



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Bacterial pathogens and indicators in guacamole - April 1, 2021, to March 31, 2024

Food microbiology - Targeted surveys - Final report



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Summary

A targeted survey¹ analyzed 891 samples of guacamole over a 3-year period from April 1, 2021, to March 31, 2024, for the presence of the pathogens *Listeria monocytogenes* (*L. monocytogenes*), *Salmonella* spp., and *E. coli* O157. All samples were also tested for generic *E. coli*, which is used as 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 891 samples tested were found to be satisfactory. *L. monocytogenes*, *Salmonella* spp., and *E. coli* O157 were not found in any of the samples. Generic *E. coli* at elevated levels (>10² most probable number (MPN)/g) were not found in any of the samples.

Overall, our survey results indicate that guacamole sold in Canada is generally safe for consumption. However, as with all foods, and especially those that are ready-to-eat (RTE), good hygienic practices are recommended for producers, retailers, and consumers.

Why the survey was conducted

This survey was conducted to generate baseline information on the quality and safety of guacamole sold at retail in Canada.

Guacamole is a RTE refrigerated product that is popular among Canadians². It is an avocado-based dip³ that is typically made by mixing ripe mashed avocados with onions, lime juice, cilantro, tomatoes, peppers, and salt.

The outer skin of avocados has been found to be frequently contaminated with *L. monocytogenes*⁴ and *Salmonella*, so unhygienic production practices can result in the contamination of its pulp during the production of guacamole. Additionally, guacamole is a high fat and high moisture food that supports the growth of bacteria⁵. Unfortunately, guacamole has been associated with numerous recalls^{6, 7, 8} and foodborne illness outbreaks.^{9, 10}

Contamination with bacterial pathogens can occur at any step in the food supply chain such as during primary production, harvest, processing, and/or packaging. Consequently, if pathogens are present, there is a potential for foodborne illness as guacamole is RTE.

When the survey was conducted

The survey was conducted over a 3-year period from April 1, 2021, to March 31, 2024.

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 891 refrigerated RTE guacamole samples were collected. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 250g.

What the samples were tested for

All samples were tested for *L. monocytogenes*, *Salmonella* spp., *E. coli* O157, and generic *E. coli*. *L. monocytogenes*, *Salmonella* spp., and *E. coli* O157 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 guacamole.

How the samples were assessed

The samples were assessed using criteria based on the principles of the following Health Canada documents: *Health Products and Food Branch (HPFB) Standards and Guidelines for Microbiological Safety of Food – An Interpretive Summary*¹², *Food and Drugs Act*¹³ (Section 4(1)), and *Policy on Listeria monocytogenes in Ready-to-Eat Foods*^{14,15}.

Table 1 – Assessment criteria

Bacteria	Satisfactory	Investigative	Unsatisfactory
<i>L. monocytogenes</i>	Not detected / 25 g	Not applicable (category 1 ^a) Detected / 25 g and $\leq 10^2$ Colony-forming unit (CFU)/g (category 2 ^a)	Detected / 25 g (category 1 ^a) >10 ² CFU/g (category 2 ^a)
<i>Salmonella</i> spp.	Not detected / 25 g	Not applicable	Detected / 25 g
<i>E. coli</i> O157	Not detected / 25 g	Not applicable	Detected / 25 g
Generic <i>E. coli</i>	$\leq 10^2$ MPN/g	> 10 ² and $\leq 10^3$ MPN/g	> 10 ³ MPN/g

No assessment guidelines had been established in Canada for the presence of *Salmonella* spp., *E. coli* O157, or indicator organisms in guacamole at the time of writing this report.

As *Salmonella* spp., and *E. coli* O157 are considered pathogenic to humans, the presence of either organism might be considered a violation of the *Food and Drugs Act*¹³ Section 4(1)a and therefore assessed as unsatisfactory.

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. *L. monocytogenes*, *Salmonella* spp., and *E. coli* O157 were not found in any of the samples. Generic *E. coli* at elevated levels (>10² MPN/g) were not found in any of the samples.

^a The pH and water activity of the sample were used to determine the product category.

Table 2 - Analysis assessment results

Bacterial analysis	Number of samples tested	Satisfactory	Investigative	Unsatisfactory
<i>L. monocytogenes</i>	891	891	Not applicable	0
<i>Salmonella</i> spp.	891	891	Not applicable	0
<i>E. coli</i> O157	891	891	Not applicable	0
Generic <i>E. coli</i>	891	891	0	0

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

Table 3 - Assessment results by production practice

Production practice	Number of samples tested (%)	Satisfactory
Conventional	858 (96.3)	858
Organic	33 (3.7)	33
Total	891 (100)	891

Table 4 - Assessment results by product origin

Origin	Number of samples tested (%)	Satisfactory
Import	790 ^b (88.7)	790
Unknown ^c	101 ^d (11.3)	101
Total	891 (100)	891

What the survey results mean

Previously published Canadian¹⁶ and US¹⁷ studies investigated the microbiological quality and safety of processed avocado and guacamole sampled at retail grocery stores and production facilities.

The Canadian study¹⁶ tested 34 retail samples of guacamole (32 imported, 2 domestically manufactured) for *L. monocytogenes*, *Salmonella* spp., *Staphylococcus aureus*, *Bacillus cereus*, *Clostridium perfringens*, and generic *E. coli*. *L. monocytogenes* (85 CFU/g) was detected in 1 (2.9%) domestically made sample.

The US study¹⁷ tested 887 samples of processed avocado and guacamole for *Salmonella* spp. and *L. monocytogenes*. *Salmonella* spp. was detected in 2 samples (0.2%) and *L. monocytogenes* was detected in 15 samples (1.7%).

All the samples in the current study were sampled at retail stores and found to be satisfactory.

^b Of the 790 imported samples, 719 were from Mexico, 7 were from the US, and 64 were from an unknown foreign country.

^c Country of origin could not be assigned from the product label or available sample information.

^d 55 of the 101 samples of unknown country of origin were processed in Canada.

Differing prevalence rates between studies may be attributable to differences in the origin of the products tested, the product types tested, processing methods, methodology or study design.

Overall, our survey results indicate that refrigerated RTE guacamole sold in Canada is generally safe for consumption. However, as with all foods, and especially with those that are RTE, 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

Where to access the survey data

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

References

1. Canadian Food Inspection Agency, [Food microbiology](#).
2. Public Health Agency of Canada, [Foodbook Report](#). 2015.
3. Merriam-Webster Dictionary, [Guacamole Definition & Meaning - Merriam-Webster](#), Accessed January 23, 2025.
4. U.S. Food and Drug Administration, [FY 2014 – 2016 Microbiological Sampling Assignment-Summary Report: Whole Fresh Avocados \(PDF\)](#). 2018.
5. Dekevich, D, Colorado State University, [Food Source Information, Avocados](#).
6. U.S. Food and Drug Administration, [GHGA Recalls Various Ready-To-Eat Vegetable Products Due to Possible Listeria Monocytogenes Contamination](#). 2022.
7. U.S. Food and Drug Administration, [Enforcement Report \(fda.gov\)](#). 2017.
8. Canadian Food Inspection Agency, [Chef Destinations, Frankly Fresh Salads and Fresh St. brands Fresh Guacamole and 7 Layer Dip recalled due to Listeria monocytogenes](#). 2017.
9. Kendall, M. E et al., [Emergence of Salsa and Guacamole as Frequent Vehicles of Foodborne Disease Outbreaks in the United States, 1973–2008](#). Foodborne Pathogens and Disease, 2013. Volume 10, No. 4.
10. Public Health – Seattle & King County, [Shiga toxin-producing E. coli O157:H7 infections associated with PCC Community Markets – West Seattle Co-op in Seattle](#), 2024.
11. Health Canada, [Compendium of Analytical Methods](#). 2011.
12. Health Canada, [Health Products and Food Branch \(HPFB\) Standards and Guidelines for Microbiological Safety of Food - An Interpretive Summary](#). 2008.
13. Health Canada, [Food and Drugs Act, RSC 1985 c F-27](#). 1985.
14. Health Canada, [Policy on Listeria monocytogenes in Ready-to-Eat Foods](#). 2011.
15. Health Canada, [Policy on Listeria monocytogenes in Ready-to-Eat Foods](#). 2023.
16. Canadian Food Inspection Agency, [Bacterial Pathogens in a Variety of Refrigerated, Multi-Ingredient, Ready-to-Eat Processed Foods - April 1, 2013 to March 31, 2018 - inspection.canada.ca](#). 2019.
17. U.S. Food and Drug Administration, [Summary Report: Processed Avocado and Guacamole FY 2017 – 2019 Microbiological Sampling Assignment \(PDF\)](#). 2022.