Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

Bacterial Pathogens and Indicator Organisms in Raw Frozen Breaded or Battered Fish and Seafood - April 1, 2024, to March 31, 2025

Food microbiology - Targeted surveys - Final report



Food microbiology targeted surveys – July 2026

Canada

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Summary

A targeted survey[1] analyzed 460 samples of raw frozen breaded or battered fish and seafood over a 1-year period from April 1, 2024, to March 31, 2025, for the presence of the pathogens S*almonella* spp., and *Staphylococcus aureus* (*S. aureus*). All samples were also tested for generic *E. coli,* which is an indicator of the overall hygienic and sanitary conditions of the food supply chain from production to the point of sale.

All (100%) of the 460 samples tested were found to be satisfactory. S*almonella* spp. was not found in any samples. Additionally, elevated levels of neither generic *E. coli* nor *S. aureus* were not found in any of the 460 samples.

Overall, our survey results indicate that raw frozen breaded and battered fish and seafood sold in Canada are generally safe for consumption. However, as with all food products, good hygienic practices should be followed by producers, retailers, and consumers to minimize the risk of contamination.

Why the survey was conducted

This survey was conducted to provide enhanced oversight of the quality and safety of raw frozen breaded and battered fish and seafood sold at retail in Canada. Fish and seafood are popular foods among Canadians of all ages[2]. Frozen fish and seafood are nutritious and convenient, ready to cook at home foods, with a long shelf life.

Unfortunately, fish and seafood have been the subject of recalls[3,4,5] and foodborne illness outbreaks[6,7]. Fish and seafood are known to support bacterial growth[8] and toxin formation[9]. Contamination with pathogens[,10] can occur at any point in the food production chain such as during production, processing, packaging, distribution, and/or during preparation for consumption. However, the primary concern with frozen breaded or battered fish and seafood relates to contamination of the hydrated bread or batter mix with *S. aureus* during production. *S. aureus* can produce heat-stable toxins and, when ingested, can cause foodborne illness. *S. aureus* toxins are highly resistant to heat and cannot be inactivated at standard cooking temperatures or even at sterilization temperatures (>121ºC). While contamination with other pathogens is possible, they are likely to be killed through standard heat treatments during production or cooking by the consumer. Regardless, whenever pathogens are present in a food, there is a potential for foodborne illness.

When the survey was conducted

The survey was conducted over a 1-year period from April 1, 2024, to March 31, 2025.

Where the samples were collected from

Samples were collected from national retail chains and local/regional grocery stores located in the following 11 major cities across Canada:

- Halifax
- Moncton
- Quebec City
- Montreal
- Ottawa
- Toronto
- Winnipeg
- Saskatoon
- Calgary
- Vancouver
- Victoria

The planned number of samples to be collected from each city was based on the population of the province in which the city was located relative to the total population of Canada.

Total number and description of samples collected

A total of 460 raw frozen breaded or battered fish and seafood samples were collected over the 1-year survey period. A sample consisted of a one or more consumer sized packages from the same lot, with a total weight of at least 250 g.

What the samples were tested for

All samples were tested for S*almonella* spp., *S. aureus*, and generic *E. coli*. *Salmonella* spp., and *S. aureus* are pathogenic bacteria while generic *E. coli* is an indicator of the overall hygienic and sanitary conditions under which the samples have been produced, processed, stored and transported.

Methods used to test the samples

Samples were analyzed using analytical methods published in Health Canada's *Compendium of Analytical Methods for the Microbiological Analysis of Foods*[11] that were appropriate for the testing of fish and seafood.

How the samples were assessed

The samples were assessed using criteria based on the principles of the CFIA's *Bacteriological guidelines for fish and fish products (end product)*[12], and guidelines developed by an international food safety authority[13]. See table 1.

Table 1 - Assessment criteria

Bacteria	Satisfactory	Investigative	Unsatisfactory
Salmonella spp.	Not detected/25 g	Not applicable	Detected/25 g
S. aureus	≤10^3 CFU/g	>10^3 and ≤10^4 CFU/g	>10^4 CFU/g
generic *E. coli*	≤10^2 CFU or MPN/g	>10^2 CFU or MPN/g	Not applicable

No specific assessment guidelines had been established in Canada for the presence of generic *E. coli* in frozen breaded or battered fish or seafood at the time of writing this report.

Unlike bacterial pathogens, most strains of generic *E. coli* are harmless. Generic *E. coli* is considered to be an indicator organism as the levels present in a food product are used to assess the overall sanitation conditions throughout the food chain from production to the point of sale. Their presence at some levels is tolerated, however, elevated levels were assessed as investigative, possibly resulting in further follow-up actions.

Survey results

All (100%) of the samples tested were found to be satisfactory. *Salmonella* spp. was not found in any samples. Generic *E. coli* at elevated levels (>10^2 MPN/g) or *S. aureus* at elevated levels (>10^3 CFU/g) were not found in any of the samples. See table 2.

Table 2 - Analysis assessment results

Bacterial analysis	Number of samples tested	Satisfactory	Investigative	Unsatisfactory
Salmonella spp.	460	460	Not applicable	0
S. aureus	460	460	0	0
generic *E. coli*	460	460	0	Not applicable

Survey results are also presented by country of origin (table 3) and product type (table 4).

Table 3 - Assessment results by country of origin

Country of origin	Number of samples tested (%)	Satisfactory
China	80 (17.4)	80
Republic of Korea	4 (0.9)	4
Portugal	1 (0.2)	1
Scotland	6 (1.3)	6
Thailand	25 (5.4)	25
United States	81 (17.6)	81
Viet Nam	48 (10.4)	48
Unknown[a]	34 (7.4)	34
Unknown[a] (Made in Canada from domestic and imported ingredients)	181 (39.3)	181
Total	**460 (100)**	**460**

Table 4 - Assessment results by product type

Product type	Number of samples tested (%)	Satisfactory
Cod	29 (6.3)	29
Mixed fish species	39 (8.5)	39
Haddock	66 (14.3)	66
Halibut	1 (0.2)	1
Perch	1 (0.2)	1
Pollock	98 (21.3)	98
Shrimp	132 (28.7)	132
Sole	35 (7.6)	35
Basa	3 (0.7)	3
Uncooked breaded salmon	5 (1.1)	5
Squid	50 (10.9)	50
Tilapia	1 (0.2)	1
Total	**460 (100)**	**460**

What the survey results mean

Previous CFIA monitoring of *S. aureus* in breaded or battered fish and seafood has shown results (unpublished) approximating those in this study.

Overall, our survey results indicate that raw frozen breaded or battered fish and seafood sold in Canada is generally safe for consumption. However, as with all foods, good hygienic practices are recommended for producers, retailers, and consumers.

[a] Product origin could not be assigned from the product label, or available sample information.

What is done with the survey results

All results are used to:

- inform risk management decisions
- support program design and re-design

Where to access the survey data

The data will be accessible on the Open Government Portal.

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