy in this case may be responsible for cross-allergenicity with other plant foods.



A) Sodium dodecyl sulfate polyacrylamide gel electrophoresis of mango extract on a 12% reducing gel (lane 1, molecular weight markers; lane 2, mango extract). B) Immunoblots of mango extract using control serum (lane 1) and serum from the mango allergic patient (lane 2).

Acknowledgments

We thank the staff of Health Center, Central Food Technological Research Institute, Mysore, India for their valuable assistance in this study. This work was supported by the Department of Science and Technology, New Delhi, India in the form of a grant-in-aid project (ref SP/SO/B48/97) to YPV.

References

1. Rubin JM, Shapiro J, Muehlbauer P, Grolnick M. Shock reaction following ingestion of mango. J Am Med Assn. 1965;193:397-8.
2. Dang RW, Bell DB. Anaphylactic reaction to the ingestion of mango: A case report. Hawaii Med J. 1967;27:149-50.
3. Miell J, Papouchado M, Marshall AJ. Anaphylactic reaction after eating a mango. Brit Med J. 1988;297:1639-40.
4. Garcia F, Moneo I, Fernandez B, Garcia-Menaya JM, Blanco J, Juste S, Gonzalo MA. Allergy to Anacardiaceae: description of cashew and pistachio nut allergens. J Investig Allergol Clin Immunol. 2000;10:173-7.
5. Bradford MM. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. Anal Biochem. 1976;72:248-54.
6. Bernstein IL, Storms WW. Practice parameters for allergy diagnostic testing. Ann. Allergy Asthma Immunol. 1995;75:543-625.
7. Laemmli UK. Cleavage of structural proteins during the assembly of the head of bacteriophage T4. Nature. 1970;227:680-5.
8. Towbin J, Staehelin T, Gordon J. Electrophoretic transfer of proteins from polyacrylamide gels to nitrocellulose sheets: Procedure and some applications. Proc. Natl. Acad. Sci. U.S.A. 1979;76:4350-4.
9. Paschke A, Kinder H, Zunker K, Wigotzki M, Weßbecher R, Vieluf D, Steinhart H. Characterization of allergens in mango fruit and

ripening dependence on the allergenic potency. Food Agric Immunol. 2001;13:51-61.
10. Paschke A, Kinder H, Zunker K, Wigotzki M, Steinhart H, Weßbecher R, Vieluf I. Characterization of cross-reacting allergens in mango fruit. Allergy. 2001;56:237-42.
11. Vargas Correa JB, Sanchez Solis L, Farfan Ale JA, Noguchi H, Moguel Banos MT, Vargas de la Pena MI. Allergological study of pollen of mango (Mangifera indica) and cross reactivity with pollen of piru (Schinus molle) [in Spanish]. Rev Alerg. 1991;38:134-8.
12. Fernandez C, Fiandor A, Martinez-Garate A, Martinez Quesada J. Allergy to pistachio: crossreactivity between pistachio nut and other Anacardiaceae. Clin Exp Allergy. 1995;25:1254-9.

Manuscript received November 7, 2006; accepted for publication March 13, 2007.

Dr Venkatesh L Hegde, PhD

Dept. Pathology, Microbiology and Immunology
University of South Carolina, School of Medicine
6439 Garners Ferry Road, Building 1, Room C24
Columbia, SC 29208 USA
E-mail: vlhegde@yahoo.com