



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Viruses in Fresh Leafy Herbs and Fresh Leafy Vegetables - April 1, 2017 to March 31, 2018 and April 1, 2020 to March 31, 2021

Food microbiology - Targeted surveys - Final report



Summary

A targeted survey¹ analysed 829 samples of whole or trimmed fresh leafy herbs and 230 whole or trimmed fresh leafy vegetables over a 2-year period from April 1, 2017 to March 31, 2018 and April 1, 2020 to March 31, 2021. All samples were tested for the presence of Hepatitis A Virus (HAV) and Norovirus (NoV) Genotypes I and II (GI, GII).

99.9% of the fresh leafy herb and 100% of the fresh leafy vegetable samples tested were found to be satisfactory. HAV and NoV GI were not found in any of the samples while NoV GII was found in 1 of the 829 (0.1%) fresh leafy herb 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 fresh leafy herbs and fresh leafy vegetables 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 fresh leafy herbs and fresh leafy vegetables sold at retail in Canada. Fresh produce including fresh leafy herbs and fresh leafy vegetables are popular among Canadians², as they provide a healthy and convenient way to meet Canada's food guide³ recommendation to eat plenty of fruits and vegetables. Unfortunately, a wide variety of produce have been associated with recalls⁴ and foodborne illness outbreaks⁵. In Canada, among all of the known food-borne pathogens (bacteria, viruses, parasites), NoV is the leading cause of food-borne illnesses and hospitalizations and the second leading cause of death⁶.

Fresh produce, including leafy herbs and leafy vegetables can be contaminated with viruses through contact with human 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, viruses 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 viruses on produce are of concern as they are a commonly consumed by Canadians and are generally consumed raw.

When was the survey conducted

The survey was conducted over a 2-year period from April 1, 2017 to March 31, 2018 and April 1, 2020 to March 31, 2021.

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 829 whole or trimmed fresh leafy herb and 230 whole or trimmed fresh leafy vegetable samples were collected. Imported fresh leafy herb samples were collected from April 1, 2017 to March 31, 2018. Imported and domestic fresh leafy vegetable and imported and domestic fresh leafy herb samples were collected from April 1, 2020 to March 31, 2021. Imported samples were collected evenly throughout the year while domestic samples were collected during the summer months to reflect the domestic production season. A sample consisted of a single or multiple consumer sized packages of the same lot weighing at least 100g for fresh leafy herbs or 150g for fresh leafy vegetables.

What were the samples tested for

All samples were tested for the presence of HAV and NoV GI, GII.

What methods were used to test the samples

Samples were analyzed using methods that detect the presence of ribonucleic acid (RNA) of HAV and NoV GI, GII.

How were the samples assessed

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

Table 1 - Assessment criteria

Virus	Satisfactory	Investigative
HAV	Not detected	Detected
NoV GI, GII	Not detected	Detected

What were the survey results

HAV and NoV GI RNA were not found in any of the fresh leafy herb (n=829) or fresh leafy vegetable (n=230) samples. NoV GII RNA was not found in any of the fresh leafy vegetable samples (n=230), but was found in 1 of the fresh leafy herb (n=829) samples.

Table 2 - Assessment results

Virus	Number of samples tested	Satisfactory (%)	Investigative (%)
HAV	1059	1058	0
NoV GI			0
NoV GII			1 ^a
Total	1059	1058 (99.9)	1 (0.09)

^aOrganic cilantro imported from the United States sampled in the spring season

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

Table 3a - Product type and origin of fresh leafy herb samples

Product type	Number of domestic samples tested	Number of imported samples tested
Basil	N/A	89
Chives	N/A	33
Cilantro	1	98 ^b
Curly leaf parsley	2	74
Dill	1	63
Flat leaf parsley	8	85
Marjoram	N/A	12
Mint	3	81
Oregano	N/A	60
Rosemary	N/A	64
Sage	1	66
Savoury	N/A	15
Tarragon	N/A	32
Thyme	N/A	41
Total (%)	16 (1.9)	813 (98.1)

^bInvestigative sample

Table 3b – Product type and origin of fresh leafy vegetable samples

Product type	Number of domestic samples tested	Number of imported samples tested
Arugula	6	6
Boston lettuce	4	1
Collards	3	1
Endive	1	3
Escarole	N/A	1
Green leaf lettuce	16	11
Iceberg lettuce	11	18
Kale	16	9
Radicchio	1	5
Red leaf lettuce	4	9
Romaine lettuce	13	9
Spinach	20	42
Swiss chard	4	2
Mixed leafy vegetables	7	7
Total (%)	106 (46.1)	124 (53.9)

Table 4 – Production practice and origin of fresh leafy herb and vegetable samples

Production practice	Number of domestic fresh leafy herbs tested	Number of imported fresh leafy herbs tested	Number of domestic fresh leafy vegetables tested	Number of imported fresh leafy vegetables tested
Conventional	15	694	94	86
Organic	1	119 ^c	12	38
Total	16	813	106	124

^cInvestigative sample

Table 5 – Country of origin of fresh leafy herb and vegetable samples

Country of origin	Number of fresh leafy herbs tested (%)	Number of fresh leafy vegetables tested (%)
Canada	16 (1.9)	106 (46.1)
China	1 (0.1)	N/A
Colombia	87 (10.5)	N/A
Dominican Republic	104 (12.5)	N/A
Ecuador	1 (0.1)	N/A
Guatemala	Not Applicable (N/A)	1 (0.4)
Israel	77 (9.3)	N/A
Jamaica	7 (0.8)	N/A
Mexico	148 (17.9)	3 (1.3)
Morocco	3 (0.4)	N/A
Peru	42 (5.1)	N/A
United States	311 ^d (37.5)	120 (52.2)
United States and Mexico	1 (0.1)	N/A
Vietnam	30 (3.6)	N/A
Unknown ^e	1 (0.1)	N/A
Total	829	230

^dInvestigative sample

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

Table 6 – Seasonal collection and origin of fresh leafy herb and vegetable samples

Season sampled	Number of domestic fresh leafy herbs tested	Number of imported fresh leafy herbs tested	Number of domestic fresh leafy vegetables tested	Number of imported fresh leafy vegetables tested
Spring (March to May)	N/A	187 ^f	N/A	13
Summer (June to August)	11	205	54	14
Fall (September to November)	5	235	52	64
Winter (December to February)	N/A	186	N/A	33
Total	16	813	106	124

^fInvestigative sample

What do the survey results mean

Previous Canadian^{7,8,9} studies on the microbial safety of retail fresh leafy herbs and vegetables have shown results approximating those found in this study.

Overall, our survey results indicate that fresh leafy herbs and vegetables 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

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

- follow-up with the importer
- review of manufacturer production, sanitation, and distribution practices

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.
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4. Canadian Food Inspection Agency. [*Recalls and safety alerts*](#).
5. Belanger, P., et al., [*An overview of foodborne outbreaks in Canada reported through Outbreak Summaries: 2008-2014*](#), Communicable Disease Report (CCDR), 2015. p. 254-262.
6. Thomas, M.K., et al., [*Estimates of Foodborne Illness-Related Hospitalizations and Deaths in Canada for 30 Specified Pathogens and Unspecified Agents*](#). Foodborne Pathogens and Disease, 2015. 12(10): p. 820-827.
7. Canadian Food Inspection Agency, [*2019-2020 National Microbiological Monitoring Program and Food Safety Oversight Program Annual Report*](#). 2020.
8. Canadian Food Inspection Agency, [*2018-2019 National Microbiological Monitoring Program and Food Safety Oversight Program Annual Report*](#). 2019.
9. Canadian Food Inspection Agency, [*2017-2018 National Microbiological Monitoring Program and Food Safety Oversight Program Annual Report*](#). 2018.