

months [from 42.1 to 18.8 ng], 19.2% after the first dose [from 42.1 to 34 ng]) and (2) an incompletely (distance obstacles) studied patient (13.3% after the first dose [from 82 to 71.9 ng]). Two patients with mastocytosis reported by Carter et al³ did not exhibit such tryptase changes. The patients with SM (all Greek nationals) seem to lack c-kit D816V mutations, but they fulfill the World Health Organization diagnostic criteria for indolent SM.

In conclusion, this case study suggests that omalizumab monotherapy might be efficacious in preventing unprovoked and sting-induced “anaphylactoid” reactions in patients with SM without c-kit exon 17 mutations. Controlled trials evaluating omalizumab’s effect on anaphylaxis in mastocytosis need to confirm these preliminary findings.

ACKNOWLEDGMENTS

We thank Dr. P. Paximadas, head of the 2nd Department of Internal Medicine, Elpis Municipal Hospital of Athens, for the mastocytosis workup of the case; the staff of the Hematology Laboratory of the University of Athens Medical School for the bone marrow studies; Lamda Iatriki Laboratories for the ImmunoCAP tryptase, serum IgE, and venom specific IgE measurements; and the patient and his wife for their cooperation.

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A CASE OF GENERALIZED URTICARIA CAUSED BY ARROWROOT INGESTION

Arrowroot (*Pueraria lobata*) is a popular plant in Asian countries, including Korea, Japan, and China. Arrowroot has been considered an herbal medicine for centuries.¹ In the food industry, it has been processed as starch or used as food supplements. Allergic reactions to arrowroot have rarely been reported, and immunologic investigations have not yet been performed.² We report a case of generalized urticaria induced by ingestion of fresh arrowroot.

A 26-year-old man visited our allergy clinic because of whole-body acute urticaria that developed 2 hours after drinking a bottle of arrowroot juice. The juice had been squeezed from a bundle of raw

Disclosures: Authors have nothing to disclose.

Funding Sources: This work was supported by a Korean Science and Engineering Foundation grant (MEST, 2009-00786746) funded by the Korean government.

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doi:10.1016/j.anai.2010.04.013

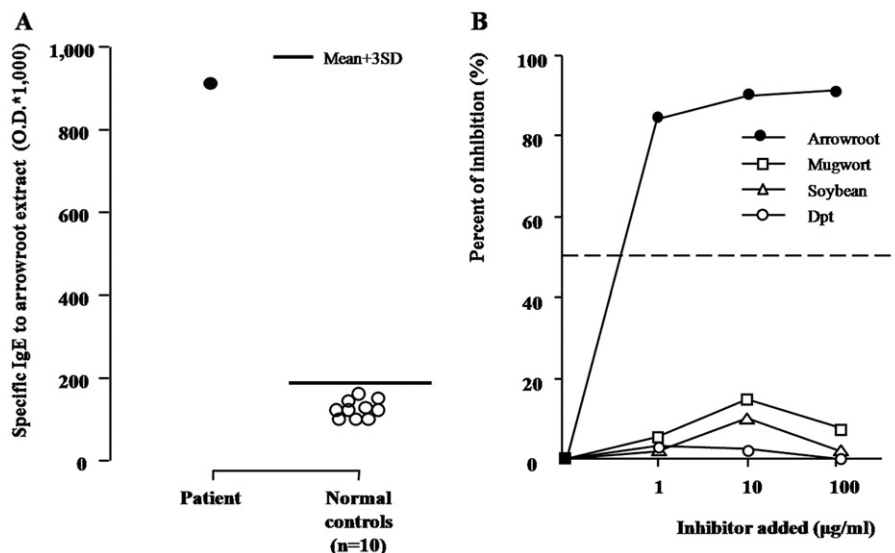


Figure 1. Arrowroot extract specific IgE serum levels determined using enzyme-linked immunosorbent assay (ELISA) from the patient and the 10 healthy controls. A, Horizontal bar indicates the positive cutoff value determined from the mean absorbance value of healthy controls $\pm$ 3 SDs. B, Arrowroot IgE ELISA inhibition test with serial additions of arrowroot, mugwort, soybean, and *Dermatophagoides pteronyssinus* extracts.

arrowroot, and the patient had consumed several bottles of arrowroot extract without any problems before this episode. He was atopic, had positive responses to house dust mites and weed pollens on a skin prick test, and had been previously diagnosed as having allergic rhinitis and atopic dermatitis. The patient had seafood allergy. To investigate the pathogenic mechanism involved, arrowroot proteins were extracted from finely chopped raw arrowroot by stirring for 2 hours at 4°C in phosphate-buffered saline (PBS). Particles were removed by centrifugation at 10,000g for 30 minutes at 4°C, and the supernatant was dialyzed overnight against PBS. The protein concentration of the extract (2.0 mg/mL) was determined using Bradford analysis.

A skin prick test using arrowroot extract showed a positive response (allergen:histamine ratio of >2+) in the patient, whereas none of the 10 nonatopic, healthy control subjects had a positive response. Serum specific IgE antibodies to arrowroot extract were measured using enzyme-linked immunosorbent assay (ELISA). High levels of specific IgE antibodies were detected in the patient's serum based on a positive cutoff value determined from the mean and standard deviation of absorbance values from 10 nonatopic, healthy controls (Figure 1A). To confirm binding specificity, ELISA IgE inhibition tests were performed by adding arrowroot extract and mugwort, soybean, and house dust mite extracts. Significant inhibition was noted with serial additions of arrowroot extract, whereas inhibition by the other extracts was minimal (Figure 1B).

Traditionally, arrowroot has been a fundamental herb used as a antipyretic, antidiarrhetic, diaphoretic, and antiemetic agent in Chinese medicine.¹ In recent times, it has been used to treat alcohol addiction because it contains many useful isoflavones. Other studies^{3,4} have demonstrated that it effectively inhibits microbial growth. Although it has been used widely, few cases of hypersensitivity reactions induced by arrowroot ingestion have been reported. A case of maculopapular exanthema due to arrowroot ingestion was reported and confirmed by a patch test, suggesting type IV hypersensitivity.² Two cases of toxic hepatitis associated with arrowroot ingestion have been reported in which generalized urticaria was accompanied by hepatitis.⁵ In this case, the patient showed only generalized urticaria without any other organ involvement, suggesting an IgE-mediated reaction. We speculate that arrowroot can cause various clinical manifestations of hypersensitivity reactions involving different pathogenic mechanisms, despite a similar exposure route.

With the increasing interest in healthy foods, food allergies related to herbs are becoming more common. Food allergies caused by herbs such as ginseng and bellflower have already been studied as pollen-food syndromes. Ginseng causes respiratory allergies in patients sensitized to birch pollen, and bellflower root shows cross-reactivity with mugwort and birch pollen.^{6,7} Arrowroot is a plant in the genus *Pueraria*, which is in the pea family *Fabaceae*. We performed IgE inhibition tests with arrowroot extract; mugwort pollen, to which the patient was already sensitized; and soybean, which belongs to the pea family. Significant inhibition was noted with serial additions of arrowroot extract, but inhibition by mugwort pollen and soybean extracts was minimal. The skin prick test using soybean extract revealed an allergen:histamine ratio of 1+. However, this patient never experiences any allergic reactions after eating beans.

In food allergy, both class 1 and class 2 food allergens can cause IgE-mediated allergic reactions. Class 2 food allergens elicit allergic symptoms only after primary sensitization with cross-reactive inhalant allergens. By contrast, class 1 food allergens not only provoke allergic sensitization in the gastrointestinal tract but also cross-link IgE. In this case, considering that the patient had a positive skin prick test response to arrowroot extract, no cross-reactivity between

weed pollens and soybean extracts, and a typical clinical manifestation, we conclude that arrowroot allergen may cause allergic reactions through direct oral sensitization not cross-reactivity with other allergens. However, further studies are needed to reveal the allergenicity of arrowroot.⁸ In conclusion, we report the first case, to our knowledge, of IgE-mediated urticaria to arrowroot extract that was confirmed by a positive skin prick test result and immunologic tests.

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OCCUPATIONAL ASTHMA CAUSED BY GERBIL: PURIFICATION AND PARTIAL CHARACTERIZATION OF A NEW GERBIL ALLERGEN

Rodents are a well-recognized cause of rhinitis and asthma in occupational and household settings.¹ The gerbil (*Meriones unguiculatus*) is a popular pet that is also used as an animal model for immunology studies.² Cases of allergy to gerbils have rarely been reported, and gerbil allergens have not been characterized to date.^{3,4}

A 33-year-old female biologist and smoker with pollinosis who worked with guinea pigs and gerbils was treated at Fundación Jiménez Díaz. One year after she began working with gerbils, she developed symptoms of nasal and ocular itching, tearing, sneezing, runny nose, and nasal stuffiness while working in the research facility with the gerbils. The symptoms subsided on weekends, and she remained asymptomatic during holidays. She also had no symptoms when working in the laboratory without the animals. In the past 2 months she experienced episodes of bronchospasm, mainly while handling the gerbils. Eosinophilia was present in blood (eosinophil

Disclosures: Authors have nothing to disclose.

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doi:10.1016/j.anai.2010.04.007