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

Bacterial Pathogens and Indicators in Plant-based Milk Alternatives - April 1, 2019 to March 31, 2022

Food microbiology - Targeted surveys - Final report

Canada

Summary

A 3-year targeted survey[1] analysed 891 samples of plant-based milk alternatives for the presence of the pathogens S*almonella* species (spp.), and *Listeria monocytogenes* (*L. monocytogenes*). All samples were also tested for total coliforms and Aerobic Colony Count (ACC) which are indicators of the overall hygienic and sanitary conditions of the food supply chain from production to the point of sale.

Over 99.4% of the samples tested were found to be satisfactory. *Salmonella* spp., *L. monocytogenes*, and total coliforms (>10^3 CFU or MPN/g) were not found in any of the samples. ACC at elevated levels were found in 5/891 (0.6%) samples. The Canadian Food Inspection Agency (CFIA) conducted appropriate follow-up activities.

Overall, our survey results indicate that plant-based milk alternatives sold in Canada are generally safe for consumption. However, as with all foods, and especially with those that are ready-to-eat (RTE), 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 plant-based milk alternatives sold at retail in Canada.

The consumption of plant-based milk alternatives has a long history in many parts of the world[2, 3]. However, in recent years they have grown in popularity and a wide variety of products have appeared on the Canadian retail marketplace[4, 5] and has been the subject of recalls[6, 7].

Contamination with bacterial pathogens can occur at any step in the food supply chain such as during production, processing, and/or packaging. The production process involves a heat treatment step[8] to destroy any bacterial pathogens that may be present, however, if this step is inadequate or if contamination occurs after processing, there is a potential for foodborne illness as these products are RTE.

When was the survey conducted

The survey was conducted over a 3-year period from April 1, 2019 to March 31, 2022.

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
- 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.

How many and what kind of samples were collected

A total of 892 refrigerated plant-based milk alternatives samples were collected. Shelf-stable products were excluded from this survey. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 250mL.

What were the samples tested for

All samples were tested for *Salmonella* spp., *L. monocytogenes,* total coliforms, and ACC. *Salmonella* spp., and *L. monocytogenes* are pathogenic bacteria while total coliforms and ACC are indicators 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*[9] that were appropriate for the testing of plant-based milk alternatives.

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 Food – An Interpretive Summary*[10], *Policy on Listeria monocytogenes in Ready-to-Eat Foods*[11], the *Food and Drugs Act*[12] (Section 4(1)) and guidelines developed by international food safety authorities[13, 14, 15].

Table 1 - Assessment criteria

Bacteria	Satisfactory	Investigative	Unsatisfactory
Salmonella spp.	Not detected	Not applicable	Detected
L. monocytogenes	Not detected	Not applicable	Detected
Total coliforms	≤ 10^3 CFU or MPN/g	> 10^3 CFU or MPN/g	Not applicable
ACC	≤ 10^6 CFU/g	> 10^6 CFU/g	Not applicable

No assessment guidelines had been established in Canada for the presence of *Salmonella* spp. or indicator organisms in plant-based milk alternatives at the time of writing this report.

As *Salmonella* spp. is considered to be pathogenic to humans its presence was assessed as unsatisfactory as it is considered to be a violation of the *Food and Drugs Act*[12] Section 4(1)a.

Unlike bacterial pathogens, total coliform strains are harmless. Similarly, ACC which is the total number of generally harmless bacteria that are able to grow in an oxygenated (aerobic) environment. Both total coliforms and ACC are considered to be indicators of the microbial quality of food. Total coliforms and ACC are indicators of the conditions under which a food is produced, processed, packaged, and stored. Their levels 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.

What were the survey results

Over 99.4% of the samples tested were found to be satisfactory. *Salmonella* spp., *L. monocytogenes*, and total coliforms (>10^3 CFU or MPN/g) were not found in any of the samples. ACC at elevated levels (>10^6 CFU/g) were found in 5/891 (0.6%) samples.

Table 2 - Assessment results

Bacterial analysis	Number of samples tested	Satisfactory (%)	Investigative (%)	Unsatisfactory
Salmonella spp.	891	886	Not applicable	0
L. monocytogenes			Not applicable	0
Total coliforms			0	Not applicable
ACC			5	Not applicable
Total	**891**	**886 (99.4)**	**5 (0.6)**	**0**

Survey results are also presented by the product's production practice (table 3), origin (table 4), source (table 5), and flavour (table 6).

Table 3 - Assessment results by production practice

Production practice	Number of samples tested (%)	Satisfactory	Investigative
Conventional	669 (75.1)	665	4
Organic	222 (24.9)	221	1
Total	**891**	**886**	**5**

Table 4 - Assessment results by product origin

Origin	Number of samples tested (%)	Satisfactory	Investigative
Import	375 (42.1)	373	2
Unknown[a]	136 (15.3)	136	0
Unknown[a] (domestically processed)[b]	380 (42.6)	377	3
Total	**891**	**886**	**5**

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

[b] "Domestically processed" refers to products which could be assigned as being processed in Canada based on the product label or available sample information.

Table 5 - Assessment results by product source

Source	Number of samples tested (%)	Satisfactory	Investigative
Almond	406 (45.6)	405	1
Almond, Cashew	28 (3.1)	28	0
Almond, Cashew, Hazelnut	1 (0.1)	1	0
Almond, Coconut	9 (1.0)	9	0
Brazil Nut	1 (0.1)	1	0
Cashew	82 (9.2)	81	1
Coconut	55 (6.2)	55	0
Oat	119 (13.4)	118	1
Pea	34 (3.8)	34	0
Rice	1 (0.1)	1	0
Soy	155 (17.4)	153	2
Total	**891**	**886**	**5**

Table 6 - Assessment results by product flavour

Flavour	Number of samples tested (%)	Satisfactory	Investigative
Almond sweetened	1 (0.1)	1	0
Chocolate sweetened	53 (5.9)	53	0
Coconut unsweetened	6 (0.7)	6	0
Coconut sweetened	5 (0.6)	5	0
Nog sweetened	7 (0.8)	6	1
Vanilla unsweetened	125 (14.0)	124	1
Vanilla sweetened	117 (13.1)	117	0
Original unsweetened	339 (38.0)	338	1
Original sweetened	238 (26.7)	236	2
Total	**891**	**886**	**5**

What do the survey results mean

No previously published studies on the microbiological quality or safety of retail plant-based alternatives were found at the time of writing this report.

Overall, our survey results indicate that plant-based milk alternatives 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

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

- follow-up with the importer
- review of manufacturer production, sanitation, and distribution practices
- review of records, including product receiving procedures and previous laboratory test results

Can I access the survey data

Yes. The data will be accessible on the Open Government Portal.

References

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