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

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

Food microbiology - Targeted surveys - Final report

Canada

Summary

A 3-year targeted survey[1] analysed 714 samples of plant-based ice cream 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. was not found in any of the samples. *L. monocytogenes* was detected in 1 of the 714 (0.1%) samples. Total coliforms at elevated levels were found in 3 of the 714 (0.4%) samples of which 2 of the 714 (0.3%) also contained ACC at elevated levels. 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 plant-based ice cream alternatives 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-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 ice cream alternatives sold at retail in Canada.

The consumption of plant-based ice cream alternatives has a long history in many parts of the world[2]. However, in recent years they have grown in popularity and a wide variety of products have appeared on the Canadian retail marketplace[3].

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 to destroy any bacterial pathogens that may be present[4], 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 714 plant-based ice cream alternative samples were collected. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 250g.

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*[5] that were appropriate for the testing of plant-based ice cream 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*[6], *Policy on Listeria monocytogenes in Ready-to-Eat Foods*[7], and the *Food and Drugs Act*[8] (Section 4(1)).

Table 1 - Assessment criteria

Bacteria	Satisfactory	Investigative	Unsatisfactory
Salmonella spp.	Not detected	Not applicable	Detected
L. monocytogenes	Not detected	≤ 10^2 CFU/g	>10^2 CFU/g
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 ice cream alternatives at the time of writing this report.

As *Salmonella* spp. 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*[8] 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*. was not found in any of the samples. *L. monocytogenes* was detected in 1 of the 714 (0.1%) samples. Total coliforms at elevated levels (>10^3 CFU or MPN/g) were found in 3 of the 714 (0.4%) samples of which 2 of the 714 (0.3%) also contained ACC at elevated levels (>10^6 CFU/g).

Table 2 - Assessment results

Bacterial analysis	Number of samples tested	Satisfactory (%)	Investigative (%)	Unsatisfactory
Salmonella spp.	714	710	Not applicable	0
L. monocytogenes			1[a]	0
Total coliforms			3[b]	Not applicable
ACC			2[b]	Not applicable
Total	**714**	**710 (99.4)**	**4 (0.6)**	**0**

[a]<5 CFU/g

[b]Elevated levels of both total coliforms and ACC were found in 2 samples.

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

Table 3 - Assessment results by production practice

Production practice	Number of samples tested (%)	Satisfactory	Investigative
Conventional	584 (81.8)	581	3
Organic	130 (18.2)	129	1
Total	**714**	**710**	**4**

Table 4 - Assessment results by product origin

Origin	Number of samples tested (%)	Satisfactory	Investigative
Domestic	14 (2.0)	13	1
Import	516 (72.3)	516	0
Unknown[c]	96 (13.5)	95	1
Unknown[c] (domestically processed)[d]	88 (12.3)	86	2
Total	**714**	**710**	**4**

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

[d] "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 main ingredient(s)

Main ingredient(s)	Number of samples tested (%)	Satisfactory	Investigative
Almond	101 (14.1)	101	0
Banana	14 (2.0)	14	0
Buckwheat	1 (0.1)	1	0
Cashew	116 (16.2)	116	0
Cashew and coconut	2 (0.3)	2	0
Chocolate	12 (1.7)	12	0
Coconut	375 (52.5)	373	2
Faba bean	22 (3.1)	22	0
Oat	40 (5.6)	39	1
Peanut	17 (2.4)	17	0
Soy	10 (1.4)	9	1
Tigernut	4 (0.6)	4	0
Total	**714**	**710**	**4**

Table 6 - Assessment results by product flavour

Flavour	Number of samples tested (%)	Satisfactory	Investigative
Caramel	72 (10.1)	71	1
Cherry	17 (2.4)	17	0
Chocolate	187 (26.2)	185	2
Chocolate Chip	13 (1.8)	13	0
Coconut	52 (7.3)	52	0
Coffee	23 (3.2)	23	0
Cookie	20 (2.8)	20	0
Cookie Dough	31 (4.3)	31	0
Fudge	11 (1.5)	11	0
Mango	19 (2.7)	19	0
Peanut butter	63 (8.8)	63	0
Strawberry	14 (2.0)	14	0
Vanilla	161 (22.5)	161	0
Other[e]	31 (4.3)	30	1
Total	**714**	**710**	**4**

[e] Flavours with <10 samples each

What do the survey results mean

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

Overall, our survey results indicate that plant-based ice cream alternatives sold in Canada is generally safe for consumption, however they can occasionally be contaminated. Consequently, 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

No illnesses were associated with the investigative *L. monocytogenes* positive sample. The investigative samples triggered appropriate follow-up activities which may have included:

- on-site visit of the manufacturer
- review of documented procedures (hygiene, sanitation) and records
- review of production and distribution records
- review of previous laboratory test results

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. Shurtleff, W. and A. Soyagi, *History of Soy Ice Cream and Other Non-Dairy Frozen Desserts (1899-2013)*. Soyinfo Center. 2013.
3. Lombardo, C., *More consumers are willing to try plant-based frozen desserts in store*. Strategy News. 2022.
4. PMG, *Processing of Frozen Dessert*. 2022.
5. Health Canada, *Compendium of Analytical Methods*. 2011.
6. Health Canada, *Health Products and Food Branch (HPFB) Standards and Guidelines for Microbiological Safety of Food - An Interpretive Summary*. 2008.
7. Health Canada, *Policy on Listeria monocytogenes in Ready-to-Eat Foods*. 2011.
8. Department of Justice Canada, *Food and Drugs Act*. 2014.