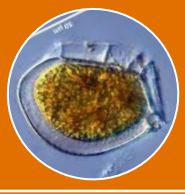
WE ALL TAKE CARE OF THE HARVEST (WATCH) PROJECT SEPTEMBER 2022

Toxic  Shellfish



Help us raise awareness of dangerous marine toxins

BEYOND ACUTE HEALTH EFFECTS

Most of what is known about the effects of marine biotoxins is based on studies examining one dose of a single biotoxin at a single point in time. We know little about:

- Chronic effects of high-dose, short-term exposures
- Long-term, low-dose exposures
- Multiple exposures (to same or different biotoxins including analogs/isomers that have varying levels of toxicity)

When combined, toxins may have additive, synergistic, or antagonistic effects. In a study of California shellfish, more than a third of mussels sampled were found to contain Paralytic, Amnesic and Diarrhetic Shellfish Toxins simultaneously, plus others (Lee et al., 2022).

REPORT ILLNESSES

To help support patients with long-term health effects, help ensure others are not harvesting seafoods at contaminated sites, and advance what is known about biotoxin-related illnesses, please report all suspected cases.

SURVEILLANCE FORMS

See http://www.bccdc.ca/health-professionals/professional-resources/surveillance-forms

Call BC Poison Control 1-800-567-8911 for more information.

Report cases of PSP, ASP and DSP to BCCDC (contact information is provided on surveillance forms)

WHY TRACK SPECIES AND PARTS EATEN, & COOKING METHODS?

- Like us, different shellfish and individuals uptake, metabolize, store and clear individual biotoxins in various ways.
- Biotoxins may be present in marine species other than shellfish, such as other plankton-eating species, and their predators.
- Although the most toxic tissues are typically those associated with digestion, toxins can be transferred to other tissues by natural means or through food handling methods.
- Levels of toxin vary with food processing, preparation/cooking and consumption practices.

IN THE EVENT OF POISONING

1. Record the age, weight and condition of patient,
2. Type and parts of seafood ingested,
3. Amount of seafood ingested,
4. Where and when the seafood was eaten,
5. Where and when and by whom the seafood was harvested,
6. How the seafood was stored/ packaged and prepared for eating,
7. Patient's medication list (which may impact G.I. transit time and absorption,
8. Who else may have eaten the seafood and what is known about their condition, and
9. Ask them to save and freeze leftover food for testing

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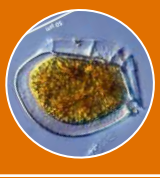
Learn more with the WATCH Project
https://www.fnha.ca/what-we-do/environmental-health/watch-project

Toxic  Shellfish 

Be aware of dangerous marine toxins

In certain conditions (e.g., warm water, sufficient light and nutrients), several phytoplankton species known to produce powerful toxins can quickly multiply or 'bloom'. The toxins concentrate in filter-feeding shellfish such as clams and are taken up by other plankton-eating species. While commercial harvest sites are routinely tested for toxins, other sites are untested or monitored less frequently. Indigenous harvesters in particular may have considerable risks of exposure.
Climate change is making these blooms more intense, frequent and longer in duration.

Watch for symptoms of Paralytic Shellfish Poisoning (PSP)

PSP is caused by ingesting saxitoxins or related compounds. In our waters, these are produced by the marine dinoflagellate *Alexandrium spp.* Saxitoxins block voltage-sensitive sodium channels and disrupt nerve conduction.

General: Onset of symptoms as soon as 30 minutes after eating, but delays up to 12 hours have been reported. Numbness and paresthesias usually occur within 30-60 minutes. Headache, dizziness, sensation of floating, ataxia and general incoordination are common. In severe cases, difficulty speaking and swallowing, muscle paralysis and respiratory failure may be seen. Symptoms may take 1-3 days to resolve with weakness lasting up to one week.

HEENT: Paresthesia and numbness of face, mouth, lips and throat (common, early). Difficulty in speaking and swallowing. Paralysis of facial muscles and jaw, immobile tongue and absent gag reflex in severe exposures. Transient blindness, nystagmus, diplopia, ophthalmoplegia and absent corneal reflexes. Pupils may be dilated and unreactive. Hypersalivation or dry mouth (uncommon).

CVS: Tachycardia, bradycardia (uncommon). T-wave changes, elevated CK-MB, hypotension (uncommon) or hypertension.

Respiratory: Hypoxia and respiratory failure due to muscle paralysis usually occurs within 12 hours post ingestion. Respiratory arrest may develop as early as 1 hour post ingestion in severe cases.

Neurologic: Paresthesias and numbness of extremities (common, occurs early). May be followed by headache, dizziness, sensation of lightness or floating, drowsiness, general incoordination and ataxia. Generalized muscle weakness leading to paralysis in severe exposures. Patients may appear comatose but remain awake and aware even if paralyzed. Deep tendon reflexes may be absent and in severe cases patients may appear to be brain dead.

GI: Nausea, vomiting, diarrhea and abdominal pain (less common).

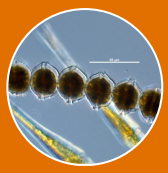
Skin: Diaphoresis.

Musculoskeletal: Muscle weakness, may take up to a week to resolve. Low back pain, may persist for several days.

Other: Allergic reactions and gastrointestinal effects due to viral or bacterial contamination may be observed concurrently with PSP.

Note: **There is an error in the Poison Control Manual**: Crabs and other shellfish CAN cause PSP if people eat the hepatopancreas or cook them whole, as cooking whole crabs can transfer the toxin to the meat.

Source: Poison Management Manual (PMM) (2015), BC Poison Control Centre. **Consult the BC Poison Control Centre for treatment advice and case reports. See also** BC Centre for Disease Control (BCCDC) PSP web page http://www.bccdc.ca/health-info/diseases-conditions/paralytic-shellfish-poisoning (includes definitions of confirmed, probable cases)



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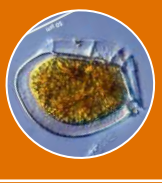


Be aware of dangerous marine toxins

Watch for symptoms of Amnesic Shellfish Poisoning (ASP)

ASP is caused by ingesting domoic acid (DA) or its isomers. In our waters, DA is produced by marine diatoms *(Pseudo-nitzschia spp.).* DA binds glutamate receptors, and causes neuronal incitation and degeneration mainly in the hippocampus, amygdala and parts of thalamus.

General: Onset of symptoms as soon as 15 minutes after eating, but delays up to 38 hours have been reported (mean 5.5 hrs). Cognitive dysfunction occurred in patients manifesting neurologic signs and symptoms within 48 to 72 hours.

Initial symptoms include nausea, vomiting and diarrhea. Severe headache, confusion and disorientation are common. Short-term memory loss more common in elderly. Myoclonus, seizures, coma, hypotension, dysrhythmias and pulmonary oedema may develop in severe cases (PMM, 2015).

Acute symptoms of ASP in 99 patients included dizziness (80%), nausea and vomiting (75%), abdominal cramps (51%), severe headache (43%), diarrhea (42%), palpitations (35%), agitation (<25%), amnesia/short -term memory loss (25%), diplopia (15%), confusion, disorientation and coma (<5%) (Schroeder, Bates, & Spallino, 2015).

HEENT: Disconjugate gaze, opthmalmoplegia and diplopia. Miosis and mydriasis have been observed. Grimacing and chewing.

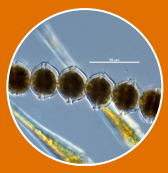
CVS: Hypotension, tachycardia, dysrhythmias (PMM, 2015). Hemodynamic instability with labile blood pressure , palpitations (Schroeder, Bates, & Spallino, 2015).

Respiratory: Increased bronchial secretions and pulmonary oedema have been reported in severe cases (PMM, 2015). Profuse respiratory secretions, respiratory difficulty (Schroeder, Bates, & Spallino, 2015).

Neurologic: Severe headache, confusion and disorientation common in patients with neurological symptoms. Short-term memory loss occurs in ~25% of patients (can be persistent), more commonly in elderly. Myoclonus, seizures (focal motor, psychomotor or generalized tonic-clonic) and coma in severe exposures. General weakness, agitation, mutism, fasciculations, transient symmetric hyperreflexia, Babinski signs or emotional instability occurs in some patients. Spastic hemiparesis persisting for 24-36 hours followed by transient hemiparesis on opposite side (2 cases) (PMM, 2015).

Patients presented with permanent neurologic sequelae, amnesia and cognitive abnormalities, including coma, mutism, seizures, and purposeless chewing and grimacing. Some patients were described with hiccups and emotional lability, with uncontrolled crying or aggressiveness. In addition, patients exhibited myoclonus, hemiparesis, and hyporeflexia. Patients had a predominantly anterograde memory disorder. However, some severely affected patients also had retrograde amnesia, extending several years prior to the intoxication. Nearly a year after the ASP event, an 84-year-old male survivor experienced sever seizures and was diagnosed with temporal lobe epilepsy caused by domoic acid intoxication.
Some neurons undergo excitoxic death ver quickly after exposure to DA However, toxicity may also develop over time. DA can initiate a “neurotoxic cascade” long after the toxin is gone. Early treatment may prevent later effects (Schroeder, Bates, & Spallino, 2015).

GI: nausea, vomiting, abdominal cramps, diarrhea (common, occur early). Hiccups (PMM, 2015). CONTINUED on next page



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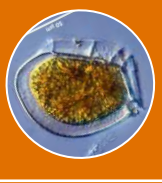

Be aware of dangerous marine toxins

Amnesic Shellfish Poisoning (ASP)

CONTINUED

Fluid/Lytes: Dehydration (PMM, 2015)

Blood: Elevated CK secondary to seizures (PMM, 2015)

Skin: Piloerection (PMM, 2015)

Musculoskeletal: Distal atrophy and mild weakness of extremities, associated with hyporeflexia in some patients (PMM, 2015).

Long-term, low dose exposures: Studies with Indigenous people in the U.S. Pacific Northwest, as well as animal studies suggest memory loss is possible with regular consumption of clams that have detectable levels of DA that are below regulatory limits. At least one study indicates these effects reverse once exposure has ceased (Lee et al., 2022).

Other: Those most affected were males, older patients (>60 years of age), as well as immunocompromised younger patients. Those >65 years of age had pre-existing illnesses, such as insulin-dependent diabetes, chronic renal disease, autoimmune conditions requiring chronic steroid therapy, hypertension with a history of TIAs, chronic hepatic dysfunction and alcoholic liver disease (Schroeder, Bates, & Spallino, 2015).

Animals studies have shown that DA can cross the placental barrier and can be transferred to neonates during lactation (Schroeder, Bates, & Spallino, 2015).

Allergic reactions and gastrointestinal effects due to viral or bacterial contamination may be observed concurrently with ASP (PMM, 2015).

Sources: Most of our understanding of ASP of humans is from a single exposure event in Canada in 1987.

Schroeder, G.,Bates, S.S., & Spallino, J. (2015). Amnesic Shellfish Poisoning: Emergency Medical Management. *Journal of Marine Science: Research & Development*, 06(01). https://doi.org/10.4172/2155-9910.1000179

Poison Management Manual (PMM) (2015), BC Poison Control Centre

Consult the BC Poison Control Centre for treatment advice and case reports.

Lee, M.J., Henderson, S.B., Clermont, H., Turna, N.S., & McIntyre, L. (Submitted to *Heliyon*, 2022, June). Beyond a single dose, single outcome: The health risks of marine biotoxins associated with the regular consumption of high quantities of seafood, with a special focus on coastal Indigenous populations.

See also BCCDC ASP web page, http://www.bccdc.ca/health-info/diseases-conditions/amnesic-shellfish-poisoning Includes definitions of confirmed, probable cases.

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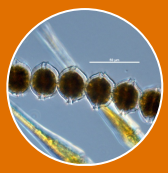

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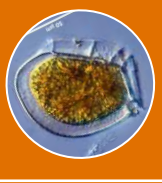

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Watch for symptoms of Diarrhetic Shellfish Poisoning (DSP)

DSP is caused by ingesting okadaic acid, dinophysis toxins, pectenotoxins or related compounds. In our waters, this toxin is produced by the marine dinoflagellate *Dinophysis spp*. Unlike PSP and ASP toxins which are hydrophilic, DSP toxins are lipophilic.

General: Symptom onset is between 30 minutes to 15 hours after eating. Usually the symptoms start in one or two hours. The recovery period is within 3 days (BCCDC, 2022).

Symptoms: Diarrhea, nausea, abdominal cramps, vomiting, headache, chills, fever (BCCDC, 2022; pers. comm., C. Whitehead, 2021).

Other: Several human and animal studies suggest that Diarrhetic Shellfish Toxins **promote tumours and are carcinogenic** (Lee et al., 2022). Studies show okadaic acid inhibits protein phosphates (important modulators of enzyme activity and cell signalling pathways), is cytotoxic to lymphocyte cells, and alters angiogenesis, among other things (Bates et al., 2020). Bates et al. (2020) suggested "the safe limit regulation should be changed to DSP toxins zero tolerance in the shellfish to be consumed by humans."

Allergic reactions and gastrointestinal effects due to viral or bacterial contamination may be observed concurrently with DSP (PMM, 2015).

Sources:

BCCDC DSP web page. (2022). http://www.bccdc.ca/health-info/diseases-conditions/diarrhetic-shellfish-poisoning. Includes definitions of confirmed, probable cases.

Poison Management Manual (PMM) (2015), BC Poison Control Centre
Consult the BC Poison Control Centre for treatment advice.

Bates, S.S., Beach, D.G., Comeau, L.A., Haigh, N., Lewis, N.I., Locke, A., Martin, J.L., McCarron, P., McKenzie, C.H., Michel, C., Miles, C.O., Pouin, M., Quilliam, M.A., Rourke, W.A., Scarratt, M.G., Starr, M., & Wells, T. (2020). Marine harmful algal blooms and phytotoxins of concern to Canada. Canadian Technical Report of Fisheries ad Aquatic Sciences 3384, Fisheries and Oceans Canada, Moncton, NB

Lee, M.J., Henderson, S.B., Clermont, H., Turna, N.S., & McIntyre, L. (Submitted to Heliyon, 2022, June). Beyond a single dose, single outcome: The health risks of marine biotoxins associated with the regular consumption of high quantities of seafood, with a special focus on coastal Indigenous populations.

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