



Clinical Notes

Food-dependent exercise-induced anaphylaxis caused by abalone

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Food-dependent exercise-induced anaphylaxis (FDEIA) is a specific type of food allergy in which exercise after the ingestion of an allergen induces anaphylaxis. However, allergen intake or exercise alone does not induce symptoms.¹ To the best of our knowledge, there are no previous reports of FDEIA caused by abalone. Here we describe the clinical presentation of a patient who underwent a food and exercise provocation test and was diagnosed with FDEIA caused by abalone.

A 14-year-old, menstruating, adolescent girl had abalone for dinner and took a bath 4 h later. One hour after bathing, itching in her eyes and ears, sore throat, discomfort in the mouth, mild abdominal pain, and coughing manifested. This was followed by hoarseness 2 h after the bath. She was transported by ambulance to our hospital. She was diagnosed with anaphylaxis and treated with a bronchodilator, an antihistamine, and a systemic steroid, and was hospitalized overnight. She had no previous history of an allergic reaction triggered by abalone intake or exercise alone. She had no allergies to crustaceans or shellfish and no history of atopic dermatitis, allergic rhinitis, or bronchial asthma, but had sensitization to mites (specific immunoglobulin E (IgE) titer 8.40 UA/mL). She was subsequently referred to us for a detailed examination. Laboratory data showed a white blood cell count at 4,900/ μ L, eosinophil count at 245/ μ L, total IgE levels at 71 IU/mL, and negative skin prick test (SPT) with abalone (as is). Later, she was readmitted to our hospital to undergo a food and exercise provocation test with boiled abalone. The severity of her symptoms was graded based on the Japanese guidelines for food allergy 2017 classification. Written informed consent for the provocation test and publication of this report was obtained from the patient and her caregiver. This study was approved by the Ethics Committee of the Miyagi Children's Hospital (approval no. 493).

Thirty minutes after consuming 53.7 g of boiled abalone, she underwent a treadmill exercise test for 15 min with a target heart rate of 180 beats/min. She developed mild abdominal pain (Grade 1) immediately after exercising; mild hypotension (systolic blood pressure dropped from 127 mmHg to 95 mmHg, Grade 2) 9 min after exercising; and right shoulder itching (Grade 1), rhinorrhea, and intermittent coughing without wheezing (Grade 1) 31 min after exercising. Her symptoms were not severe enough to warrant adrenaline administration, and she was diagnosed with FDEIA caused by abalone. Thereafter, she was instructed to avoid the combination of abalone consumption and exercise, menstruation, or bathing.

To ascertain an IgE-mediated reaction, an enzyme-linked immunosorbent assay (ELISA) for abalone was performed as described in a previous report.² The patient's optical density at 450 nm was 3.95 (Z-score 4.8) and 2.24 ± 0.36 (average $\pm$ SD) for six healthy controls. These results suggest abalone-specific IgE presence. As there was discordance in negative SPT and positive ELISA results, we performed basophil activation test (BAT) with reference to the previous report.³ Additionally, BAT to abalone was investigated as described previously.⁴ Both CD63 and CD203c expression on basophils increased with abalone extract in a dose-dependent manner, suggesting that basophils were activated by abalone in an IgE-mediated fashion (Fig. 1). As the two types of BAT were positive, we considered them to be true positives, not false positives.

To detect the allergen protein, we performed immunoblotting with abalone extracts as described previously.² The patient's serum reacted with 4 bands at 60, 37, 33, and 25 kDa (Fig. S1). Based on molecular weight, the 33 kDa protein was estimated to be Hal 1.1 (tropomyosin); however, the other proteins could not be identified.

Food-dependent exercise-induced anaphylaxis is caused by a combination of the consumption of an allergen and exercise.¹ Moreover, involvement of the menstrual cycle and ambient temperature has been reported.⁵ In the present case, even though the patient did not exercise during the first episode of anaphylaxis, menstruation and the warm ambient temperature associated with bathing may have co-triggered it. The food and exercise provocation test results confirmed the diagnosis of FDEIA in this case.

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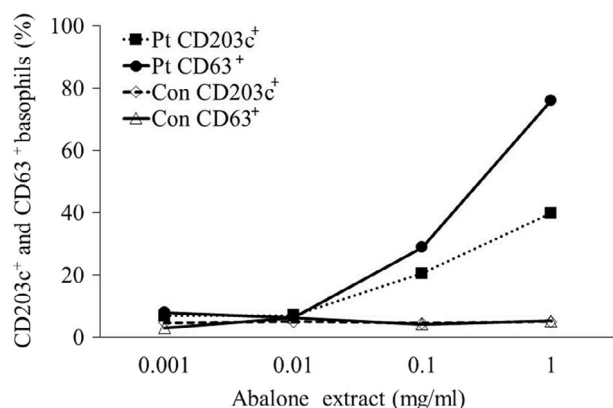


Fig. 1 Basophil activation stimulated by abalone. The expression of CD63 and CD203c markers on basophils was analyzed using a flow cytometer (BD FACSCalibur™, Becton, Dickinson and Company, Franklin Lakes, NJ, USA). The expression of CD63 and CD203c on basophils increased with abalone extract in a dose-dependent manner. Con, control; Pt, patient.

In conclusion, this report establishes that abalone can cause FDEIA. Besides exercise, attention should be paid to the co-triggers of menstruation and ambient temperature to prevent and manage the recurrence of FDEIA.

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Disclosure

The authors declare no conflict of interest.

Author contributions

M.N., S.H. and K.M. designed the study and wrote the manuscript. Y.K. and Y.N. performed the experiments and analyzed the data. All authors read and approved the final manuscript.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Fig S1. Immunoblotting of abalone using sera from the patient and three controls. Dots represent the reactions by controls and stars represent the patient's reactions. Lane A: amido black stain, Lane P: patient, Lanes C1-3: controls, MW: Molecular weight. We prepared an antigen extract from abalone and conducted sodium dodecyl sulfate polyacrylamide gel electrophoresis and immunoblotting with some modifications using 4–12% Bis-Tris-Gel (Invitrogen, Carlsbad, CA, USA) and AP-labeled anti-human IgE antibodies (KPL, Gaithersburg, MD, USA).