



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Parasites in Imported Fresh Leafy Herbs - April 1, 2017 to March 31, 2022

Food microbiology - Targeted surveys - Final report



Summary

A targeted survey¹ analysed 1730 samples of imported fresh leafy herbs over a 5-year period from April 1, 2017 to March 31, 2022. All samples were tested for the presence of *Cyclospora cayetanensis* (*C. cayetanensis*) while 1173 samples were also tested for *Cryptosporidium* species (spp.) and *Toxoplasma gondii* (*T. gondii*).

99.8% of the samples tested were found to be satisfactory. *Cryptosporidium* spp. and *T. gondii* were not found in any samples. *C. cayetanensis* was found in 4 of the 1730 (0.2%) samples. 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 imported fresh leafy herbs 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 consumed raw, good hygienic practices are recommended for producers, retailers, and consumers.

Why was this survey conducted

The survey was conducted to provide enhanced oversight of the safety of imported fresh leafy herbs sold at retail in Canada. While fresh leafy herbs are popular among Canadians², they have unfortunately been associated with recalls³ and foodborne illness outbreaks^{4,5}.

Fresh produce, including leafy herbs can be contaminated with parasites through contact with human and animal waste at any step in the food supply chain such as during production, harvest, post-harvest handling, packaging, distribution, and/or at retail. Unlike bacteria, parasites are unable to grow on foods, however they can remain viable for extended periods of time and may cause illness when ingested. Therefore the presence of parasites on fresh leafy herbs is of concern as they are a commonly consumed by Canadians and are generally consumed raw.

When was the survey conducted

The survey is ongoing, however the results reported herein are for samples collected over a 5-year period from April 1, 2017 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 or Saint John
- Quebec City
- Montreal
- Toronto
- Ottawa
- Vancouver
- Victoria or Kelowna
- 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 1730 imported fresh leafy herbs were collected. Wherever possible, pre-packaged samples were collected. Throughout all 5 years of the survey, the scope of sampling included parsley, cilantro, dill, basil, mint, and chives. Sage, thyme, oregano, tarragon, savoury, and marjoram were also sampled, however sampling of these herbs were limited to the first 3 years of the survey. Samples were collected throughout the year, however a higher proportion was sampled during the months of April to October to reflect the seasonality of foodborne parasitic infections in endemic countries^{6,7,8}, imports into Canada, and reported cases of cyclosporiasis in Canada. During the first 2 years of the survey, all sample types were randomly collected throughout the year. During year 3 of the survey, cilantro accounted for half of the samples collected. During years 4 and 5, cilantro and basil accounted for a third each of the samples collected. Both basil^{8,9} and cilantro⁹ have been frequently associated with cyclosporiasis. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 100g.

What were the samples tested for

All 1730 samples were tested for *C. cayetanensis*. Of the 1730 samples, 1173 were also analysed for *Cryptosporidium* spp., and *T. gondii*.

What methods were used to test the samples

Samples were analyzed using methods that detect the presence of deoxyribonucleic acid (DNA) of *C. cayentanensis*, *Cryptosporidium* spp., and *T. gondii*.

How were the samples assessed

There are currently no Canadian standards regarding the presence of parasites in fresh produce. As the analytical methods used in this survey can only determine the presence or absence of parasite DNA, they cannot discriminate between living (infectious) and dead (non-infectious) parasites. Therefore, the detection of parasite DNA was assessed as “investigative” and required further consideration to determine appropriate follow-up actions.

Table 1 - Assessment criteria

Parasite	Satisfactory	Investigative
<i>C. cayentanensis</i>	Not detected	Detected
<i>Cryptosporidium</i> spp.	Not detected	Detected
<i>T. gondii</i>	Not detected	Detected

What were the survey results

Cryptosporidium spp. and *T. gondii* DNA were not found in any samples. *C. cayentanensis* DNA was found in 4 of the 1730 (0.2%) samples.

Table 2 - Assessment results

Parasite	Number of samples tested	Satisfactory (%)	Investigative (%)
<i>C. cayentanensis</i>	1730	1726	4
<i>Cryptosporidium</i> spp ^a			0
<i>T. gondii</i> ^a			0
Total	1730	1726 (99.8)	4 (0.2)

^a Tested in 1173 samples.

Survey results are also presented by production practice (table 3), origin (table 4), product type (table 5), and season sampled (table 6).

Table 3 - Assessment results by production practice

Production practice	Number of samples tested (%)	Satisfactory	Investigative
Conventional	1440 (83.2)	1438	2
Organic	290 (16.8)	288	2
Total	1730	1726	4

Table 4 - Assessment results by product origin

Product origin	Number of samples tested (%)	Satisfactory	Investigative
China	2 (0.1)	2	0
Colombia	141 (8.2)	139	2
Costa Rica	1 (0.06)	1	0
Dominican Republic	143 (8.3)	143	0
Ecuador	7 (0.4)	7	0
Ethiopia	7 (0.4)	7	0
Israel	136 (7.9)	136	0
Jamaica	13 (0.8)	13	0
Mayotte	1 (0.06)	1	0
Mexico	376 (21.7)	376	0
Morocco	12 (0.7)	12	0
Peru	36 (2.1)	36	0
Thailand	2 (0.1)	2	0
United States	788 (45.6)	786	2
United States and Mexico	10 (0.6)	10	0
Vietnam	54 (3.1)	54	0
Unknown ^b	1 (0.06)	1	0
Total	1730	1726	4

^b Unknown refers to those samples for which the country of origin could not be assigned from the product label or available sample information.

Table 5 - Assessment results by product type

Product type	Number of samples tested (%)	Satisfactory	Investigative
Basil	282 (16.3)	281	1
Chives	74 (4.3)	74	0
Cilantro	401 (23.2)	399	2
Curly leaf parsley	140 (8.1)	140	0
Dill	160 (9.3)	160	0
Flat leaf parsley	241 (13.9)	241	0
Marjoram	9 (0.5)	9	0
Mint	191 (11.0)	190	1
Oregano	52 (3.0)	52	0
Sage	91 (5.3)	91	0
Savoury	2 (0.1)	2	0
Tarragon	26 (1.5)	26	0
Thyme	61 (3.5)	61	0
Total	1730	1726	4

Table 6 - Assessment results by season sampled

Season	Number of samples tested (%)	Satisfactory	Investigative
Spring (March to May)	481 (27.8)	481	0
Summer (June to August)	484 (28.0)	484	0
Fall (September to November)	475 (27.5)	474	1
Winter (December to February)	290 (16.8)	287	3
Total	1730	1726	4

What do the survey results mean

Previous Canadian^{10,11} studies on the microbial safety of retail fresh leafy herbs have shown results approximating those found in this study while interim results of a U.S.¹² study on *C. cayetanensis* in fresh herbs show a higher prevalence rate. Differing prevalence rates between studies may be attributable to differences in product type tested, methodology, study design, etc.

Overall, our survey results indicate that imported fresh leafy herbs 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 consumed raw, 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

While no illnesses were related to the investigative samples, these results triggered appropriate follow-up actions including a food safety investigation.

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. Public Health Agency of Canada, [*Foodbook Report*](#). 2015.
3. U.S. Food and Drug Administration, [*Shenandoah Growers, Inc Issues a Limited, Voluntary Recall of Specific Imported Organic Basil Because of Potential Health Risk*](#). 2021.
4. Public Health Agency of Canada, [*Public Health Notice: Outbreak of Cyclospora infections linked to salad products and fresh herbs*](#). 2020.
5. Hadjilouka, A., and Tsaltas D., [*Cyclospora Cayetanensis – Major Outbreaks from Ready to Eat Fresh Fruits and Vegetables*](#). *Foods*. 2020. 9:1703.
6. Kaminsky, R.G., et al., [*Marked seasonality of Cyclospora cayetanensis infections: ten-year observation of hospital cases, Honduras*](#). *BMC Infectious Diseases*. 2016. Feb 4;16:66.
7. Muchiri J.M., et al., [*Seasonality of Cryptosporidium oocyst detection in surface waters of Meru, Kenya as determined by two isolation methods followed by PCR*](#). *Journal of Water and Health*. 2009. Mar;7(1): p.67-75.
8. FAO/WHO, [*Multicriteria-Based Ranking for Risk Management of Food-Borne Parasites*](#). Microbiological Risk Assessment Series (MRA) 23. 2014.
9. Public Health Agency of Canada, [*Causes of cyclosporiasis \(Cyclospora\)*](#). 2016.
10. Canadian Food Inspection Agency, [*2011-2013 Cyclospora cayetanensis and Cryptosporidium spp. in Fresh Produce*](#). 2016.
11. Canadian Food Inspection Agency, [*2013-2014 Cyclospora cayetanensis and Cryptosporidium spp. in Fresh Leafy Herbs and Green Onions*](#). 2016.
12. U.S. Food and Drug Administration, [*Microbiological Surveillance Sampling: FY18-21 Fresh Herbs \(Cilantro, Basil & Parsley\) Assignment*](#). 2020.