

Seaweed allergy

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Clinical Implications

- This is the first report of food allergy to seaweed. There is cross-reactivity among the species within the same group. Patients allergic to seaweed should avoid all products containing seaweed, unless tolerance has been proved with negative skin and challenge test results.

TO THE EDITOR:

Seaweeds or macroalgae are multicellular marine autotrophic (photosynthetic) organisms. They are globally distributed and can be found in every climate zone. These eukaryotic organisms are not plants, animals, or fungi and belong to the kingdom Protista. Traditionally, seaweeds are classified into 3 groups on the basis of pigmentation: red (*Rodophyta*), brown (*Phaeophyceae*), and green (*Chlorophyta*).¹ Edible seaweeds are very popular in East Asia, particularly in Korea, China, and Japan. Some of the most common species used in food preparation include the red seaweeds *Porphyra* (Nori) for sushi wrappings, *Palmaria Palmata* (dulse), and *Chondrus crispus* (Irish moss) as a thickening agent. Varieties of brown seaweeds, such as the kelps *Undaria pinnatifida* (wakame) and *Laminaria japonica* (kombu), and green seaweeds, such as *Ulva spp* (sea lettuce), are consumed as sea vegetables.

A 27-year-old gentleman was referred to our allergy clinic for investigation of possible seafood allergy. On one occasion, he was eating sushi containing shellfish and within minutes developed abdominal discomfort and felt hot. He had a shower and soon developed generalized urticaria with facial angioedema. A few months later, similar symptoms recurred immediately after eating sushi containing shellfish. Both reactions were treated with high-dose chlorphenamine. On further consumption of shellfish in the form of sushi from a Japanese food restaurant, he immediately developed generalized urticaria, lip and tongue tingling, throat tightening, and nose congestion. His symptoms resolved with a quadruple dose of cetirizine. He has a background of mild exercise-induced asthma and occasional episodes of mild heat-induced urticaria only after hot showers. He has no history of rhinitis, eczema, or food allergy. Of note, his diet included at least 1 to 2 portions of shellfish monthly until a few weeks before his first reaction to sushi.

The meal to which the patient most recently reacted included the following ingredients: crustaceans (tiger prawn, crab), egg, salmon, rice, milk, mustard, sesame seeds, soya, sulphites, wheat, avocado, cucumber, carrot, palm oil, canola oil, vinegar, ginger, and seaweed (Nori). He confirmed that he had reintroduced all the above ingredients apart from crustaceans, sesame, and seaweed. He tolerates spicy foods without reaction. Skin prick test results to common aeroallergens (including house dust mite), crustaceans, and molluscs were unequivocally negative. Prick to prick test results to fresh tiger prawn, fresh crab, and sesame (fresh and solution) were also negative. However, prick to prick

test result to fresh Nori seaweed was positive with a 13-mm wheal. Further prick to prick test results to other red seaweed species were also positive: *Chondrus crispus* produced an 8-mm wheal and *Palmaria Palmata* a 7-mm wheal. Prick to prick test results to green (*Ulva spp*) and brown seaweed (*Undaria pinnatifida*) were negative. Skin testing was validated with positive histamine control and negative normal saline control. Prick to prick test result with seaweed species in 5 healthy volunteers was negative. We also performed skin test to antacid (Peptac liquid, which contains sodium alginate, derived from brown seaweed), the result of which was negative. We then proceeded to a provocation test with Peptac liquid and the patient tolerated 20 mL without developing symptoms.

Both history and positive skin test results are suggestive of an IgE-mediated mechanism; therefore, a diagnosis of seaweed allergy was made. Sensitization most likely occurred during previous seaweed consumption. Although the amino acid composition of several seaweed species is known, the structure and biological properties of seaweed proteins are still relatively poorly documented. Phycobiliproteins, the main proteins of red seaweeds, and phycolectins are possible allergens.² Alginic acid (sodium alginate) has been ruled out as a possible culprit after the negative provocation test result to antacid, which was expected because it is derived from brown seaweeds. Different seaweed groups do not seem to cross-react, which is also expected considering that seaweeds are in a polyphyletic group not sharing a common ancestor.³ The patient was offered further provocation tests to brown and green seaweeds to clarify his allergy status, but he felt that it would not be of any practical value because seaweed is an umbrella term referring to all 3 groups. Therefore, he was advised to strictly avoid all products containing seaweed.

Seaweeds have been extensively used for centuries, especially as natural mineral sources and in pharmaceutical and food industries for their unique polysaccharides (eg, agar, alginates, and carrageenan). There have been several studies regarding various therapeutic properties of seaweeds, including antitumor, antidiabetic, anti-inflammatory, and cardioprotective effects.¹ Antiallergic properties have also been attributed to marine polysaccharides, which appear to downregulate the allergic responses via inhibiting the T_H2 response and IgE production, and suppressing the mast cell degranulation. Seaweed consumption has been increased in Western countries in recent decades due to the rising popularity of the Asian cuisine and the growing use of products from natural sources.

Allergy to seaweed-derived products has been previously reported. Airborne allergens from nonedible green algae have been reported to increase the respiratory symptoms in children with respiratory allergy.⁴ Occupational pulmonary hypersensitivity to brown seaweed dust was noted in 7% of the workers in a British factory producing alginates.⁵ Alginate paste used for dental impressions might be the cause of fatal anaphylaxis to a patient with severe comorbidities.⁶ Anaphylaxis to antacid tablet⁷ and alginate dressing⁸ have also been reported. There are also multiple reports of hypersensitivity reactions after laminaria stick insertion (derived from the brown seaweeds *Laminaria japonica* or *digitata*) during dilation and evacuation procedures in obstetrics,⁹ which are suggestive of underlying IgE-mediated mechanism.

To our knowledge, this is the first case of food allergy to red (Nori) seaweed. We have shown cross-reactivity among the species of the same group. There is high chance for a patient allergic to red seaweed to tolerate seaweeds from the other groups, but food challenges are required to prove tolerance.

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