

Botulism in British Columbia: The RISK of Home-Canned Products

Why are we concerned?

In 2011 and 2013, botulism was diagnosed in two people who consumed home canned products in BC. Fortunately, both cases recovered. One person ate home canned green beans, and the other person purchased a single jar of home-prepared watermelon jelly from a charitable organization which had a table set-up outside of a grocery store.¹ Despite having eaten only a small amount of jelly this person had difficulty breathing, was hospitalized and ultimately diagnosed with botulism.

In recent years, sales of home-canned products, particularly seafoods, from non-commercial sources such as internet sales (for example Craig's List) and in roadside markets have been documented. Canned seafoods such as salmon and trout are high-risk foods as they have the potential to be contaminated with botulinum toxin—the toxin which causes botulism. Improper preparation of these foods by home producers and sales to the public could result in serious and sometimes fatal illness.

What is botulism?

Although botulism is relatively rare, this disease has a high fatality (death) rate. Prior to the availability of antitoxin and modern medical care in Canada, fatality rates exceeded 50%.² Botulism is caused by a bacterium called *Clostridium botulinum*. This organism is characterized by its' ability to multiply in anaerobic conditions (environments without oxygen) and produce botulinum toxin. This makes canned products high risk environments, as they have no oxygen. *C. botulinum* has two forms, a vegetative cell bacterium form and an environmentally resistant spore form. Spores in canned foods can be destroyed with thermal processing by cooking canned foods above the boiling point (above 100°C or 212°F) under pressure in a thermal pressure cooker for a specified pressure and time. Botulinum toxin is considered one of the most lethal toxins known; the median lethal dose is one nanogram of toxin per kilogram of body mass – one teaspoon is enough to kill 100,000 people.³

What do we know about botulism outbreaks in British Columbia?

Soils throughout British Columbia commonly contain this bacterium.⁴ Salmon and other finfish are also reservoirs for *Clostridium botulinum*, in particular type E botulinum⁵. Salmon and other animals ingest botulinum spores resulting in the spores being present in the intestinal tract of the animals. Fish, especially uneviscerated (ungutted) fish and poorly cleaned fish, are considered from a food processing viewpoint to be higher risk and potentially hazardous foods. These foods, for instance, are not permitted to be prepared at home and then sold in farmers' markets in BC, according to provincial guidelines.⁶

A summary of recorded botulism outbreaks caused by home-prepared (and two restaurants - prepared) canned and bottled foods in Canada is shown in Table 1. From 1919 to 2011 there were 20 recorded botulinum outbreaks involving improperly prepared canned foods. These outbreaks caused 86 illnesses and 12 deaths. The foods involved included meats (venison), fish (salmon and trout), vegetables (corn, spinach, beans, pepper, mushrooms, garlic, asparagus, tomatoes), a soup and a jelly preserve. The majority of Canadian botulism outbreaks occurred in BC (63%), including the two restaurant outbreaks in the 1980s. The most recent cases of botulism identified in canned products were from improperly home prepared green beans and watermelon jelly. Outbreaks were identified in many geographic regions throughout the province of BC, and include coastal and inland regions, urban and rural areas.⁷ In most outbreaks, foods were prepared at home and served to family members and friends. However, notable botulism outbreaks in BC also included a home-prepared food received from a food bank, from a volunteer selling a home-prepared food for a charity outside a major grocery chain, and two large restaurant outbreaks.



Botulism in British Columbia: The RISK of Home-Canned Products

A summary of the types of food categories that caused foodborne botulism outbreaks in Canada between 1961 and 2005 is shown in Table 2. Excluding outbreaks without an identified source, 147 of 170 (86%) of all outbreaks were traced to marine animal foods. These are predominantly non-commercially prepared foods consumed by northern First Nations peoples (seal, walrus and beluga meats). However, the 28 outbreaks (16%) traced to salmon eggs all occurred in First Nations peoples in BC. In this traditional native dish, salmon eggs are fermented into a paste or cheese (called lakulan) in a jar or barrel. The presence of *C. botulinum* bacterial spores, lack of oxygen and temperatures above 3°C allow the bacteria to grow and toxin to form. The most recent botulinum outbreak in eastern Canada was attributed to fish in an Egyptian ethnic food called fesikh: three people became ill from eating imported fesikh in April 2012. The fish used in fesikh is not gutted before fermentation, so botulinum spores present in the stomach of the fish can produce toxins.⁸

There were also four botulism outbreaks in BC caused by smoked salmon. In one of these outbreaks, it appeared that the smoking process was done incorrectly. Filleted salmon was brined in salt, sugar and spices for eight hours at ambient temperature, and then smoked (temperature not noted) for another two days. The salmon appeared burned on the outside and raw on the inside.⁹ Two persons became ill, and while one recovered within two weeks, the second person was still experiencing fatigue and muscle weakness six months after consuming the smoked salmon.⁹ In another cluster of illnesses that occurred in North Vancouver, 3 of 4 people who ate home smoked salmon died. This salmon was prepared without brine, improper smoking technique was used, and other practices (handling and storage) were questioned at the time.⁹

How do commercial operations control for botulism?

Commercial canning operations that prepare fish, meat and vegetables are required to do a botulinum cook process for commercial sterility.¹⁰ Foods with low acid levels, including meat and fish, are considered high risk and referred to as potentially hazardous foods. These foods require the strictest type of processing, to ensure

that botulism spores will not germinate and grow to produce toxin. This type of process is known as a 12D process, and means that the time and temperature used to heat the product will reduce the bacterial load in the product by 12 logs, or put simply, a spore will only have a one in a billion chance of survival.¹⁰ The conditions are to cook for an equivalent of 121.1°C (250°F) for 3 minutes.¹⁰

Commercial fish smoking operations also have standards for smoking of products, for storage and packaging. Smoked products may receive a hot or cold smoke. The type of process will determine what controls are applied to ensure safety of the final product. In both cases, hygienic handling and packaging must be done properly, as reduced oxygen packaging increases the risk for botulism in these types of products. These requirements and further information can be found in government regulations, documents and guidance.¹¹⁻¹³

What should the public know when purchasing or receiving bottled, canned or smoked products?

Home-prepared foods, when properly prepared and processed, while still considered higher risk, can be safe to eat. If you receive a home-prepared product as a gift, ask the cook how it was prepared. With low acid canned products, a thermal pressure cooker must be used, and the correct processing time and temperatures used according to the type of food being "put up". Advice on how to protect yourself from botulism and how to prepare these kinds of foods are available in the BC Health Files, and elsewhere.^{14,15}

However, high risk home-prepared bottled, canned and smoked products are not permitted for commercial sales. These include internet sales, road-side sales or sales at local markets. All foods prepared in licensed and regulated facilities are inspected and approved to make sure they are hygienic and follow proper processing procedures. All foods should also have a proper label that includes the name and address of where the product was made. If you have any question about the foods you've purchased, you can contact your local health authority to ensure the product was made in an approved facility.

If you're not sure whether a product is safe to eat follow this simple rule
"when in doubt, throw it out".

Botulism in British Columbia: The RISK of Home-Canned Products

References

1. BC Centre for Disease Control. BCCDC expands advisory to include all products prepared by Jamnation Fine Foods as they may be contaminated with botulism. 2011; Available from: http://www.bccdc.ca/resourcemarketing/newsandalerts/healthalerts/2011HealthAlerts/botulism_March10.htm.
2. Hauschild AH, Gauvreau L. Food-borne botulism in Canada, 1971-84. CMAJ. 1985 Dec 1;133(11):1141-6.
3. Horowitz BZ. Botulinum toxin. Critical Care Clinics. 2005 Oct;21(4):825-39, viii.
4. Dolman CE. Human botulism in Canada. Can Med Assoc J. 1953 Jun;68(6):538-43.
5. International Commission on Microbiological Specifications for Foods (ICMSF). Chapter 5. Clostridium botulinum. Micro-organisms in Foods 5. London: Blackie Academic & Professional; 1996.
6. BC Centre for Disease Control. Temporary Food Markets, Guideline for Sale of Foods at Temporary Food Markets. BC Centre for Disease Control; 2012 [cited 2012 July 20]; Available from: <http://www.bccdc.ca/NR/rdonlyres/8084EFC3-3010-4908-876E-37BF359A939D/0/GuidelinesSaleofFoodsatTemporaryFoodMarkets2012FINAL.pdf>.
7. Wong J, Fung J, Isaac-Renton J, Trinidad A, Mak S, McIntyre L. Poster P-58. Foodborne botulism in British Columbia: A 30 Year History. Vancouver, BC2008; Available from: http://www.bccdc.ca/NR/rdonlyres/FE2B2B64-1ADC-460E-A12D-87E2522573C8/0/BotulismOver30Years_CAMID2008.pdf.
8. Health Canada, Canadian Food Inspection Agency. High Risk of Botulism from Ungutted Salted Fish Products, such as Fesikh. 2012 [cited 2012 Oct 12]; Available from: http://www.hc-sc.gc.ca/ahc-asc/media/advisories-avis/_2012/2012_65-eng.php and <http://www.inspection.gc.ca/english/corpaffr/recapp/2012/20120419e.shtml>.
9. Mathias RG, Wong CK, Bratty PJA, Robinson RG, Kettys GDM, Fung CP, et al. Botulism in British Columbia 1982-1984. BC Medical Journal. 1986;28(7):504-7.
10. FSIS. Principles of Thermal Processing. 2005 [cited 2012 October 12]; Available from: http://www.fsis.usda.gov/PDF/FSRE_SS_3PrinciplesThermal.pdf.
11. BC Centre for Disease Control. Provincial Fish Inspection. 2012 [cited 2012 Oct 12]; Available from: <http://www.bccdc.ca/foodhealth/fish/Provincial+Fish+Inspection.htm>.
12. Canadian Food Inspection Agency. Fish and Seafood Product Inspection. 2012 [cited 2012 Oct 12]; Available from: <http://www.inspection.gc.ca/food/fish-and-seafood/product-inspection/eng/1299825912467/1302832821939>.
13. Food and Drug Administration. Fish and Fisheries Products Hazards and Controls Guidance. Rockville, MD: US Food and Drug Administration; 2011 [cited 2012 Oct 12]; 4th ed:[Available from: <http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/Seafood/FishandFisheriesProductsHazardsandControlsGuide/default.htm>].
14. Utah State University Cooperative Extension. Food Preservation and Canning. 2012 [cited 2012 Oct 12]; Available from: <http://extension.usu.edu/utah/htm/fcs/food-preservation-canning>.
15. Government of British Columbia. Home Canning - How to Avoid Botulism. 2012 [cited 2012 Oct 12]; Available from: <http://www.healthlinkbc.ca/healthfiles/hfile22.stm>.
16. Dolman CE. Additional botulism episodes in Canada. Can Med Assoc J. 1954 Sep;71(3):245-9.
17. Dolman CE, Kerr DE. Botulism in Canada, with report of a type E outbreak at Nanaimo, B. C. Can J Public Health. 1947 Jan;38(1):48-57.
18. Dolman CE. Human botulism in Canada (1919-1973). Can Med Assoc J. 1974 Jan 19;110(2):191-7 passim.
19. St Louis ME, Peck SH, Bowering D, Morgan GB, Blatherwick J, Banerjee S, et al. Botulism from chopped garlic: delayed recognition of a major outbreak. Ann Intern Med. 1988 Mar;108(3):363-8.
20. McLean HE, Peck S, Blatherwick J, Eng G, Black WA, Fung C, et al. Restaurant-associated botulism from in-house bottled mushrooms - British Columbia. Canada Diseases Weekly Report. 1987;13(8):35-6.
21. Loutfy MR, Austin JW, Blanchfield B, Fong IW. An outbreak of foodborne botulism in Ontario. Can J Infect Dis. 2003 Jul;14(4):206-9.
22. Austin JW. Botulism Results. Health Canada.
23. Leclair D, Fung J, Isaac-Renton JL, Proulx JF, May-Hadford J, Ellis A, et al. Foodborne botulism in Canada, 1985-2005. Emerg Infect Dis. 2013 Jun;19(6):961-8.

Botulism in British Columbia: The RISK of Home-Canned Products

Table 1. Summary of documented home canned foods responsible for botulism in British Columbia and else-where in Canada from 1919 to 2013

Botulism Type	Food	Processing	Number of Cases	Number Dead	Location (year)	Notes of interest pertaining to incident	Ref
ND ¹	Meat (venison)	Home canned	2	1	Corbetton, ON (1934)	Meat boiled for 3 to 4 hours, then packed into glass quart jars (also boiled). These were fitted with rubber rings and sealed.	16
ND	Fish	Home canned	5	2	Maple Creek, SK (1941)		4
E	Salmon	Home canned	3	3	Nanaimo, BC (1944)	First bacteriological identification of botulism in Canada's history	16,17
ND	Meat	Home canned	4	0	Masefield, SK (1949)		4
E	Trout	Home pickled	1	1	Natal, BC (1952)	Case caught trout in Elk River and by custom cleaned fish on bank. Trout was made into patties, dipped in eggs and cracker crumbs, fired and placed in glass jars with sliced raw onions. A hot vinegar and salt mix was poured over the fish, and they were sealed without heating. No reheating before being eaten.	4
A	Corn on the cob	Home canned	2	2	Grand Forks, BC (1953)	Glass bottles used. Boiled bottles continuously for four and one half hours. Before serving corn, reboiled for several minutes.	16
A	Spinach	Home canned	2	0	Rock Creek, BC (1953)	Glass bottles used, 16 oz and 24 oz with metal lids and screw tops. Jars boiled for two hours. pH was 6.2.	16
ND	Beets	Home canned	1	0	Gilpin, BC (1953)	Glass bottles used. Jars stood in boiling water for one hour.	16
A	String beans	Home canned	1	0	Vancouver, BC (1964)		18
A	Green peppers	Home canned	3	2	Lower Nicola, BC (1965)	Glass quart jars used.	18
A	Corn	Home canned	1	0	Surrey, BC (1983)		2
A	Vegetables	Home-canned	1	0	North Vancouver, BC (1984)	Home canned food originated from a food bank	2,9
B	Mushrooms	Home-canned	1	0	Montreal, PQ (1985)		2
B	Garlic-in-oil	Restaurant-bottled	36	0	Vancouver, BC (1985)	Garlic-in-oil left at room temperature. Product was unacidified.	19
A	Mushrooms	Restaurant-bottled	11	0	Vancouver, BC (1987)	Mushrooms boiled for 15 min, packed into glass quart jars, and filled with boiling water. Left for two to three hours, then sealed.	20
A	Asparagus	Home-canned	3	1	Ottawa, ON (1991)		21
A	Beef and vegetable soup	Home-canned	1	0	Osoyoos, BC (1993)		7
B	Tomatoes	Home-canned	6	0	Toronto, ON (1999)	Tomatoes boiled for one hour, then placed into glass jars and sealed. Stored in cellar.	21
B	Watermelon jelly	Home-canned – sold publicly	1	0	Nanaimo, BC (2011)	Watermelon juice un-acidified before preparing jelly.	1
A	Green beans	Home-canned	1	0	Vancouver Island (2013)	Green beans. Spoiled jars had pH between 6 and 7.	

¹ – ND=not determined

Botulism in British Columbia: The RISK of Home-Canned Products

Table 2. Summary of documented marine and other animal foodstuffs responsible for botulism between 1961and 2005^{2,18,20-23}

	Marine Animal Foods				Other Foods	
	Seal meat and seal flippers	Salmon eggs (fermented)	Beluga and walrus meat	Fish products	All other foods (ie. vegetables, meats)	Unknown food
No. of outbreaks	69	28	36	14	23	10
No. of cases	132	64	90	32	80	10
No of deaths	28	11	9	7	3	1
Botulism types	88% type E (n=61) 12% ND (n=8)	93% type E (n=26) 3.5% type B (n=1) 3.5% ND (n=1)	94.4% type E (n=34) 2.8% type A (n=1) 2.8% ND (n=1)	79% type E (n=11) 21% type B (n=3)	43% type A (n=10) 30% type B (n=7) 22% type E (n=5) 4% ND (n=1)	60% type E (n=6) 30% type B (n=3) 10% type ABE (n=1)

¹—ND=not determined