

Fish and Shellfish Allergy

The prevalence of an allergic reaction after the ingestion of seafood is not uncommon. What may be less appreciated is that individuals can develop work-related asthma while working with seafood. Occupational exposure generally causes skin and respiratory symptoms with gastrointestinal and systemic anaphylactic symptoms being unusual. Like allergies caused by ingestion, the work – related reactions are IgE mediated and skin and IgE specific antigen testing are available. Reports of allergic reactions after people ingest seafood are much more common than allergic reactions from exposure in occupational settings. For some species like snails and limpets, where there are reports of allergies after ingestion, there are no reports from the occupational setting.

Seafood includes shellfish in the Mollusca Phylum (i.e. abalone, clams, octopus, scallops and squid) and in the *Anthropoda* phylum (i.e. crustaceans such as lobster and shrimp). There are hundreds of thousands of species in these phyla but only a limited number are harvested commercially.

Tropomyosin is considered the major seafood antigen and can be found in many types of mollusks. Antibodies to tropomyosin cross-react with antigens to dust mites and cockroaches (1, 2). However, other allergens besides tropomyosin have been identified in seafood (3).

Anisakis simplex is a species of the genus *Anisakis* and is a parasitic nematode that infects marine fish and mammals. This nematode is common in all salt water fish but is less common in waters with low populations of marine mammals since marine mammals are required to complete the nematode's life cycle. Ingestion of raw or undercooked fish can cause anisakiosis, an acute gastrointestinal infection. The allergenic component of *Anisakis* is not destroyed by the heat of cooking. Allergy to *Anisakis simplex* has been identified as the causal antigen in some workers with occupational asthma

who work with fish (4).

Table I shows the fish and Table II the shellfish associated with work-related asthma. Some of these individuals with work-related asthma also have urticaria and/or gastrointestinal symptoms after ingestion of seafood. In addition to the fish and shellfish listed in the tables, there are letters to the editor reporting work-related asthma to workers processing abalone, cuttlefish and mussels. These letters do not provide sufficient information about immunological and pulmonary function tests as do the articles about fish and shellfish included in the two tables.

Table I. Fish Reported to Cause Work-Related Asthma

Salmon (*Salmo salar*)
Trout (*Oncorhynchus*, *Salmo* and *Salvelinus* genera)
Turbot (*Scophthalmus maximus*)

Table II. Shellfish Reported to Cause Work-Related Asthma

Clams (*Bivalvia* class)
Crabs (*Pleocyemata* suborder)
 Rock crab (*Cancer irroratus*)
 Snow crab (*Chionoecetes* genus)
Lobster (*Homarus* and *Nephrops* genera)
Octopus (*Cephalopoda* class)
Scallops (*Pectinidae* family)
Shrimp/Prawns
 Scuds (*Gammarus* genus)
 Brine shrimp (*Anostraca* order)
Squid (*Loligo vulgaris*)

Clams (*Bivalvia* Class)

Clams are a type of mollusk in the Phylum *Mollusca*, class *Bivalvia*. There are approximately 15,000 species, of which 500 are freshwater. The species of clams eaten vary throughout the world. Two workers from Canada had specific IgE and specific antigen challenge tests to clam extract.

Desjardins A, Malo JL, L'Archevêque J, et al. Occupational IgE-mediated sensitization and asthma caused by clam and shrimp. *J Allergy Clin Immunol* 1995; 96: 608-17.

Crabs (*Pleocyemata* suborder)

Crabs are crustaceans in the same order as lobster and shrimp but a different suborder, *Pleocyemata*. There are approximately 4,500 species of crabs; marine, freshwater and terrestrial. There are ten species that are most commonly used commercially.

Cartier A, Malo JL, Forest F, et al. Occupational [asthma](#) in [snow crab](#)-processing workers. *J Allergy Clin Immunol* 1984;74:261-269.

Lobster (*Homarus* and *Nephrops* genera)

Lobster are marine crustaceans in the order *Decapoda* and the family *Nephropidae*. Commercial species are in the genus *Homarus* and in the genus *Nephrops*. There are two case reports of workers from Canada cooking lobster who developed asthma in relationship to work. Both had specific antigen challenge testing with a drop of 22-23% after exposure to lobster extract and positive skin test or specific IgE to the extract. Thirteen of 50 lobster processing workers had positive skin tests to lobster extract.

Patel PC, Cockcroft DW. Occupational asthma caused by exposure to cooking lobster in the work environment: a case report. *Annals of Allergy* 1992; 68:360-361.

Octopus (Class *Cephalopoda*)

Octopus is a type of cephalopod mollusc. There are approximately 300 species. Cephalopod is the class of marine mollusks that also includes squid, cuttlefish and nautilus. *Mollusca* is the phylum which has ten classes including *Cephalopoda*. A worker from Spain had asthma when working with octopus but not other kinds of seafood. She had both positive specific antigen challenge and specific IgE to octopus extract.

Rosado A, Tejedor MA, Benito C, et al. Occupational asthma caused by octopus particles. *Allergy* 2009; 64:1101-1102.

Salmon (*Salmo salar*)

Salmon is the common name of different fish in the Salmonidae family, the same family as trout. Salmon are anadromous, born in fresh water, migrate to salt water and then return to fresh water to spawn.

Trout typically do not migrate into salt water. However, some species of salmon spend their whole life cycle in fresh water and salmon have been introduced into the Great Lakes. Atlantic salmon (*Salmo salar*) is one species of salmon found in the North Atlantic, and also raised on fish farms. There are reports from Greece, Spain and Sweden of work-related asthma in workers processing salmon with specific antigen challenge testing and specific IgE to salmon extract.

Rodriguez J, Reano M, Vives R, et al. Occupational asthma caused by fish inhalation. *Allergy* 1997; 52: 866-869.

Scallops (*Pectinidae* Family)

Scallops are molluscs in the order *Ostreoida* and in the *Pectinidae* Family. They are only found in salt-water. The largest commercial catch of wild scallops is the Atlantic Sea Scallop (*Placopectin magellanicus*). A worker from Scotland developed urticaria, coughing and shortness of breath after processing scallops. She had obstruction on spirometry and decreased peak flows in relationship to work. She had positive specific IgE to scallop extract.

Barracough RM, Walker J, Hamilton N, et al. Sensitization to king scallop (*Pectin maximus*) and queen scallop (*Chlamys opercularis*) proteins. *Occupational Medicine* 2006; 56:63-66.

Shrimp/Prawns

Shrimps and prawns are crustaceans in the order *Decapoda*. Shrimps are in the suborder *Pleocyemata* and prawns are in the suborder *Dendrobranchiata*. The gill structure differs between shrimps and prawns. However, in culinary/commercial use the terms are interchanged with the same species being called a prawn in Great Britain and British Commonwealth countries and called a shrimp in the United States. Also the Norwegian Lobster (*Nephrops norvegicus*), a very common commercial species in Europe, is also referred to as a prawn, although it is the order *Decapoda*, in the lobster family, *Nephropidae*, and is not a prawn. There are approximately 3,500 species of shrimp and 500 species of prawns in the order *Decapoda*. About 25 species of shrimp/prawn are harvested for human ingestion.

There are also approximately 15,000 species of shrimp not in the order *Decapoda*; these include brine shrimp in the order *Anostraca* and scud shrimp in the order *Amphipoda*. Both brine and scud shrimp are widely used to make fish food. Both shrimp processors and restaurant workers in Canada and Texas have been reported with work-related asthma from shrimp confirmed by specific antigen challenge testing.

Similarly, workers in Greece, Greenland and Poland have been reported with positive skin prick tests and specific IgE to shrimp extract.

Desjardins A, Malo JL, L'Archevêque J, et al. Occupational IgE-mediated sensitization and asthma caused by clam and shrimp. *J Allergy Clin Immunol*. 1995;96:608-17.

Goetz DW, Whisman BA. Occupational asthma in a seafood restaurant worker: cross-reactivity of shrimp and scallops. *Ann Allergy Asthma Immunol* 2000; 85:461-466.

Shrimp meal/Scud shrimp

Shrimp meal is derived from brine shrimp. These shrimp inhabit inland salt-water lakes. They are not found in the ocean. Their eggs can be dormant and hatched to provide live feed for fish and crustaceans. The genus *Artemia* has eight species, including *Artemia salina*, the species described in the medical report (1). Brine shrimp are also sold as a novelty item, "Sea-Monkeys". Scud Shrimp is a crustacean in the *Amphipoda* Order. There are 200 species in the *Gammarus* genus. Scud shrimp are used to make fish and pet food. There are reports from Germany, Italy, Norway and Spain of fish/pet food workers and laboratory technicians feeding fish with work-related asthma confirmed by specific antigen challenge testing. Workers had positive skin prick tests or specific IgE to the extract of the species used in the facility.

Baur X, Huber H, Chen Z. Asthma to *Gammarus* shrimp. *Allergy* 2000; 55: 96-97.

Carino M, Elia G, Molinini R, et al. Shrimp-meal asthma in the aquaculture industry. *Med Lav* 1985;76: 471-475.

Squid (*Loligo vulgaris*)

Loligo vulgaris is called the European or the common squid. It is found in coastal waters from the North Sea to Africa. There is a report from Poland of a worker in a frozen food processing facility who developed dyspnea three years after beginning to work with squid. He had a positive skin prick test, specific IgE and specific antigen challenge test to squid extract.

Wiszniewska M, Tymoszek D, Pas-Wyroslak A, et al. Occupational allergy to squid (*Loligo vulgaris*). *Occupational Medicine* 2013; 63:298-300.

Trout (Genus *Oncorhynchus*, *Salmo* and *Salvelinus*)

Trout is the common name of over 50 fresh and salt-water fish in the family Salmonidae. Salmon are in the same family. There are reports from Denmark, Greece

and Spain of workers processing trout with work-related asthma confirmed by specific antigen challenge testing, peak flow testing and specific IgE to trout extract.

Sherson D, Hansen I, Sigsgaard T. Occupationally related respiratory symptoms in trout-processing workers. *Allergy* 1989, 44:336-341.

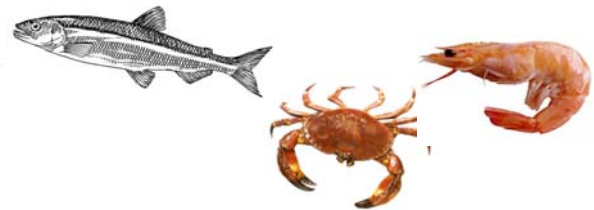
Turbot (*Scophthalmus maximus*)

Turbot is a flat fish that is both farmed and trawled in the Baltic, Black and Mediterranean Seas and the North Atlantic. It is in the family Scophthalmidae. Seventy five percent of turbot fish come from Spain. There is one report from Spain of three workers with work-related asthma who had positive peak flow testing in relationship to work and specific IgE to turbot.

Carral CP, Martin-Lazao J, Ledesma A, et al. Occupational Asthma Caused by Turbot Allergy in 3 Fish-Farm Workers. *J Investig Allergol Clin Immunol* 2010; 20: 349-351.

References

1. Leung PSC, Chow WK, Duffey S, et al. IgE reactivity against a cross-reactive allergen in crustacea and mollusca: Evidence for tropomyosin as the common allergen. *J Allergy Clin Immunol* 1996; 98:954-961.
2. Taylor SL. Chapter 4, Molluscan Shellfish Allergy. *Advances in Food and Nutrition Research* 2008; 54:139-177.
3. Asero R, Mistrello G, Amato S, et al. Shrimp allergy in Italian adults: A multicenter study showing a high prevalence of sensitivity to novel high molecular weight allergens. *Int Arch Allergy Immunol* 2011; 157:3-10.
4. Armentia A, Lombardero M, Callejo A, et al. Occupational asthma by *Anisakis simplex*. *J Allergy Clin Immunol* 1998; 102:831-834.



We have had one report in Michigan of a restaurant worker with work-related asthma from shrimp. We are interested in hearing about other known or suspected cases of work-related lung disease from fish or other exposures, all of which are reportable conditions in Michigan. Kenneth Rosenman, MD as always is available to assist you with diagnostic or management issues, 1-800-446-7805.

*Project

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News

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S Remember to report all cases of occupational disease!

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