



# Bacterial Pathogens and Indicators in Ready-to-Eat Dried Powdered Spices - April 1, 2018 to March 31, 2021

## Food microbiology - Targeted surveys - Final report



## Summary

A 3-year targeted survey<sup>1</sup> analysed 1762 samples of ready-to-eat (RTE) dried powdered spices for the presence of the pathogens *Salmonella* species (spp.), *Staphylococcus aureus* (*S. aureus*), *Bacillus cereus* (*B. cereus*), and *Clostridium perfringens* (*C. perfringens*). All samples were also tested for generic *Escherichia coli* (*E. coli*) which is an indicator of the hygienic and sanitary conditions of the food supply chain from production to the point of sale.

Over 99.9% of the samples tested were found to be satisfactory. *S. aureus* (>10<sup>2</sup> CFU/g), *B. cereus* (>10<sup>4</sup> CFU/g), *C. perfringens* (>10<sup>4</sup> CFU/g), and generic *E. coli* (> 10<sup>2</sup> MPN/g) were not found in any samples. *Salmonella* spp. was found in 1 of the 1762 (0.06%) samples. The Canadian Food Inspection Agency (CFIA) conducted appropriate follow-up activities and included a food recall by the industry. There were no reported illnesses related to these products.

Overall, our survey results indicate that RTE dried powdered spices sold in Canada are generally safe for consumption, however they can occasionally be contaminated. Consequently, as with all foods, and especially with those that are ready for consumption without further preparation, good hygienic practices are recommended for producers, retailers, and consumers.

## Why was this survey conducted

The survey was conducted to provide enhanced oversight of the quality and safety of RTE dried powdered spices sold at retail in Canada. This survey focused on spices that are predominantly used in RTE applications such as cinnamon and pepper, and commonly consumed by Canadians<sup>2</sup>.

Spices are primarily used to enhance the flavour of foods and are made from various parts of a plant including the fruits, roots, bark or seeds which are dried and then ground<sup>3</sup>. Dried spices are low moisture foods that do not support the growth of pathogens, however if present pathogens can survive for long periods of time.

Unfortunately, dried spices have been associated with food recalls<sup>4, 5</sup> and outbreaks<sup>6</sup> of foodborne illnesses as they can become contaminated with pathogens during production, harvest, post-harvest handling, processing, packaging, distribution and/or at retail. When consumed, the presence of bacterial pathogens creates the potential for foodborne illness.

## When was the survey conducted

The survey was conducted over a 3-year period from April 1, 2018 to March 31, 2021.

## Where were the samples collected from

As spices have a long shelf life, samples were collected from national retail chains and local/regional grocery stores in year 1 and 3 of the survey to avoid repeatedly sampling the same lot of product. In year 2 of the survey, samples were collected from natural health stores or ethnic stores. All samples were taken from retail stores located in the following 11 major cities across Canada:

- Halifax
- Saint John or Moncton
- Quebec City
- Montreal
- Toronto
- Ottawa
- Vancouver
- Kelowna or Victoria
- Calgary
- Saskatoon
- Winnipeg

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.

## How many and what kind of samples were collected

A total of 1762 RTE dried powdered spice samples were collected. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 100g.

## What were the samples tested for

All samples were tested for *Salmonella* spp., *S. aureus*, *B. cereus*, *C. perfringens*, and generic *E.coli*. *Salmonella* spp. *S. aureus*, *B. cereus*, and *C. perfringens* 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.

## What methods were 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*<sup>7</sup> that were suitable for the testing of dried powdered spices.

## How were the samples assessed

The samples were assessed using criteria based on the principles of Health Canada's *Health Products and Food Branch Standards and Guidelines for Microbiological Safety of Foods – An Interpretive Summary*<sup>8</sup>.

**Table 1 - Assessment criteria**

Bacteria	Satisfactory	Investigative	Unsatisfactory
<i>Salmonella</i> spp.	Not detected	Not applicable	Detected
<i>S. aureus</i>	$\leq 10^2$ CFU/g	$> 10^2$ and $\leq 10^4$ CFU/g	$> 10^4$ CFU/g
<i>B. cereus</i>	$\leq 10^4$ CFU/g	$> 10^4$ and $\leq 10^6$ CFU/g	$> 10^6$ CFU/g
<i>C. perfringens</i>	$\leq 10^4$ CFU/g	$> 10^4$ and $\leq 10^6$ CFU/g	$> 10^6$ CFU/g
Generic <i>E. coli</i>	$\leq 10^2$ MPN/g	$> 10^2$ and $\leq 10^3$ MPN/g	$> 10^3$ MPN/g

## What were the survey results

Over 99.9% of the samples tested were found to be satisfactory. *S. aureus* ( $>10^2$  CFU/g), *B. cereus* ( $>10^4$  CFU/g), *C. perfringens* ( $>10^4$  CFU/g), and generic *E.coli* ( $> 10^2$  MPN/g) were not found in any samples. *Salmonella* spp. was found in 1 of the 1762 (0.06%) samples.

**Table 2 - Assessment results**

Bacterial analysis	Number of samples tested	Satisfactory (%)	Investigative	Unsatisfactory (%)
<i>Salmonella</i> spp.	1762	1761	Not applicable	1
<i>S. aureus</i>			0	0
<i>B. cereus</i>			0	0
<i>C. perfringens</i>			0	0
Generic <i>E. coli</i>			0	0
<b>Total</b>	<b>1762</b>	<b>1761(99.9)</b>	<b>0</b>	<b>1(0.06)</b>

Survey results are also presented by production practice (table 3), origin (table 4), and product type (table 5).

**Table 3 - Assessment results by production practice**

Production practice	Number of samples tested (%)	Satisfactory	Unsatisfactory
Conventional	1120 (63.6)	1119	1
Organic	642 (36.4)	642	0
<b>Total</b>	<b>1762</b>	<b>1761</b>	<b>1</b>

**Table 4 - Assessment results by product origin**

Product origin	Number of samples tested (%)	Satisfactory	Unsatisfactory
Domestic	16 (0.9)	16	0
Import	1302 (73.9)	1301	1
Unknown <sup>a</sup>	343 (19.5)	343	0
Unknown <sup>a</sup> (domestically processed) <sup>b</sup>	101 (5.7)	101	0
<b>Total</b>	<b>1762</b>	<b>1761</b>	<b>1</b>

<sup>a</sup> "Unknown" refers to those samples for which the country of origin could not be assigned from the product label or available sample information.

<sup>b</sup> "Domestically processed" refers to samples which could be assigned as being processed in Canada based on the product label or available sample information.

**Table 5 - Assessment results by product type**

Product type	Number of samples tested (%)	Satisfactory	Unsatisfactory
Allspice	12 (0.7)	12	0
Black pepper	126 (7.2)	126	0
Cayenne pepper	19 (1.1)	19	0
Celery salt	41 (2.3)	41	0
Celery seed	5 (0.3)	5	0
Chili powder	101 (5.7)	100	1
Cinnamon	266 (15.1)	266	0
Coriander	62 (3.5)	62	0
Garlic	140 (8.0)	140	0
Ginger	165 (9.4)	165	0
Mustard	83 (4.7)	83	0
Nutmeg	127 (7.2)	127	0
Onion	137 (7.8)	137	0
Paprika	218 (12.4)	218	0
Turmeric	222 (12.6)	222	0
White pepper	38 (2.2)	38	0
<b>Total</b>	<b>1762</b>	<b>1761</b>	<b>1</b>



## What do the survey results mean

Previous Canadian<sup>9, 10</sup> and international<sup>11, 12, 13</sup> studies on the microbial quality and safety of retail dried spices have shown results approximating those in our study. Differing prevalence rates between studies may be attributable to differences in product types tested, methodology, study design, etc.

Overall, our survey results indicate that RTE dried powdered spices sold in Canada are generally safe for consumption, however they can occasionally be contaminated. Consequently, as with all foods, and especially with those that are ready for consumption without further preparation, good hygienic practices are recommended for producers, retailers and consumers.

## What is done with the survey results

All results are used to:

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

While no illnesses were related to the unsatisfactory sample, these results triggered appropriate follow-up actions including:

- facility inspections
- additional sampling and testing
- a food recall<sup>5</sup>

## Can I access the survey data

Yes. The data will be accessible on the [Open Government Portal](#).

## References

1. Canadian Food Inspection Agency, [\*Food chemistry and microbiology\*](#).
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