



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Bacterial Pathogens and Indicators in Pasteurized Goat, Sheep, and Water Buffalo Milk Cheese - April 1, 2019, to March 31, 2023

Food microbiology - Targeted surveys - Final report



Summary

A 4-year targeted survey¹ analysed 910 samples of pasteurized goat, sheep, and water buffalo milk cheese 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.

Almost all (99.8%) of the samples tested were found to be satisfactory. *Salmonella* spp., *L. monocytogenes*, and *S. aureus* at elevated levels were not detected in any of the samples. Generic *E. coli* at elevated levels was found in 2 of the 910 (0.2%) samples. The Canadian Food Inspection Agency (CFIA) conducted appropriate follow-up activities.

Overall, our survey results indicate that pasteurized goat, sheep, and water buffalo milk cheese sold in Canada are generally safe for consumption. However, as with all food, and especially those that are ready-to-eat (RTE) good hygienic practices are recommended for producers, retailers and consumers.

Why this survey was conducted

The survey was conducted to generate baseline information on the quality and safety of pasteurized goat, sheep, and water buffalo milk cheese sold at retail in Canada. A similar survey² was conducted from 2018 to 2021, however the samples were not selected based on the animal source. The product types sampled under this survey include soft³, semi-soft³, firm³, and hard³ pasteurized cheeses which are all commonly consumed by Canadians⁴ of all ages. Unfortunately, many cheeses have been associated with recalls⁵ and foodborne illness outbreaks^{6,7,8} and are considered to be high risk foods.

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

When the survey was conducted

The survey was conducted over a 4-year period from April 1, 2019, to March 31, 2023.

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
- Toronto
- Ottawa
- Vancouver
- 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.

Total number and description of samples collected

A total of 910 pasteurized goat, sheep, and water buffalo cheese samples were collected. A variety of product types were selected to represent a range of moisture content (soft³, semi-soft³, firm³, and hard cheeses³). 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., *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.

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*⁹ that were suitable for the testing of pasteurized cheese.

How 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 Foods – An Interpretive Summary*¹⁰, *Policy on Listeria monocytogenes in Ready-to-Eat Foods*¹¹ and the *Food and Drugs Act*¹² (Section 4(1)).

Table 1 - Assessment criteria

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

No assessment guidelines had been established in Canada for the presence of *Salmonella* spp. in pasteurized cheese at the time of writing this report. As this bacteria is considered pathogenic to humans it's presence was assessed as unsatisfactory as it is considered to be a violation of the *Food and Drugs Act*¹² Section 4(1)a.

Survey results

Over 99.7% of the samples tested were found to be satisfactory. *Salmonella* spp., *L. monocytogenes*, and *S. aureus* ($>10^2$ CFU/g) were not detected in any of the samples. Generic *E. coli* at elevated levels ($>10^2$ CFU/g) were found in 2 of the 910 (0.2%) samples.

Table 2 – Analysis assessment results

Bacteria	Number of samples tested	Satisfactory	Investigative	Unsatisfactory	Not assessed
<i>L. monocytogenes</i>	910	910	0	0	0
<i>Salmonella</i> spp.	910	910	Not applicable	0	0
<i>S. aureus</i>	910	315	0	0	595 ^b
Generic <i>E. coli</i>	910	908	2 ^{c,d}	0	0

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

^b 595 samples were reported as <250 CFU/g and therefore the sample results could not be assessed.

^c 1600 CFU/g, semi-soft ripened sheep and goat's cheese, imported from Greece, Graviera.

^d 500 CFU/g, hard ripened sheep's cheese, imported from Italy, Pecorino crontonese.

Survey results are also presented by origin (table 3), production practice (table 4), animal source (table 5), moisture on a fat free basis (MFFB)³ (table 6), and whether the product is ripened or unripened.

Table 3 - Assessment results by product origin

Product origin	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Domestic	524 (57.6)	524	0	0
Import	219 (24.1)	217	2	0
<i>Bulgaria</i>	14	14	0	0
<i>France</i>	58	58	0	0
<i>Greece</i>	36	35	1	0
<i>Israel</i>	1	1	0	0
<i>Italy</i>	8	7	1	0
<i>Netherlands</i>	1	1	0	0
<i>Norway</i>	2	2	0	0
<i>Spain</i>	86	86	0	0
<i>United Kingdom</i>	5	5	0	0
<i>United States</i>	1	1	0	0
Unknown ^e	167 (18.4)	167	0	0
Total	910	908	2	0

Table 4 - Assessment results by production practice

Production practice	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Conventional	896 (98.5)	894	2	0
Organic	14 (1.5)	14	0	0
Total	910	908	2	0

Table 5 - Assessment results by animal source

Animal source	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Goat	727 (79.9)	727	0	0
Sheep	118 (13.0)	117	1	0
Sheep and Goat	17 (1.9)	16	1	0
Sheep, Goat, and Cow	1 (0.1)	1	0	0
Water Buffalo	47 (5.2)	47	0	0
Total	910	908	2	0

^e "Unknown" refers to those samples for which the country of origin could not be assigned from the product label or available sample information.

Table 6 - Assessment results by moisture on a fat free basis³

MFFB ³	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Hard (<50%)	37 (4.1)	36	1	0
Firm (50-62%)	260 (28.6)	260	0	0
Semi-soft (62-67%)	87 (9.6)	86	1	0
Soft (67-80%)	526 (57.8)	526	0	0
Total	910	908	2	0

Table 7 - Assessment results by ripened vs. unripened

Ripened or Unripened	Number of samples tested (%)	Satisfactory	Investigative	Unsatisfactory
Ripened	361 (39.7)	359	2	0
Unripened (Fresh)	549 (60.3)	549	0	0
Total	910	908	2	0

What the survey results mean

Previous Canadian^{2,13} and international¹⁴ studies on the microbiological quality and safety of retail pasteurized cheeses have shown results approximating those in our study, however no pathogens were detected in any of the samples in the current 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 pasteurized cheese sold in Canada are generally safe for consumption. However, as with all food, and especially 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

The investigative samples triggered appropriate follow-up activities which may have included:

- on-site visit of the manufacturer
- review of manufacturer production and sanitation practices
- review of records and inspection of equipment and establishment conditions

Where to access the survey data

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

References

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