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

Bacterial Pathogens, Viruses and Parasites in Various Food Commodities - April 1, 2016 to March 31, 2019

Food microbiology- Targeted surveys - Interim report

Summary

While the food we eat in Canada is among the safest in the world, the consumption of food contaminated with foodborne pathogens (bacteria, viruses and parasites) can cause foodborne illness. It has been estimated that approximately 4 million (1 in 8) Canadians are affected by foodborne illnesses each year.

Targeted surveys are one of several surveillance activities that the Canadian Food Inspection Agency (CFIA) conducts on the Canadian food supply. The purpose of targeted surveys is to generate baseline information on the occurrence of microorganisms in food. Targeted surveys can vary in duration from several months to several years depending on the objective of each survey.

The food commodities included in this report are commonly consumed by Canadians across various age groups. Unfortunately, most of these types of foods have been associated with recalls and outbreaks of foodborne illnesses in the past. There are numerous points in the food production chain where contamination with pathogens can occur such as during production, processing, packaging and distribution. Given that most of the commodities covered by this report are consumed without further preparation, the presence of pathogens creates a potential risk for foodborne illnesses.

The purpose of this interim report is to provide preliminary results related to on-going surveys that the CFIA is currently conducting on the following commodities:

- flavoured refrigerated milk
- dairy ice cream
- various cheese products
- raw ground meats (beef, veal, lamb)
- refrigerated ready-to-eat (RTE) liver pâté
- refrigerated RTE sliced/shredded lunch meat
- fully cooked, RTE refrigerated chicken or turkey breast strips
- refrigerated RTE fish and seafood products
- domestic and imported stone fruits
- imported fresh berries
- imported fresh leafy herbs
- RTE fresh-cut fruits
- domestic and imported, conventional and organic fresh baby leafy vegetables
- fresh seed sprouts and microgreens
- frozen pre-packaged cut fruits and berries
- frozen cut fruit and vegetable blends and leafy green vegetables for smoothies
- imported frozen cut fruits

- powdered infant cereal
- conventional and organic dried ground spices
- raw plain oats

From April 1, 2016 to March 31, 2019, 18,040 samples of the above listed commodities were collected from retail locations in 11 cities across Canada and tested for various pathogens. Almost all (98.7%, 17801/18040) of the samples were assessed as satisfactory, while 1.2% (218/18040) were assessed as investigative and 0.1% (21/18040) were assessed as unsatisfactory. Most of the surveys covered in this report have a >99% satisfactory rate to date, with the exceptions being:

- flavoured refrigerated milk (97.9% satisfactory)
- raw ground meats (beef (98.8% satisfactory), veal (92.4% satisfactory), lamb (80.4% satisfactory)
- domestic and imported stone fruits (98.7% satisfactory)
- RTE fresh-cut fruits (98.6% satisfactory)
- fresh seeds sprouts and microgreens (98.6%% satisfactory)
- frozen pre-packaged cut fruits and berries (98.6% satisfactory)
- frozen cut fruit and vegetable blends and leafy green vegetables for smoothies (98.3% satisfactory)
- powdered infant cereal (96.9% satisfactory)

CFIA conducted appropriate follow-up activities for samples that were assessed as investigative or unsatisfactory. These follow-up activities may have included additional facility inspections, product recalls and additional sampling. There have been no reported illnesses linked to the contaminated products.

It is important to note that the assessments reported herein are preliminary as the targeted surveys are still underway and consequently, no conclusions can be drawn at this time. It is unlikely, but possible that the assessments may be adjusted if any policy or regulatory change occurs with respect to a particular food/hazard combination. This report is being provided as a proactive means of sharing a snapshot of the work conducted to date. Final reports containing further details and a full analysis of the results will be made available in the coming years as the surveys are completed.

What are targeted surveys

Targeted surveys are used by the CFIA to focus its surveillance activities on areas of highest health risk. The information gained from these surveys provides support for the allocation and prioritization of the agency's activities to areas of greater concern. Originally started as a project under the Food Safety Action Plan (FSAP), targeted surveys have been embedded in the CFIA's regular surveillance activities since 2013. Targeted surveys are a valuable tool for generating information on certain hazards in foods, identifying and characterizing new and emerging hazards, informing trend analysis, prompting and refining health risk assessments, highlighting potential contamination issues, as well as assessing and promoting compliance with Canadian regulations.

Food safety is a shared responsibility. CFIA works with federal, provincial, territorial and municipal governments and provides regulatory oversight of the food industry to promote safe handling of foods throughout the food production chain. The food industry and retail sectors in Canada are responsible for the food they produce and sell, while individual consumers are responsible for the safe handling of the food they have in their possession.

What is an interim report

Targeted surveys can vary in duration from several months to several years depending on the objective of each survey. The purpose of this interim report is to provide preliminary results related to on-going surveys that the CFIA is currently conducting.

Will the CFIA publish final reports

Yes, upon conclusion of the surveys, final reports will be made publically available on the CFIA website.

What foods did we test and why

The commodities listed below were selected for targeted surveys to gather baseline information on the occurrence of pathogens (bacteria, viruses and parasites) in these foods. They are all commonly consumed by Canadians of all ages[1]. Unfortunately, most of these types of commodities have been associated with recalls and outbreaks of foodborne illnesses in the past, as they can become contaminated with pathogens during various points in the food production process (production, processing, packaging, distribution). Given that most of the commodities covered by this report are consumed without further preparation, the presence of pathogens in them creates a potential risk for foodborne illnesses.

- flavoured refrigerated milk

- dairy ice cream
- various cheese products
- raw ground meats (beef, veal, lamb)
- refrigerated RTE liver pâté
- refrigerated RTE sliced/shredded lunch meat
- fully cooked, RTE refrigerated chicken or turkey breast strips
- refrigerated RTE fish and seafood products
- domestic and imported stone fruits
- imported fresh berries
- imported fresh leafy herbs
- ready-to-eat fresh-cut fruits
- domestic and imported, conventional and organic fresh baby leafy vegetables
- fresh seed sprouts and microgreens
- frozen pre-packaged cut fruits and berries
- frozen cut fruit and vegetable blends and leafy green vegetables for smoothies
- imported frozen cut fruits
- powdered infant cereal
- conventional and organic dried ground spices
- raw plain oats

What, when and from where did we sample

All samples were collected from national retail chains and local/regional grocery stores located in 11 major cities across Canada. These cities encompassed 4 geographical areas:

- Atlantic (Halifax, Saint John)
- Quebec (Quebec City, Montreal)
- Ontario (Toronto, Ottawa)
- West (Vancouver, Kelowna, Calgary, Saskatoon, Winnipeg).

A sample consisted of a single or multiple unit(s) (individual consumer-size package(s)) from a single lot with a sufficient total weight to conduct all analyses (approximately 250g).

Samples were collected between April 1 and March 31 of the year(s) in which the targeted surveys were conducted.

How many samples have been collected and what have they been tested for

The number of samples collected for each targeted survey and the microorganisms (bacteria, viruses and parasites) for which they were tested are outlined in table 1.

Table 1 - Targeted survey details

Anticipated targeted survey period - fiscal year(s)	Commodity	Total number of samples collected and tested to March 31, 2019	Microorganisms tested
2017/2018 to 2019/2020	Flavoured refrigerated milk	1198	*Listeria monocytogenes (L. monocytogenes)*, aerobic colony count (ACC)
2017/2018 to 2019/2020	Dairy ice cream	786	*L. monocytogenes*, ACC
2018/2019 to 2019/2020	Soft cheese with spices or other flavouring ingredients	578	*L. monocytogenes*, *Salmonella* species (spp.), *Staphylococcus aureus* (*S.aureus*), generic *Escherichia coli* (*E. coli*)
2018/2019 to 2019/2020	Single serve cheese	295	*L. monocytogenes*, *Salmonella* spp., *S. aureus*, generic *E. coli*
2018/2019 to 2019/2020	Sliced cheese	592	*L. monocytogenes*, *Salmonella* spp., *S. aureus*, generic *E. coli*
2018/2019 to 2019/2020	Shredded/grated cheese	599	*L. monocytogenes*, *Salmonella* spp., *S. aureus*, generic *E.coli*
2016/2017	Raw ground beef	589	*E. coli* O157, non-O157 Verotoxigenic *E. coli* (non-O157 VTEC)
2017/2018 to 2019/2020	Raw ground veal	940	*E. coli* O157, non-O157 VTEC, generic *E. coli, Salmonella* spp. in first 100 samples
2018/2019 to 2019/2020	Raw ground lamb	194	*E. coli* O157, non-O157 VTEC, generic *E. coli*
2018/2019 to 2019/2020	Refrigerated RTE liver pâté	299	*L. monocytogenes*, *Salmonella* spp., *S. aureus*, generic *E.coli*
2018/2019 to 2019/2020	Refrigerated RTE sliced/shredded lunch meat	595	*L. monocytogenes*, *Salmonella* spp., *S. aureus*, generic *E.coli*

Anticipated targeted survey period - fiscal year(s)	Commodity	Total number of samples collected and tested to March 31, 2019	Microorganisms tested
2018/2019 to 2019/2020	Fully cooked, RTE refrigerated chicken or turkey breast strips	595	*L. monocytogenes, Salmonella* spp., *S. aureus,* generic *E.coli*,
2018/2019 to 20192020	Refrigerated RTE fish and seafood products	300	*L. monocytogenes*, *Salmonella* spp., *S. aureus*, generic *E. coli*
2016/2017 and 2018/2019 to 2019/2020	Imported stone fruits	1175	Generic *E. coli*, *E. coli* O157, *Salmonella* spp., *L. monocytogenes, Shigella*
2016/2017 and 2018/2019 to 2019/2020	Domestic stone fruits	778	Generic *E. coli*, *E. coli* O157, *Salmonella* spp., *L. monocytogenes, Shigella*
2017/2018 to 2019/2020	Imported fresh berries	773	*Cyclospora, Cryptosporidium, Toxoplasma*
2017/2018 to 2018/2019	Imported fresh leafy herbs	771	*Cyclospora, Cryptosporidium, Toxoplasma*
2017/2018	Imported fresh leafy herbs	799	Hepatitis A virus (HAV), Norovirus (NoV) (Genotype I and II (GI, GII))
2017/2018 to 2019/2020	RTE fresh-cut fruits	765	HAV, NoV (GI, GII)
2018/2019 to 2019/2020	Domestic and imported, organic and conventional fresh baby leafy vegetables	1060	*L. monocytogenes*, *Salmonella* spp., *E. coli* O157, generic *E. coli*
2018/2019 to 2019/2020	Fresh seed sprouts and microgreens	1189	*L. monocytogenes*, *Salmonella* spp., *E. coli* O157, generic *E. coli*
2017/2018 to 2019/2020	Frozen pre-packaged cut fruits and berries	1592	*L. monocytogenes*, *Salmonella* spp., *E. coli* O157, generic *E.coli*, ACC

Anticipated targeted survey period - fiscal year(s)	Commodity	Total number of samples collected and tested to March 31, 2019	Microorganisms tested
2018/2019 to 2019/2020	Frozen cut fruit and vegetable blends and leafy green vegetables for smoothies	118	*L. monocytogenes*, *Salmonella* spp., *E. coli* O157, generic *E.coli*, ACC
2018/2019 to 2019/2020	Imported frozen cut fruits	285	HAV, NoV (GI, GII)
2018/2019	Powdered infant cereal	162	*Enterobacteriaceae*
2018/2019 to 2019/2020	Dried ground spices	893	Generic *E. coli*, *Salmonella* spp., *Bacillus cereus* (B. cereus), *Clostridium Perfringens* (*C. perfringens*), *S. aureus*
2018/2019 to 2019/2020	Raw plain oats	120	*Salmonella* spp., *E.coli* O157, *B. cereus*, *C. perfringens*, *S.aureus*, generic *E. coli*

What analytical methods were used and how were samples assessed

Samples were analyzed using methods published in Health Canada's *Compendium of Analytical Methods for the Microbiological Analysis of Foods*[2] and CFIA internally-developed methods.

The assessment criteria (table 2) are based on the principles of Health Canada's *Health Products and Food Branch Standards and Guidelines for Microbiological Safety of Foods*[3] or in the absence of Health Canada's Guidelines, on other international food safety authorities' microbiological guidelines[4-6]. The assessment guidelines for *L. monocytogenes* are based on Health Canada's Policy on *Listeria monocytogenes* in RTE foods[7] and are dependent upon the sample type analysed (Category 1, 2A or 2B). The assessment guidelines for *E.coli* O157 in raw meats are based on Health Canada's Guidance Document on *E. Coli O157:H7 and E. Coli O157:Nm in Raw Ground Beef*[8].

No assessment guidelines had been established in Canada for the presence of ACC, generic *E. coli, Salmonella* spp., *Shigella, E.coli* O157, or non-O157 VTEC in some food commodities at the time of writing this report. As *Salmonella* spp., *Shigella* and *E. coli* O157 are considered pathogenic to humans their presence was considered to be a violation of the *Food and Drugs Act* (FDA) Section 4(1)a[9] and therefore in the absence of assessment guidelines, was assessed by the CFIA as unsatisfactory. The detection of non-O157 VTEC was assessed as investigative, indicating that further follow-up actions may be warranted depending upon the virulence profile[10] (such as the serotype and associated virulence gene(s)) identified.

Unlike harmful bacterial pathogens (e.g. *Salmonella, E. coli* O157), generic *E. coli* and *enterobacteriaceae* are commonly found in the intestines of humans and animals and most strains are harmless. Similarly, ACC is the total number of generally harmless bacteria that are able to grow in an oxygenated (aerobic) environment. ACC are normal components of the environment and can be found in soil and natural water sources. Generic *E. coli*, *enterobacteriaceae* and ACC are considered to be indicator organisms and their 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. An investigative assessment which may result in further follow-up actions is associated with elevated levels (table 2). As the results are based on the analysis of one unit (n=1), further sampling may be required to verify their levels in the lot. An unsatisfactory assessment is associated with the presence of high levels of these organisms (table 2) as it may indicate a breakdown in Good Agricultural Practices, or Good Manufacturing Practices (sanitation practices), and therefore possibly warranting the initiation of follow-up activities to, for example, improve sanitation conditions along the food chain.

Table 2 - Assessment criteria for bacteriology tests

Analysis	Commodity	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
ACC	Flavoured refrigerated milk	$\leq 5x10^4$ colony forming units (CFU)/mL	$>5x10^4$ and $\leq 10^6$ CFU/mL	$>10^6$ CFU/mL
ACC	Dairy ice cream	$\leq 10^5$ CFU/g	$>10^5$ and $\leq 10^6$ CFU/g	$>10^6$ CFU/g
ACC	Frozen pre-packaged cut fruits and berries & frozen cut fruit and vegetable blends and leafy green vegetables for smoothies	$\leq 10^4$ CFU/g	$>10^4$ CFU/g	NA
B. cereus	Dried ground spices	$\leq 10^4$ CFU/g	$>10^4$ and $\leq 10^6$ CFU/g	$>10^6$ CFU/g

Analysis	Commodity	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
B. cereus	Raw plain oats	≤10^4 CFU/g	>10^4 CFU/g	NA
C. perfringens	Dried ground spices	≤10^4 CFU/g	>10^4 and ≤10^6 CFU/g	>10^6 CFU/g
C. perfringens	Raw plain oats	≤10^4 CFU/g	>10^4 CFU/g	NA
E. coli O157	All commodities tested for *E.coli* O157	Not detected	NA	Detected
Enterobacteriaceae	Powdered infant cereal	Not detected	>10 most probable number(MPN)/g	NA
Generic *E.coli*	Cheese (soft with spices or other flavourings, single serve, sliced, shredded/grated)	≤ 10^2 CFU/g	>10^2 and ≤2x10^3 CFU/g	>2x10^3 CFU/g
Generic *E.coli*	Fully cooked RTE chicken/turkey breast strips	≤ 10 CFU/g	>10 and ≤10^3 CFU/g	>10^3 CFU/g
Generic *E.coli*	Raw plain oats	≤10^2 CFU/g	>10^2 CFU/g	NA
Generic *E.coli*	Raw ground lamb, and veal	≤100 CFU/g	>100 CFU/g	NA
Generic *E.coli*	All other commodities tested for generic *E.coli*	≤ 10^2 CFU/g	>10^2 and ≤10^3 CFU/g	>10^3 CFU/g
L. monocytogenes	category 1 product[a]	Not detected	N/A	Detected
L. monocytogenes	category 2A and B product[a]	Not detected	Detected and ≤10^2 CFU/g	>10^2 CFU/g
L. monocytogenes	Fresh baby leafy vegetables, Fresh seed sprouts & microgreens, Stone fruits, whole wheat	Not detected	Detected	NA
Non-O157 VTEC	Raw ground lamb, beef, and veal, wheat flour	Not detected	Detected	NA
Salmonella spp.	All food samples tested for Salmonella spp.	Not detected	NA	Detected
Shigella spp.	Stone fruits	Not detected/25g	NA	Detected/25g

Analysis	Commodity	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
S. aureus	All food samples tested for S.aureus	≤10^2 CFU/g	>10^2 and ≤10^4 CFU/g	>10^4 CFU/g
S. aureus	Raw plain oats	≤10^4 CFU/g	>10^4 CFU/g	NA

[a] The pH and water activity of the sample were used to determine product category

At the time of writing this report, no assessment guidelines had been established in Canada for viruses and parasites in whole or fresh-cut produce. In addition, the analytical methods used to analyse the samples detect the presence of viral RNA and parasite DNA and cannot discriminate between viable (potentially infectious) from non-viable (non-infectious) viruses and parasites. Consequently, the detection of viral RNA or parasite DNA was assessed as investigative indicating that further consideration is warranted to determine which follow-up activities would be the most appropriate (table 3).

Table 3 – Assessment criteria for parasitology and virology tests

Analysis	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
Cryptosporidium	Not detected	Detected	NA
Cyclospora	Not detected	Detected	NA
Giardia	Not detected	Detected	NA
HAV	Not detected	Detected	NA
NoV (GI and GII)	Not detected	Detected	NA

What were the survey results

Results of the targeted surveys (as of March 31, 2019) can be found in table 4.

Table 4 - Survey results as of March 31, 2019

Commodity	Total number of samples tested to March 31, 2019	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Results
Flavoured refrigerated milk	1198	1173 (97.9%)	12 (1.0%)	13 (1.1%)	I = ACC >10^5 and ≤10^6 CFU/g (12) U = ACC >10^6 CFU/g (13)

Commodity	Total number of samples tested to March 31, 2019	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Results
Dairy ice cream	786	781 (99.4%)	3 (0.4%)	2 (0.3%)	I = ACC >10^5 and ≤10^6 CFU/g (3) U = ACC >10^6 CFU/g (2)
Cheese (Soft with flavourings, single serve, sliced, or shredded)	2064	2064 (100.0%)	0	0	All Satisfactory
Raw ground beef	589	582 (98.8%)	7 (1.2%)	0	I = non-O157 VTEC (7)
Raw ground veal	940	869 (92.4%)	68 (7.2%)	2 (0.2%)	I = non-O157 VTEC (38) I = non-O157 VTEC and generic *E. coli* >10^2 CFU/g (5) I = *Salmonella* spp.(6) I = generic *E. coli* >10^2 CFU/g (20) U = *E. coli* O157 (2) Note: 1 sample could not be assessed
Raw ground lamb	194	156 (80.4%)	37 (19.1%)	1 (0.5%)	I = non-O157 VTEC (36) I = non-O157 VTEC and generic *E. coli* >100 CFU/g (1) U = *E. coli* O157
Refrigerated RTE liver pâté	299	299 (100.0%)	0	0	All Satisfactory
Refrigerated RTE sliced/shredded lunch meat	595	595 (100.0%)	0	0	All Satisfactory
Fully cooked, RTE refrigerated chicken or turkey breast strips	595	595 (100.0%)	0	0	All Satisfactory
Refrigerated RTE fish and seafood products	300	299 (99.7%)	0	1 (0.3%)	U = generic *E. coli* >10^3 CFU/g
Imported stone fruit	1175	1158 (98.6%)	16 (1.4%)	1 (<0.1%)	I = *L. monocytogenes* (15) I = generic *E. coli* >10^2 and ≤10^3 CFU/g (1) U = *L. monocytogenes* (pH and Aw indicate that sample is a Category 1 product)

Commodity	Total number of samples tested to March 31, 2019	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Results
Domestic stone fruit	778	770 (99.0%)	8 (1.0%)	0	I = *L. monocytogenes*
Imported fresh berries	773	772 (99.9%)	1 (0.1%)	N/A	I = Toxoplasma
Imported fresh leafy herbs	771	771 (100%)	N/A	N/A	All Satisfactory
Imported fresh leafy herbs	799	798 (99.9%)	1 (0.1%)	N/A	I = NoV (GII)
RTE fresh-cut fruits	765	754 (98.6%)	11 (1.4%)	N/A	I = HepA (5) I = NoV(G1) (4) I = NoV(GII) (2)
Fresh baby leafy vegetables	1060	1053 (99.3%)	7 (0.7%)	0	I = *L. monocytogenes* (5) I = generic *E. coli* $>10^2$ and $\leq 10^3$ CFU/g (2)
Fresh seed sprouts and microgreens	1189	1172 (98.6%)	17 (1.4%)	0	I = *L. monocytogenes* (15) I = generic *E. coli* $>10^2$ and $\leq 10^3$ CFU/g (2)
Frozen pre-packaged cut fruits and berries	1592	1570	22	0	I = ACC $>10^4$ CFU/g
Frozen cut fruit and vegetable blends and leafy green vegetables for smoothies	118	116 (98.6%)	2 (1.4%)	0	I = ACC $>10^4$ CFU/g
Imported frozen cut fruits	570	569 (99.8%)	1 (0.1%)	N/A	I = NoV (GI)
Powdered infant cereal	162	157 (96.9%)	5 (3.1%)	N/A	I = *Enterobacteriaceae*
Dried ground spices	893	892 (99.9%)	0	1 (0.1%)	U = *Salmonella* spp. detected
Raw plain oats	120	120 (100.0%)	0	0	All Satisfactory
Grand Total	**18040**	**17801 (98.7%)**	**218 (1.2%)**	**21 (0.1%)**	**N/A**

What do the survey results mean and what are they used for

Interim results show that almost all (98.7%, 17801/18040) of the samples were assessed as satisfactory, while 1.2% (218/18040) were assessed as investigative and 0.1% (21/18040) were assessed as unsatisfactory. Most of the surveys covered in this report have a >99% satisfactory rate to date, with the only exceptions being:

- flavoured refrigerated milk (97.9% satisfactory)
- raw ground meats (beef (98.8% satisfactory), veal (92.4% satisfactory), lamb (80.4% satisfactory)
- domestic and imported stone fruits (98.7% satisfactory)
- RTE fresh-cut fruits (98.6% satisfactory)
- fresh seeds sprouts and microgreens (98.6%% satisfactory)
- frozen pre-packaged cut fruits and berries (98.6% satisfactory)
- frozen cut fruit and vegetable blends and leafy green vegetables for smoothies (98.3% satisfactory)
- powdered infant cereal (96.9% satisfactory)

CFIA conducted appropriate follow-up activities for samples that were assessed as investigative or unsatisfactory. These follow-up activities may have included additional facility inspections, product recalls and additional sampling. There have been no reported illnesses linked to the contaminated products.

It is important to note that the assessments reported herein are preliminary as the targeted surveys are still underway and consequently, no conclusions can be drawn at this time. It is unlikely, but possible that the assessments may be adjusted if any policy or regulatory change occurs with respect to a particular food/hazard combination. This report is being provided as a proactive means of sharing a snapshot of the work conducted to date. Final reports containing further details and a full analysis of the results will be made available in the coming years as the surveys are completed.

Surveillance testing results will be used by the CFIA to inform risk management decisions and to support program design and re-design.

References

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