

LETTER TO THE EDITOR

Anaphylaxis caused by ingesting jellyfish in a subject with fermented soybean allergy: Possibility of epicutaneous sensitization to poly-gamma-glutamic acid by jellyfish stings

Dear Editor,

Jellyfish stings are known to induce delayed allergic skin reactions, however, there have been few reports of reactions after jellyfish ingestion.^{1,2} We report herein on anaphylaxis after jellyfish ingestion in a subject allergic to fermented soybeans (*nattō*).

A 45-year-old man presented with two episodes of anaphylactic reaction 2 h after dinners including jellyfish salad, accompanied by dyspnea, chest tightness, abdominal cramps, palpitations, vomiting, dizziness, headache and loss of consciousness. These reactions required emergency hospital care including hydration and i.v. antihistamines after self-injected adrenaline. The patient's medical history revealed childhood bronchial asthma and adult-onset food allergies to *nattō*, crab and shrimp.³ The onset of the *nattō* allergy was 8 years prior to the episodes under consideration, and poly-gamma-glutamic acid (PGA) was identified as the causative allergen. The patient had surfed since the age of 20 years and had been frequently stung by jellyfish.

The patient's diet diaries revealed that jellyfish, which he consumed infrequently, was common to the two episodes, while he ate the other foods in the meals daily without incident.

To identify the causative food in these two episodes, a skin prick test and a basophil activation test (BAT) were performed. The patient's serum total immunoglobulin (Ig)E concentration was 4182 IU/mL. Specific IgE antibodies were detected against shrimp, crab, soybean and rice, but not against other ingredients (ImmunoCAP; Phadia, Uppsala, Sweden). Skin prick testing for desalted jellyfish (Kanetoku, Hyogo, Japan), *nattō* and PGA was positive with wheal diameters of 3.3×3.2 , 8.1×5.1 and 11.9×5.8 mm, respectively (positive control, 10 mg/mL histamine hydrochloride, wheal diameter 6.9×5.6 mm; negative control, saline, wheal diameter 0×0 mm). In three healthy controls, skin prick testing for them was negative. BAT was performed using an Allergen Kit (Beckman Coulter, Fullerton, CA, USA) to quantify basophil CD203c expression as described previously (Fig. 1).⁴ Extract of jellyfish was found to enhance basophil CD203c expression in a concentration-dependent manner. Whole-blood BAT showed 35.7% CD203c-positive cells at 100 μ g/mL of jellyfish extract in the patient.

Anaphylactic reactions after jellyfish ingestion are rare. Imamura *et al.*² reported a female surfer with jellyfish allergy, and speculate that she was sensitized by jellyfish stings; IgE immunoblotting suggested that the causative allergen was a

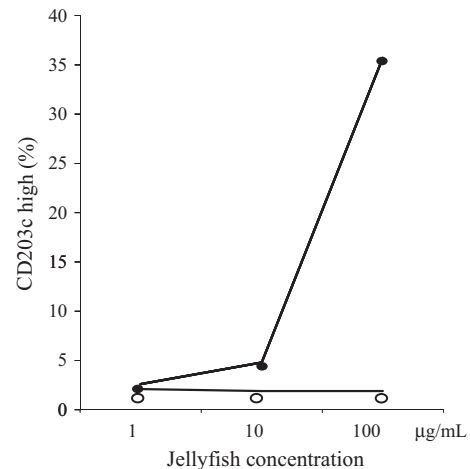


Figure 1. The patient (closed circles) and control (open circles) peripheral blood mononuclear cells were incubated with jellyfish for 60 min. CD203c-expressing basophils were detected using fluorescence-activated cell sorting. Control data (three healthy adults) are shown as mean $\pm$ standard deviation. Positive controls (anti-immunoglobulin E) showed 71.6% and 46.9–73.6% CD203c-expressing cells in the patient and controls, respectively.

high molecular weight of 200-kDa protein. Interestingly, PGA is known to be a major allergen of *nattō* with a high molecular weight ranging from 100 to over 1000 kDa, and has been detected only extracellularly in some prokaryotes, including *nattō* bacteria (*Bacillus subtilis*) and intracellularly in cnidarian nematocyte capsules.⁵ By attracting cations within the capsule, PGA is critical for nematocyte discharge, which involves rapid changes in intracapsular osmotic pressure. Furthermore, 10 of 12 *nattō* allergy cases (83.3%) in our hospital were surfers and/or divers frequently stung by jellyfish. Therefore, we speculate that our patient also might have been sensitized to jellyfish nematocyte PGA by stings via the skin during surfing, and consequently developed the anaphylactic reactions to ingested jellyfish and *nattō*. Further investigation is needed to clarify whether the causative allergen of jellyfish may be PGA and may be cross-reactive to *nattō* PGA.

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CONFLICT OF INTEREST: None.

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REFERENCES

- 1 Burnett JW, Calton GJ, Burnett HW. Jellyfish envenomation syndromes. *J Am Acad Dermatol* 1996; **35**: 991–993.
- 2 Imamura K, Tsuruta D, Tsuchisaka A *et al*. Anaphylaxis caused by ingestion of jellyfish. *Eur J Dermatol* 2013; **23**: 392–395.
- 3 Inomata N, Osuna H, Yanagimachi M, Ikezawa Z. Late-onset anaphylaxis to fermented soybeans: the first confirmation of food-induced, late-onset anaphylaxis by provocation test. *Ann Allergy Asthma Immunol* 2005; **94**: 402–406.
- 4 Nagao M, Hiraguchi Y, Hosoki K *et al*. Allergen-induced basophil CD203c expression as a biomarker for rush immunotherapy in patients with Japanese cedar pollinosis. *Int Arch Allergy Immunol* 2008; **146**(Suppl 1): 47–53.
- 5 Weber J. Poly(γ -glutamic acid)s are the major constituents of nematocysts in *Hydra* (Hydrozoa, Cnidaria). *J Biol Chem* 1990; **265**: 9664–9669.