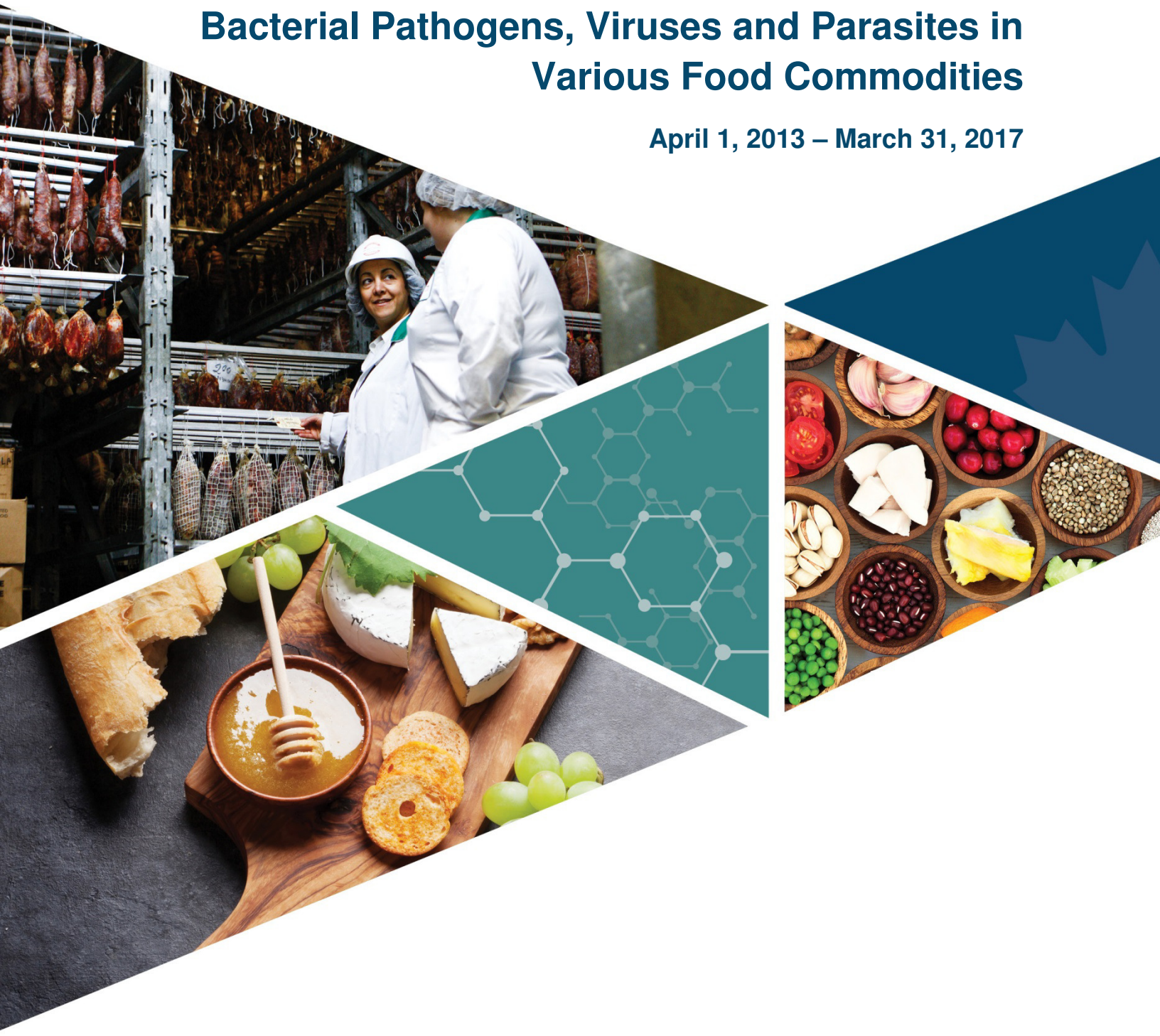
Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Food Microbiology – Targeted Surveys

INTERIM REPORT

Bacterial Pathogens, Viruses and Parasites in Various Food Commodities

April 1, 2013 – March 31, 2017



Canada

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 food-borne illness. It has been estimated that approximately 4 million (1 in 8) Canadians are affected by food-borne illnesses each year.

Targeted surveys are one of several surveillance activities that CFIA conducts on the Canadian food supply. The purpose of targeted surveys is to generate baseline information on the occurrence of pathogens 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 food-borne 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:

- Refrigerated Dips
- Refrigerated Sauces and Salad Dressings
- Refrigerated Ready-to-Eat Salads
- Refrigerated Desserts
- Raw Milk Cheese
- Dried Herbs
- Dried Sprouted Seeds
- Dried Teas
- Dried Seed and Nut Powder
- Powdered Infant Formula
- Chocolate-Based Confectionaries
- High Pressure Processed (HPP) and Unpasteurized Juices
- Raw Ground Beef and Veal
- Stone Fruits
- Snow and Sugar Snap Peas

From April 1, 2013 to March 31, 2017, a total of 19404 samples of the above listed commodities were collected from retail locations in 11 cities across Canada and tested for various pathogens. Interim results show that almost all of the samples tested were free of the pathogens tested for, with 99.4% (19284/19404) of the samples being assessed as satisfactory. Of the 19404 samples tested, 0.4% (88/19404) were assessed as investigative and 0.2% (32/19404) were assessed as unsatisfactory. Most of the targeted surveys in this interim report have a >99% satisfactory rate to date. The only exceptions are the Dried Sprouted Seed survey (96.5% satisfactory) and the Raw Ground Beef & Veal survey (98.8% satisfactory).

The Canadian Food Inspection Agency (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 a policy change occurs with respect to a particular pathogen. 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 Canadian Food Inspection Agency (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. The Canadian Food Inspection Agency 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 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 (i.e. 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.

- Refrigerated Dips
- Refrigerated Sauces and Salad Dressings
- Refrigerated Ready-to-Eat Salads
- Refrigerated Desserts
- Raw Milk Cheese
- Dried Herbs
- Dried Sprouted Seeds
- Dried Teas
- Dried Seed and Nut Powder
- Powdered Infant Formula
- Chocolate-Based Confectionaries
- High Pressure Processed (HPP) and Unpasteurized Juices
- Raw Ground Beef and Veal
- Stone Fruits
- Snow and Sugar Snap Peas

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 four geographical areas: Atlantic (Halifax and Saint John), Quebec (Quebec City, Montreal), Ontario (Toronto, Ottawa), and the West (Vancouver, Kelowna, Calgary, Saskatoon and Winnipeg).

A sample consisted of a single or multiple unit(s) (e.g., 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

Targeted Survey Period - Fiscal Year(s)	Commodity	Total Number of Samples Collected and Tested to March 31, 2017	Microorganisms Tested
2013-2014 & 2015-2018	Refrigerated Dips	995*	Generic *Escherichia coli* (*E.coli*), *Salmonella* species (spp.), *Listeria monocytogenes* (*L. monocytogenes*), *Bacillus cereus* (*B.cereus*), *Staphyloccocus aureus* (*S.aureus*), *Clostridium perfringens* (*C.perfringens*)
2013-2014 & 2015-2018	Refrigerated Sauces and Salad Dressings	996*	
2013-2014 & 2015-2018	Refrigerated Ready-to-Eat Salads	1776*	
2016-2018	Refrigerated Desserts	1598*	
2014-2018	Raw Milk Cheese	1416*	Generic *E.coli*, *E. coli* O157, *Salmonella* spp., *S.aureus*, *L. monocytogenes*
2014-2015 & 2016-2018	Dried Herbs	1893*	Generic *E. coli, Salmonella* spp.*, B. cereus*, *C. perfringens*, *S. aureus*
2016-2018	Dried Teas	592*	
2016-2018	Dried Seed and Nut Powder	292*	
2014-2018	Dried Sprouted Seeds	1642*	Generic *E.coli*, E. coli O157, Non-O157 Verotoxigenic E.coli (non-O157 VTEC), *Salmonella* spp., *B. cereus*, *C. perfringens*, *S. aureus*

Targeted Survey Period - Fiscal Year(s)	Commodity	Total Number of Samples Collected and Tested to March 31, 2017	Microorganisms Tested
2015-2018	Powdered Infant Formula	2632*	Generic *E. coli*, *Salmonella spp.*, *Enterobacteriaceae*, *Cronobacter spp.*
2016-2018	Chocolate-Based Confectionaries	1991	Coliforms, Generic *E. coli*, *Salmonella spp.*
2016-2018	HPP and Unpasteurized Juices	797	Generic *E. coli*, *E. coli* O157, *Salmonella spp.*, *Shigella*
	HPP and Unpasteurized Juices	690	Hepatitis A, Norovirus (GI, GII)
	HPP and Unpasteurized Juices	13	*Cyclospora, Cryptosporidium, Toxoplasma, Giardia*
2016-2017 & 2017-19	Raw Ground Beef (2016-2017) and Veal (2017-2019)	589*	*E. coli* O157, non-O157 VTEC, Generic *E. coli*
2016-2017 & 2018-2019	Stone Fruits	1001	Generic *E. coli*, *E. coli* O157, *Salmonella* spp., *L. monocytogenes, Shigella*
2016-2019	Snow and Sugar Snap Peas	491	*Cyclospora, Cryptosporidium, Toxoplasma, Giardia*

*Not all samples were tested for all microorganisms

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[4-7]. The assessment guidelines for *Listeria monocytogenes* are based on Health Canada's Policy on *Listeria monocytogenes* in RTE foods[8] and are dependent upon the sample type analysed (i.e. Category 1, 2A or 2B). The assessment criteria for *Cronobacter spp.* are based on Health Canada's Interim Microbiological Criteria for Powdered Infant Formula[9].

No assessment guidelines had been established in Canada for the presence of *Salmonella* species (spp.), *Shigella,* Verotoxigenic *Escherichia coli* O157 (*E. coli* O157), or non-O157 Verotoxigenic *Escherichia coli (*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[10] 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 serotype identified. All non-O157 VTEC have the potential to cause human illness, however at this time there is no established virulence profile for pathogenic non-O157 VTEC[11] and consequently unless previously associated with human illness it is difficult to establish its human health significance. Of the non-O157 VTEC serotypes identified to date, the following have been identified as causing the majority of non-O157 VTEC infections in Canada (O26, O103, O111, O117, O121, and O145)[11].

Unlike harmful bacterial pathogens (e.g. *Salmonella, E. coli* O157), generic *Escherichia coli* (*E.coli*), coliforms and enterobacteriaceae are commonly found in the intestines of humans and most strains are harmless. They 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 (See Table 2). As the results are based on the analysis of one unit (n=1), further sampling is required to verify their levels in the lot. An unsatisfactory assessment is associated with the presence of high levels of these organisms (See 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.

S. aureus, C. perfringens and B. cereus are commonly found in the environment and are bacteria that can produce protein toxins when present in high levels in foods, which can cause foodborne illness. An investigative assessment which may result in further follow-up actions is associated with elevated levels (See Table 2). As the results are based on the analysis of one unit (n=1), further sampling is required to verify their levels in the lot. The presence of high levels of these organisms (See Table 2) is indicative of the potential to cause foodborne illnesses. Therefore, samples with high levels of *S. aureus, C. perfringens or B. cereus* (See Table 2) are assessed as unsatisfactory indicating that follow-up activities are warranted.

Table 2 - Assessment Criteria for Bacteriology Tests

Analysis	Assessment		
	Satisfactory	**Investigative**	**Unsatisfactory**
Coliforms	≤1.8 CFU/g or MPN/g	>1.8 and ≤10^2 CFU/g or MPN/g	>10^2 CFU/g or MPN/g
Generic *E. coli*			
- Refrigerated Dips - Refrigerated Sauces and Salad Dressings - Refrigerated Ready-To-Eat Salads	≤ 10^2 CFU/g or MPN/g	NA	>10^2 CFU/g or MPN/g
- Raw Ground Veal	≤ 10^2 CFU/g or MPN/g	>10^2 CFU/g or MPN/g	NA
- Refrigerated Desserts	≤1.8 CFU/g or MPN/g	>1.8 and ≤10^3 CFU/g or MPN/g	>10^3 CFU/g or MPN/g
- Raw Milk Cheese	≤5x10^2 CFU/g or MPN/g	> 5x10^2 and ≤ 2x10^3 CFU/g or MPN/g	>2x10^3 CFU/g or MPN/g
- Dried Herbs - Dried Sprouted Seeds - Dried Teas - HPP and Unpasteurized Juice - Stone Fruits	≤10^2 CFU/g or MPN/g	>10^2 and ≤10^3 CFU/g or MPN/g	>10^3 CFU/g or MPN/g
- Dried Seed and Nut Powder	≤10 CFU/g or MPN/g	> 10 and ≤10^3 CFU/g or MPN/g	>10^3 CFU/g or MPN/g
- Powdered Infant Formula	≤1.8 CFU/g or MPN/g	>1.8 and ≤10 CFU/g or MPN/g	>10 CFU/g or MPN/g
- Chocolate-Based Confectioneries	≤1.8 CFU/g or MPN/g	>1.8 and ≤10^2 CFU/g or MPN/g	>10^2 CFU/g or MPN/g

Analysis	Assessment		
	Satisfactory	Investigative	Unsatisfactory
B. cereus			
- Refrigerated Dips - Refrigerated Sauces and Salad Dressings - Refrigerated Ready-To-Eat Salads - Refrigerated Desserts - Dried Sprouted Seeds - Dried Seed and Nut Powder	≤10^3 CFU/g	>10^3 and ≤ 10^4 CFU/g	>10^4 CFU/g
- Dried Herbs - Dried Teas	≤10^4 CFU/g	> 10^4 and ≤ 10^6 CFU/g	>10^6 CFU/g
C. perfringens			
- Refrigerated Dips - Refrigerated Sauces and Salad Dressings - Refrigerated Ready-To-Eat Salads - Dried Sprouted Seeds - Dried Seed and Nut Powder	≤10^2 CFU/g	>10^2-≤10^3 CFU/g	>10^3 CFU/g
- Dried Herbs - Dried Teas	≤10^4 CFU/g	> 10^4 and ≤ 10^6 CFU/g	>10^6 CFU/g
S. aureus			
- Refrigerated Dips - Refrigerated Sauces and Salad Dressings - Refrigerated Ready-To-Eat Salads - Refrigerated Desserts - Dried Herbs - Dried Sprouted Seeds - Dried Teas - Dried Seed and Nut Powder	≤10^2 CFU/g	> 10^2 and ≤ 10^4 CFU/g	>10^4 CFU/g
- Raw Milk Cheese	≤10^3 CFU/g	>10^3 and ≤ 10^4 CFU/g	>10^4 CFU/g

Analysis	Assessment		
	Satisfactory	**Investigative**	**Unsatisfactory**
***Salmonella* spp.**	Not detected/25g	NA	Detected/25g
***Shigella* spp.**	Not detected/25g	NA	Detected/25g
***E. coli* O157**	Not detected/25g	NA	Detected/25g
Non-O157 VTEC	Not detected/25g or 65g	Non-O157 VTEC detected/25g or 65g	NA
L. monocytogenes (stone fruit)	Not detected/25g	Detected/25g	NA
L. monocytogenes (Category 1 product)	Not detected/25g	NA	Detected/25g
L. monocytogenes (Category 2A& B product)	Not detected/25g	Detected/25g and $\leq 10^2$ CFU/g	$>10^2$ CFU/g
Enterobacteriaceae	Not detected/10g	Detected/10g	NA
***Cronobacter* spp.**	Not detected/125g	NA	Detected/125g

At the time of writing this report, no assessment guidelines had been established in Canada for viruses and parasites in fresh produce and juices. 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	Assessment		
	Satisfactory	Investigative	Unsatisfactory
Cryptosporidium	Not detected	Detected	NA
Cyclospora	Not detected	Detected	NA
Giardia	Not detected	Detected	NA
Toxoplasma	Not detected	Detected	NA
Hepatitis A	Not detected	Detected	NA
Norovirus (GI and GII)	Not detected	Detected	NA

What Were the Survey Results?

Results of the Targeted Surveys (as of March 31, 2017) can be found in Table 4.

Table 4 - Survey Results As Of March 31, 2017

Commodity	Total Number of Samples Tested to March 31, 2017	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments/ Results
Refrigerated Dips	995	993 (99.8%)	1 (0.1%)	1 (0.1%)	I=*B. cereus* (1) U=*B. cereus* (1)
Refrigerated Sauces and Salad Dressings	996	996 (100%)	-	-	All satisfactory
Refrigerated Ready-to-Eat Salads	1776	1772 (99.77%)	3 (0.17%)	1 (0.06%)	I=*L. monocytogenes* (2) *B. cereus* (1) U=*L. monocytogenes* (1)
Refrigerated Desserts	1598	1589 (99%)	9 (1%)	-	I= Generic *E.coli* (6), *B. cereus*(3)

Commodity	Total Number of Samples Tested to March 31, 2017	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments/ Results
Raw Milk Cheese	1416	1410 (99.6%)	3 (0.2%)	3 (0.2%)	I=*S. aureus* (3) U=*S. aureus* (3)
Dried Herbs	1893	1887 (99.6%)	3 (0.2%)	3 (0.2%)	I=*S. aureus* (1), *B. cereus* (2) U=*Salmonella* (1), Generic *E. coli* (2)
Dried Sprouted Seeds	1642	1585 (96.5%)	38 (2.3%)	19 (1.2%)	I=*B. cereus* (31), Generic *E. coli* (4), non-O157 VTEC (3) U=*B. cereus* (12), *Salmonella (5),* Generic *E. coli* (2)
Dried Teas	592	589 (99.5%)	2 (0.3%)	1 (0.2%)	I=*B. cereus* (2) U=*Salmonella* (1)
Dried Seed and Nut Powder	292	291 (99.7%)	-	1 (0.3%)	U=Generic *E. coli* (1)
Powdered Infant Formula	2632	2631 (99.96%)	1 (0.04%)	-	I=*Enterobacteriaceae* (1)
Chocolate-Based Confectionaries	1991	1971 (99%)	18 (0.9%)	2 (0.1%)	I=Coliforms (18) U=Coliforms (2)
HPP and Unpasteurized Juices (Bacteriology)	797	796 (99.9%)	1 (0.1%)	-	I= Generic *E. coli* (1)
HPP and Unpasteurized Juices (Virology)	690	690 (100%)	-	NA	All satisfactory
HPP and Unpasteurized Juices (Parasitology)	13	13 (100%)	-	NA	All satisfactory

Commodity	Total Number of Samples Tested to March 31, 2017	Satisfactory (S)	Investigative (I)	Unsatisfactory (U)	Comments/ Results
Raw Ground Beef and Veal*	589	582 (98.8%)	7 (1.2%)	NA	I=non-O157 VTEC (7)
Stone Fruits	1001	998 (99.7%)	3 (0.3%)	NA	I=*L. monocytogenes* (3)
Snow and Sugar Snap Peas	491	491 (100%)	-	NA	All satisfactory
Grand Total	**19404**	**19284 (99.4%)**	**88 (0.4%)**	**32 (0.2%)**	

*Test results reported in this Interim report include only raw ground beef as raw ground veal testing began on April 1st, 2017 which is outside the scope of this report.

What Do The Survey Results Mean And What Are They Used For?

Interim results show that almost all of the samples tested were free of the pathogens tested for, with 99.4% (19284/19404) of the samples being assessed as satisfactory. Of the 19404 samples tested, 0.4% (88/19404) were assessed investigative and 0.2% (32/19404) were assessed as unsatisfactory. Most of the targeted surveys in this interim report have a >99% satisfactory rate to date. The only exceptions are the Dried Sprouted Seed survey (96.5% satisfactory) and the Raw Ground Beef & Veal survey (98.8% satisfactory).

The Canadian Food Inspection Agency (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 a policy change occurs with respect to a particular pathogen. 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

1. Public Health Agency of Canada, *Foodbook Report*, PHAC. 2015.

2. Health Canada, *Compendium of Analytical Methods*.

3. Health Canada, *Health Products and Food Brnach (HPFB) Standards and Guidelines for Microbiological Safety of Food - An Interpretive Summary*. 2008.

4. *Microbiological Guidelines for Food (for Ready-to-Eat food in General and Specific Food Items)*, H.-K.C.F.F. Safety, 2014.

5. *Guidelines for Assessing the Microbiological Safety of Ready-to-Eat Foods Placed on the Market* U.H.P. Agency, 2009.

6. *Microbiological Quality Guide for Ready-to-Eat Food*, N.F. Authority, 2009.

7. *The Enterobacteriaceae and Their Significance to the Food Industry*, I.E.I.L.S. Institute, 2011.

8. Health Canada, *Policy on Listeria monocytogenes in Ready-to-Eat Foods*, 2011.

9. Health Canada,Health Canada's Interim Microbiological Criteria for Powdered Infant Formula. 2013

10. Department of Justice Canada, *Food and Drugs Act*. 2014.

11. Catford, A.K., V.;Martinez-Perez, A.;Gill, A.; Buenaventura, E.; Couture, H.; and Farber, M. J. , *Risk Profile on Non-O157 Verotoxin- Producing Escherichia Coli in Produce, Beef, Milk and Dairy Products in Canada.* Int Food Risk Anal J., 2014. **4**(21).