



DATASHEET

Microbiological Hazard Series

Pathogen Name: *Clostridium botulinum*

Characteristics: *Clostridium botulinum* is an anaerobic, gram-positive, spore-forming bacterium that produces a potent neurotoxin. The spores are heat-resistant and can survive in foods that are incorrectly or minimally processed. It can grow between a temperature of 3 to 50°C and a pH of 4.6 – 9.0.

There are 7 distinct forms of botulinum toxin, types A–G. Four of these (types A, B, E and rarely F) cause human botulism. Types C, D and E cause illness in other mammals, birds and fish.

Pathogenicity: Botulism is caused by a neurotoxin formed during the growth of *Clostridium botulinum*. This neurotoxin binds to the neuromuscular junction and blocks excitatory synaptic transmission by inhibiting acetylcholine release causing (flaccid) paralysis and sometimes fatal respiratory failure.

Foodborne botulism, caused by consumption of improperly processed food, is a rare but potentially fatal disease if not diagnosed rapidly and treated with antitoxin.

Infectious Dose: An extremely small amount is needed, a few nanograms of the toxin can cause illness.

Sources (Including High - Risk food groups): Widely distributed in nature with it being found in soil and marine environments as well as the intestinal tracts of fish and mammals.

Common food vehicles include low-acid processed foods, canned products, garlic oil, smoked fish or other marine products especially those packed in vacuum packs.

Onset Period: Usually 18-36 hours but it can range from 4 hours to 8 days.

Illness, Symptoms and Complications: Initial symptoms include double vision, blurred vision, slurred speech, vertigo, trouble swallowing and muscle weakness.

If the disease is not treated symptoms may progress to paralysis of the arms, legs, trunk and respiratory muscles. Patients with severe cases that involve paralysis of the respiratory muscles may need mechanical ventilation and intensive care for weeks or months.

Controls to reduce the risk:

Sources recommend that the following controlling factors should be used singly or in combination to prevent growth and toxin production in chilled foods with a shelf-life of more than ten days.

A heat treatment of 90°C for ten minutes or equivalent lethality, a pH of 5 or less throughout the food and throughout all components of complex foods.

A minimum salt level of 3.5% in the aqueous phase throughout the food and throughout all components of complex foods, a water activity (a_w) of 0.97 or less throughout the food and throughout all components of complex foods.

Other factors to help eliminate would include avoiding cross-contamination e.g take care when gutting or preparing fish products.

Safety of canned food is based on the destruction of the spores i.e 121°C for a minimum of 3 minutes also known as (Botulinum Cook).

It is also important to discard any cans that are blown or have defective seams.

Pathogenic Bacteria :: *Clostridium botulinum*

EXAMPLE OUTBREAKS		
YEAR	LOCATION	DETAILS
1989	UK	Hazelnut Yoghurt became contaminated from canned hazelnut puree that was used during its production. This resulted in 27 people becoming ill and 1 death.
2013	China	Smoked ribs consumed from a restaurant resulted in 12 people becoming ill.
2017	USA	Nacho cheese consumed caused 10 people to be hospitalized with 7 of those patients being placed on ventilators due to paralysis of muscles used for breathing. It resulted in 1 death.

SUMMARY TABLE	
Source	<ul style="list-style-type: none"> Found in the environment and intestinal tracts of mammals/fish Canned products Smoked fish Garlic Oil
Growth Temperature	<ul style="list-style-type: none"> 3 to 50°C
Growth pH range	<ul style="list-style-type: none"> 4.6 and 9.0
Onset period	<ul style="list-style-type: none"> 18 to 36 hours (Can range from 4 hours to 8 days)
At risk groups	<ul style="list-style-type: none"> All groups are susceptible
Illness, Symptoms, Complications	<ul style="list-style-type: none"> Blurred or Double vision Slurred speech Vertigo Muscle weakness Severe cases: Paralysis of muscles
Controls	<ul style="list-style-type: none"> Heat treatment: 90°C for ten minutes or equivalent lethality Canned products: 121 °C for minimum for 3 minutes (Botulinum Cook) Avoid cross contamination Gloves Personal Protective Clothing
Published Risk Assessments	<ul style="list-style-type: none"> NCBI: Risk assessment of proteolytic <i>Clostridium botulinum</i> in canned foie gras. https://www.ncbi.nlm.nih.gov/pubmed/26093992 International Journal of Environmental Health Engineering: Risk assessment of the growth of <i>Clostridium botulinum</i> and spores germination induced by high hydrostatic pressure in seafood. http://www.ijehe.org/article.asp?issn=2277-9183;year=2016;volume=5;issue=1;spage=20;epage=20;aualast=Jalali Journal of Food Protection: Estimating the Survivahttp://jfoodprotection.org/doi/abs/10.4315/0362-028X-63.2.190?code=fopr-sitel of <i>Clostridium botulinum</i> Spores during Heat Treatments

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