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

Bacterial Pathogens and Indicators, Viruses and Parasites in Various Food Commodities - April 1, 2018 to March 31, 2022

Food microbiology - Targeted surveys - Interim report

Food microbiology targeted surveys – January 2023

Canada

Summary

From April 1, 2018 to March 31, 2022, a total of 18,811 food samples were tested in a suite of ongoing targeted surveys[1] to investigate the presence of bacterial pathogens and indicators, viruses and parasites.

Of the samples tested, 99.2% were satisfactory, 0.8% were investigative, and 0.06% were unsatisfactory. The Canadian Food Inspection Agency (CFIA) conducted appropriate follow-up activities including the oversight of industry led voluntary food recalls. There were no reported illnesses related to these products.

Final reports, which will include a detailed analysis of the results, will be published over the next few years as the surveys are completed.

What is an interim report

An interim report provides preliminary results related to on-going targeted surveys[1] which can vary in duration from several months to several years depending on the objective of each survey.

Will final reports be published

Yes, upon conclusion of the surveys, final reports or scientific publications will be published.

What foods were tested

The presence of bacterial pathogens and indicators, viruses and parasites were investigated in a variety of foods of the following commodities:

- raw and pasteurized cheese
- non-cow dairy milk
- fresh and frozen fruits and vegetables
- plant-based foods
- seafood
- powdered infant formula and baby food
- tahini
- guacamole
- fresh herb paste
- raw shelled nuts
- ready-to-eat (RTE) sausages

Why were these foods tested

The selected foods are all commonly consumed by Canadians of all ages[2]. Unfortunately, most of these commodities have been associated with recalls and outbreaks of foodborne illnesses. Contamination with pathogens can occur at any step in the food supply chain such as during production, processing, packaging, distribution and/or at retail. Given that most of the commodities covered by this report are consumed without further preparation, the presence of pathogens creates the potential for foodborne illness.

When were the samples collected

The samples were collected from April 1, 2018 to March 31, 2022.

Where were the samples collected from

Samples were collected from national retail chains and local/regional grocery stores located in 11 major cities across Canada:

- Halifax
- Saint John or Moncton
- Quebec City
- Montreal
- Toronto
- Ottawa
- Vancouver
- Kelowna or Victoria
- Calgary
- Saskatoon
- Winnipeg

A sample consisted of a single or multiple consumer-size packages from the same lot weighing at least 250 g. 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.

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*[3], CFIA internally-developed methods, methods from other organizations such as ISO or FDA BAM, and methods that detect the presence of deoxyribonucleic acid (DNA) of *Cyclospora* and *Giardia*.

How were the samples assessed

The samples were assessed using criteria (tables 1, 2, 3) 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*[4], *Policy on Listeria monocytogenes in Ready-to-Eat Foods*[5] and the *Food and Drugs Act* (Section 4 (1))[6]. In the absence of Health Canada standards, policies or guidelines, the assessment criteria are based on guidelines developed by international food safety authorities. Detailed information about the assessment criteria used for each commodity will be provided in the final reports which will be published after the surveys have concluded.

Table 1. Assessment criteria for indicator organisms

Analysis	Product(s)	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
Aerobic Colony Count (ACC)	Non-cow dairy milk	$\leq 10^6$ CFU/mL	$>10^6$ CFU/mL	Not Applicable (N/A)
Total coliforms	Non-cow dairy milk	$\leq 10^3$ CFU/mL	$>10^3$ CFU/mL	N/A
Generic *Escherichia coli* (*E. coli*)	Non-cow pasteurized dairy milk cheese	$\leq 10^2$ CFU or MPN/g	$>10^2$ and $\leq 2x10^3$ CFU or MPN/g	$>2x10^3$ CFU or MPN/g
Generic *E. coli*	Fresh fruits and vegetables	$\leq 10^2$ CFU/g or MPN/g	$>10^2$ and $\leq 10^3$ CFU/g or MPN/g	$>10^3$ CFU/g or MPN/g
Generic *E. coli*	RTE plant-based meat	$\leq 10^2$ CFU/g	$>10^2$ and $\leq 10^3$ CFU/g	$>10^3$ CFU/g
Generic *E. coli*	Raw plant-based meat	$\leq 10^2$ CFU/g	$> 10^2$ CFU/g	N/A
Generic E. coli	Arctic surf clams	≤4 MPN/g	> 4 and ≤ 40 MPN/g	>40 MPN/g
Generic *E. coli*	Seaweed salad	$\leq 10^2$ MPN/g	$> 10^2$ MPN/g	N/A
Generic *E. coli*	Raw dairy milk cheese	$\leq 5x10^2$ CFU or MPN/g	$>5x10^2$ and $\leq 2x10^3$ CFU or MPN/g	$>2x10^3$ CFU or MPN/g

Table 2. Assessment criteria for pathogenic bacteria

Analysis	Product(s)	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
E. coli O157	All products tested for *E.coli* O157	Not detected/25 g	N/A	Detected/25 g
Non-O157 Shiga-toxigenic *E. coli* (STEC)	All products tested for non-O157 STEC	Not detected/25 g	Detected/25 g	N/A
Listeria monocytogenes (*L. monocytogenes*)	Category 1 products[a]	Not detected/25 g	N/A	Detected/25 g
L. monocytogenes	Category 2A and 2B products[a]	Not detected/25 g	≤10^2 CFU/g	>10^2 CFU/g
L. monocytogenes	Microgreens Whole mushrooms Whole fruits	Not detected/25 g	Detected/25 g (enumeration is required)	N/A
Salmonella	All products tested for *Salmonella* (except for specified products)	Not detected/25 g	N/A	Detected/25 g
Salmonella	RTE meat sausages	Not detected/65 g	N/A	Detected/65 g
Salmonella	Powdered infant formula	Not detected/125 g	N/A	Detected/125 g
Staphylococcus aureus (*S. aureus*)	Plant-based RTE meat	≤10^4 CFU/g	>10^4 CFU/g	N/A
S. aureus	Raw dairy milk cheese	≤10^3 CFU/g	>10^3 and ≤ 10^4 CFU/g	>10^4 CFU/g
S. aureus	Non-cow pasteurized dairy milk cheese	≤10^2 CFU/g	>10^2 and ≤10^4 CFU/g	>10^4 CFU/g
S. aureus	RTE meat sausages	≤250 CFU/g	>250 and ≤10^4 CFU/g	>10^4 CFU/g
Enterobacteriaceae	Powdered infant formula	Not detected/10 g	Detected/10 g	N/A
Cronobacter	Powdered infant formula	Not detected/125 g	N/A	Detected/125 g
Commercial sterility	Baby foods in retort pouches	Pass	N/A	Fail

[a] Information such as storage condition (frozen or refrigerated), shelf life, and if applicable, pH and water activity were used to determine the product category.

Table 3. Assessment criteria for viruses and parasites

Analysis	Product(s)	Satisfactory assessment	Investigative assessment	Unsatisfactory assessment
Cyclospora[b] *Giardia*[b] Hepatitis A Virus (HAV)[b] Norovirus Genotype (I and II) (NoV (GI and GII))[b]	All products tested for parasites or viruses	Not detected	Detected	N/A

[b] The detection methods used cannot discriminate between potentially infectious and non-infectious viruses or parasites.

What were the survey preliminary results

Details about each targeted survey and test results (as of March 31, 2022) can be found in table 4.

Table 4. Survey results as of March 31, 2022

Fiscal year(s)	Product (sample plan ID)	Microorganisms tested	Number of samples tested	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments
2020/2021 2021/2022	Imported raw dairy milk cheese (SB3015)	*L. monocytogenes* *Salmonella* *E. coli* O157 *S. aureus* Generic *E. coli*	784	784	0	0	All satisfactory
2021/2022	Domestic raw dairy milk cheese (SB3098)	*L. monocytogenes* *Salmonella* *E. coli* O157 *S. aureus* Generic *E. coli*	299	299	0	0	All satisfactory
2021/2022	Non-cow raw milk cheese (SB3097)	*L. monocytogenes* *Salmonella* *S. aureus* Generic *E. coli*	288	287	0	1	U=Generic *E. coli*
2019/2020 2020/2021 2021/2022	Non-cow pasteurized dairy milk cheese (SB3077)	*L. monocytogenes* *Salmonella* *S. aureus* Generic *E. coli*	616	615	1	0	I=Generic *E. coli*
2019/2020 2020/2021 2021/2022	Non-cow dairy milk (SB3073)	*L. monocytogenes* *Salmonella* ACC Total coliforms	506	434	72	0	I=ACC (59) I=Total coliforms (4) I=ACC & total coliforms (9)
2019/2020 2020/2021 2021/2022	Fresh seed sprouts (SB3082)	*Salmonella* (2021-2022 only) *E. coli* O157 STEC Generic *E. coli*	709	706	2	1	I=VTEC(1) I=Generic E. coli (1) U=Generic E. coli
2019/2020	Fresh microgreens (SB3083)	*Salmonella* *E. coli* O157 STEC Generic *E. coli* *L. monocytogenes*	75	73	2	0	I=*L. monocytogenes* I=Generic E. coli

Fiscal year(s)	Product (sample plan ID)	Microorganisms tested	Number of samples tested	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments
2021/2022	Fresh whole mushrooms (enoki, beech, oyster, king oyster) (SB3114)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	493	484	9	0	I=*L. monocytogenes* (9)
2021/2022	Red onions (SB3115)	*Salmonella* *E. coli* O157 Generic *E. coli*	300	300	0	0	All satisfactory
2021/2022	Imported green onions (SB3223)	HAV NoV (GI, GII)	199	199	0	N/A	All satisfactory
2021/2022	Domestic green onions (SB3224)	HAV NoV (GI, GII)	54	54	0	N/A	All satisfactory
2020/2021 2021/2022	Domestic whole leafy vegetables (SB3092)	*Salmonella* (2021-2022 only) *E. coli* O157 VTEC Generic *E. coli*	245	243	2	0	I=Generic *E. coli* (2)
2021/2022	Domestic whole leafy vegetables (SB3102)	*Salmonella* *E. coli* O157 Generic *E. coli*	193	192	1	0	I=Generic *E. coli* (1)
2021/2022	Domestic fresh whole vegetables (SB3106)	*Salmonella* *E. coli* O157 Generic *E. coli*	300	300	0	0	All satisfactory
2020/2021 2021/2022	Imported whole leafy vegetables (SB3093)	*Salmonella* (2021-2022 only) *E. coli* O157 VTEC Generic *E. coli*	285	284	1	0	I=VTEC
2021/2022	Imported whole leafy vegetables (SB3101)	*Salmonella* *E. coli* O157 Generic *E. coli*	283	283	0	0	All satisfactory
2021/2022	Imported fresh whole vegetables (SB3105)	*Salmonella* *E. coli* O157 Generic *E. coli*	495	494	1	0	I=Generic *E. coli*

Fiscal year(s)	Product (sample plan ID)	Microorganisms tested	Number of samples tested	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments
2019/2020 2020/2021 2021/2022	Imported romaine lettuce (SB3085)	*Salmonella* (2021-2022 only) *E. coli* O157 Generic *E. coli*	709	709	0	0	All satisfactory
2019/2020 2020/2021 2021/2022	Imported romaine lettuce hearts (SB3086)	*Salmonella* (2021-2022 only) *E. coli* O157 Generic *E. coli*	1059	1058	1	0	I=Generic *E. coli*
2021/2022	Imported fresh whole leafy vegetables (SB3221)	*Cyclospora* *Giardia*	179	177	2	N/A	I=*Cyclospora* (2)
2021/2022	Imported fresh leafy herbs (SB3103)	*Salmonella* *E. coli* O157 Generic *E. coli*	389	385	3	1	I=Generic *E. coli* (3) U=Generic *E. coli*
2021/2022	Domestic fresh leafy herbs (SB3104)	*Salmonella* *E. coli* O157 Generic *E. coli*	189	188	1	0	I= Generic *E. coli* (1)
2020/2021	Domestic whole fresh vegetables and herbs (F258R)	*Salmonella* *E. coli* O157 Generic *E. coli*	91	91	0	0	All satisfactory
2020/2021	Imported whole fresh vegetables and herbs (F259R)	*Salmonella* *E. coli* O157 Generic *E. coli*	196	196	0	0	All satisfactory
2020/2021	Domestic fresh-cut RTE prepackaged vegetable salads (F242R)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	15	15	0	0	All satisfactory
2020/2021	Imported fresh-cut RTE prepackaged vegetable salads (F247R)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	193	193	0	0	All satisfactory

Fiscal year(s)	Product (sample plan ID)	Microorganisms tested	Number of samples tested	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments
2021/2022	Fresh-cut RTE prepackaged leafy vegetable-based salads with dressing kids (SB3209)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	424	422	0	2	U=*L. monocytogenes* (1) U=*Salmonella* (1)
2021/2022	Fresh-cut RTE prepackaged leafy vegetable-based salads without dressing kits (SB3210)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	386	383	0	3	U=*L. monocytogenes* (3)
2021/2022	Imported fresh-cut leafy vegetable-based salads (SB3217)	HAV NoV (GI, GII)	279	279	0	N/A	All satisfactory
2021/2022	Domestic fresh-cut leafy vegetable-based salads (SB3218)	HAV NoV (GI, GII)	105	105	0	N/A	All satisfactory
2019/2020 2020/2021 2021/2022	Imported fresh-cut romaine lettuce (SB3087)	*Salmonella* (2021-2022 only) *E. coli* O157 Generic *E. coli*	797	797	0	0	All satisfactory
2020/2021 2021/2022	Imported fresh-cut leafy vegetable-based salads (F263R &SB3222)	*Cyclospora* *Giardia*	616	614	2	N/A	I=*Cyclospora* I=*Giardia*
2020/2021	Domestic fresh whole fruits (F260R)	*Salmonella* *E. coli* O157 Generic *E. coli*	81	81	0	0	All satisfactory
2020/2021	Imported fresh whole fruits (F261R)	*Salmonella* *E. coli* O157 Generic *E. coli*	194	194	0	0	All satisfactory

Fiscal year(s)	Product (sample plan ID)	Microorganisms tested	Number of samples tested	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments
2021/2022	Imported fresh whole fruits (SB3107)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	397	395	2	0	I=*L. monocytogenes* (2)
2021/2022	Domestic fresh whole fruits (SB3108)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	200	197	3	0	I=*L. monocytogenes* (3)
2021/2022	Imported fresh berries (SB345)	HAV NoV (GI, GII)	298	298	0	N/A	All satisfactory
2021/2022	Domestic fresh berries (SB346)	HAV NoV (GI, GII)	118	118	0	N/A	All satisfactory
2021/2022	Fresh-cut fruits (SB3211)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	420	420	0	0	All satisfactory
2021/2022	Frozen berries (SB3215)	HAV NoV (GI, GII)	294	293	1	N/A	I=Norovirus
2021/2022	Frozen cut fruits (SB3112)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	297	297	0	0	All satisfactory
2021/2022	Frozen cut fruits (bulk packaged) (SB3212)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	135	135	0	0	All satisfactory
2018/2019 2019/2020	Imported frozen-cut fruits (SB3063)	HAV NoV (GI, GII)	484	484	0	N/A	All satisfactory
2021/2022	Frozen- cut fruits (SB3216 & SB3088)	HAV NoV (GI, GII)	558	558	0	N/A	All satisfactory
2020/2021 2021/2022	Plant-based RTE sausages / burgers (SB3094)	*L. monocytogenes* *Salmonella* *S. aureus* Generic *E. coli*	753	753	0	0	All satisfactory
2020/2021 2021/2022	Plant-based Raw sausages / burgers (SB3095)	*Salmonella* *E. coli* O157 Generic *E. coli*	487	484	3	0	I=Generic *E. coli* (3)
2020/2021 2021/2022	Imported tahini (FS358R & SB3099)	*Salmonella*	256	253	N/A	3	U=*Salmonella* (3)

Fiscal year(s)	Product (sample plan ID)	Microorganisms tested	Number of samples tested	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments
2021/2022	Guacamole (SB3113)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	299	299	0	0	All satisfactory
2021/2022	Herb paste (SB3116)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	28	28	0	0	All satisfactory
2021/2022	Seaweed salad (SB3117)	*L. monocytogenes* *Salmonella* *E. coli* O157 Generic *E. coli*	290	290	0	0	All satisfactory
2021/2022	Domestic oysters (SB3219)	HAV NoV (GI, GII)	132	126	6	N/A	I=NoV (GI and GII) (3) I=Nov (GII) (3)
2021/2022	Imported oysters (SB3220)	HAV NoV (GI, GII)	52	23	29	N/A	I=NoV (GI) (8) I=NoV (GII) (8) I=NoV (GI and GII) (13)
2021/2022	Arctic surf clams (SB3118)	*L. monocytogenes* *Salmonella* Generic *E. coli*	55	55	0	0	All satisfactory
2021/2022	RTE meat sausages (SB3213)	*L. monocytogenes* *Salmonella* *S. aureus* Generic *E. coli*	285	284	1	0	I=Generic *E. coli*
2021/2022	Raw shelled nuts (SB3119)	*Salmonella* *E. coli* O157 Generic *E. coli*	494	494	0	0	All satisfactory
2020/2021 2021/2022	Powdered infant formula (FS360R & SB3100)	*Salmonella* (2021-2022 only) *Cronobacter* *Enterobacteriaceae*	267	266	1	0	I=*Enterobacteriaceae*
2021/2022	Baby food in retort pouches (SB3214)	Commercial sterility	186	186	0	0	All satisfactory
Total (%)	**-**	**-**	**18,811**	**18,654 (99.2)**	**146 (0.8)**	**11 (0.06)**	**-**

What is done with the survey results

All results are used to:

- inform risk management decisions
- support program design and re-design

All investigative and unsatisfactory results triggered appropriate follow-up actions such as:

- on site visit of the manufacturer
- follow-up with the importer
- review of hygiene and sanitation procedures
- review of production and distribution records
- review of previous laboratory test results
- additional sampling and testing
- food recalls

Can I access the survey data

All of the results reported herein are considered preliminary, as the targeted survey are still ongoing. Therefore, the data will only be accessible to the public on the Open Government portal following the publication of the final report or scientific publication.

References

1. Canadian Food Inspection Agency, *Food chemistry and microbiology.*
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6. Department of Justice, *Food and Drugs Act.* 2014.