



Canadian Food  
Inspection Agency

Agence canadienne  
d'inspection des aliments

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

## Food microbiology - Targeted surveys - Final report



## Summary

A 3-year targeted survey<sup>1</sup> analysed 4331 samples of ready-to-eat meat (RTE) products (deli meats, sausages, liver pâtés, poultry breast strips) for the presence of the pathogens *Listeria monocytogenes* (*L. monocytogenes*), *Salmonella* species (spp.), and *Staphylococcus aureus* (*S. aureus*). 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.

99.7% of the samples tested were found to be satisfactory. *Salmonella* spp., and *S. aureus* (> 10<sup>2</sup> CFU/g) were not found in any of the samples. *L. monocytogenes* was found in 12 of the 4331 (0.3%) samples and generic *E. coli* at elevated levels were found in 1 of the 4331 (0.02%) samples. The Canadian Food Inspection Agency (CFIA) conducted appropriate follow-up activities. There were no reported illnesses related to these products.

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

## Why was this survey conducted

The survey was conducted to generate baseline information on the quality and safety of RTE meat products sold at retail in Canada. The RTE meat product types sampled under this survey included deli meats, sausages, poultry breast strips, and liver pâtés which are all commonly consumed by Canadians<sup>2</sup>. Unfortunately, many of these foods have been associated with recalls<sup>3, 4</sup>, and foodborne illness outbreaks<sup>5, 6</sup> and are considered to be high-risk foods<sup>7</sup>.

Contamination with bacterial pathogens can occur at any step in the food supply chain such as during production, processing, distribution and/or at retail, and when consumed, their presence creates the potential for foodborne illness. In an attempt to determine the cumulative effect of each step in the food supply chain on the overall quality and safety of the food, and unique to specific surveys, samples were collected as close to the product best before date as possible.

## When was the survey conducted

The survey was conducted over a 3-year period from April 1, 2018 to March 31, 2021, however sausages were only collected during the last 2 years of the survey.

## Where were the samples collected from

Samples were collected from national retail chains and local/regional grocery 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 4331 RTE meat samples were collected of which 1285 were deli meats, 1275 were poultry breast strips, 1176 were sausages and 595 were liver pâtés. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 250g. Samples were collected as close to the best before date as possible to account for the effects of storage conditions along the food chain.

## What were the samples tested for

All samples were tested for *L. monocytogenes*, *Salmonella* spp., *S. aureus* and generic *E. coli*. *L. monocytogenes*, *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 processed, stored and transported.

## What methods were used to tests the samples

Samples were analyzed using analytical methods published in Health Canada's *Compendium of Analytical Methods for the Microbiological Analysis of Foods*<sup>8</sup> that were suitable for the testing of RTE meats.

## How were samples assessed

The samples were assessed using criteria based on the principles outlined in the following Health Canada documents: *Health Products and Food Branch Standards and Guidelines for Microbiological Safety of Foods – An Interpretive Summary*<sup>9</sup>, *Policy on Listeria monocytogenes in Ready-to-Eat Foods*<sup>10</sup>, and the *Food and Drugs Act*<sup>11</sup> (Section 4(1)).

**Table 1 - Assessment criteria**

Bacteria	Satisfactory	Investigative	Unsatisfactory
<i>L. monocytogenes</i>	Not detected	Not applicable (category 1 <sup>a</sup> ) Detected and $\leq 10^2$ CFU/g (category 2 <sup>a</sup> )	Detected (category 1 <sup>a</sup> ) > $10^2$ CFU/g (category 2 <sup>a</sup> )
<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
Generic <i>E. coli</i>	$\leq 10$ CFU/g <sup>b</sup> $\leq 10^2$ CFU/g	> 10 and $\leq 10^3$ CFU/g <sup>b</sup> > $10^2$ and $\leq 10^3$ CFU/g	> $10^3$ CFU/g

<sup>a</sup> The pH and water activity of the sample were used to determine the product category

<sup>b</sup> RTE chicken/turkey breast strips

No assessment guidelines had been established in Canada for the presence of *Salmonella* spp. in RTE meat at the time of writing this report. As this bacteria is considered pathogenic to humans its presence was assessed as unsatisfactory as it is considered to be a violation of the *Food and Drugs Act*<sup>11</sup> Section 4(1)a.

## What were the survey results

99.7% of the samples tested were found to be satisfactory. *Salmonella* spp., and *S. aureus* (>  $10^2$  CFU/g) were not found in any of the samples tested. *L. monocytogenes* was found in 12 of the 4331 (0.3%) samples at levels of < 5 CFU/g and generic *E. coli* at 410 CFU/g was found in 1 of the 4331 (0.02%) samples.

**Table 2 - Assessment results**

Bacteria	Number of samples tested	Satisfactory (%)	Investigative (%)	Unsatisfactory (%)
<i>L. monocytogenes</i>	4331	4318	6 <sup>c</sup>	6 <sup>d</sup>
<i>Salmonella</i> spp.			Not applicable	0
<i>S. aureus</i>			0	0
Generic <i>E. coli</i>			1 <sup>e</sup>	0
<b>Total</b>	<b>4331</b>	<b>4318 (99.7)</b>	<b>7 (0.2)</b>	<b>6 (0.1)</b>

<sup>c</sup> < 5 CFU/g, dry sausage

<sup>d</sup> < 5 CFU/g, ham, pastrami, and cooked sausage, 150 CFU/g, pork liver pâté

<sup>e</sup> 410 CFU/g, chicken breast strips

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

**Table 3 - Assessment results by product origin**

Product Origin	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Domestic	918 (21.2)	914	4	0
Import	280 (6.5)	277	3	0
Unknown <sup>f</sup>	65 (1.5)	64	0	1
Unknown <sup>f</sup> (domestically processed) <sup>g</sup>	3068 (70.8)	3063	0	5
<b>Total</b>	<b>4331</b>	<b>4318</b>	<b>7</b>	<b>6</b>

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

**Table 4 - Assessment results by RTE product type**

Product type	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Deli meat	1285 (29.7)	1283	0	2 <sup>h</sup>
Liver pâté	595 (13.7)	594	0	1 <sup>i</sup>
Chicken or turkey breast strips	1275 (29.4)	1274	1 <sup>j</sup>	0
Sausage	1176 (27.2)	1167	6 <sup>k</sup>	3 <sup>l</sup>
<b>Total</b>	<b>4331</b>	<b>4318</b>	<b>7</b>	<b>6</b>

<sup>h</sup> *L. monocytogenes* detected in ham and pastrami (category 1)

<sup>i</sup> *L. monocytogenes* detected in pork liver pâté (category 1)

<sup>j</sup> Generic *E. coli* detected in chicken breast strips

<sup>k</sup> *L. monocytogenes* detected in dry sausages (category 2)

<sup>l</sup> *L. monocytogenes* detected in fully cooked sausages (category 1)

## What do the survey results mean

Previous Canadian<sup>12</sup> and U.S.<sup>13</sup> studies on the microbial safety of RTE meats 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 meat products sold in Canada are generally safe for consumption, however they can be infrequently contaminated. Consequently, as with all food, and especially those that are ready for consumption without further preparation or cooking, 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 illness were related to the investigative and unsatisfactory samples, these results triggered appropriate follow-up actions including:

- facility inspections
- additional sampling and testing
- removal of affected products from the marketplace

## 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](#).
2. Public Health Agency of Canada, *Foodbook Report*. 2015.
3. Canadian Food Inspection Agency, [Updated Food Recall Warning - European Butcher brand Smoked Pork Hock recalled due to \*Listeria monocytogenes\*](#). 2021.
4. Canadian Food Inspection Agency, [Updated Food Recall Warning - Silver Maple brand Frozen All White Meat Fully Cooked Diced Chicken recalled due to \*Listeria monocytogenes\*](#). 2021.
5. Public Health Agency of Canada, [Public Health Notice - Outbreak of \*Listeria\* infections linked to Rosemount brand cooked diced chicken](#). 2019.
6. Lone, J. and R. Huffman, *Building food safety into the company culture: a look at Maple Leaf Foods*. Perspectives in Public Health, 2014. **134**(4): p. 200-205.
7. Ontario Ministry of Health Ministry of Long-Term Care, [Food Safety - Frequently Asked Questions](#). 2021.
8. Health Canada, *Compendium of Analytical Methods for the Microbiological Analysis of Foods*. 2011.
9. Health Canada, *Health Products and Food Branch (HPFB) Standards and Guidelines for Microbiological Safety of Food - An Interpretive Summary*. 2008.
10. Health Canada, [Policy on \*Listeria monocytogenes\* in Ready-to-Eat Foods](#). 2011
11. Department of Justice Canada, *Food and Drugs Act*. 2014.
12. Canadian Food Inspection Agency, [National Microbiological Monitoring Program and Food Safety Oversight Program Annual Report 2019-2020](#).
13. U.S. Department of Agriculture Food Safety and Inspection Service, [Microbiological Testing Program for RTE Meat and Poultry and Pasteurized Egg Product](#).