

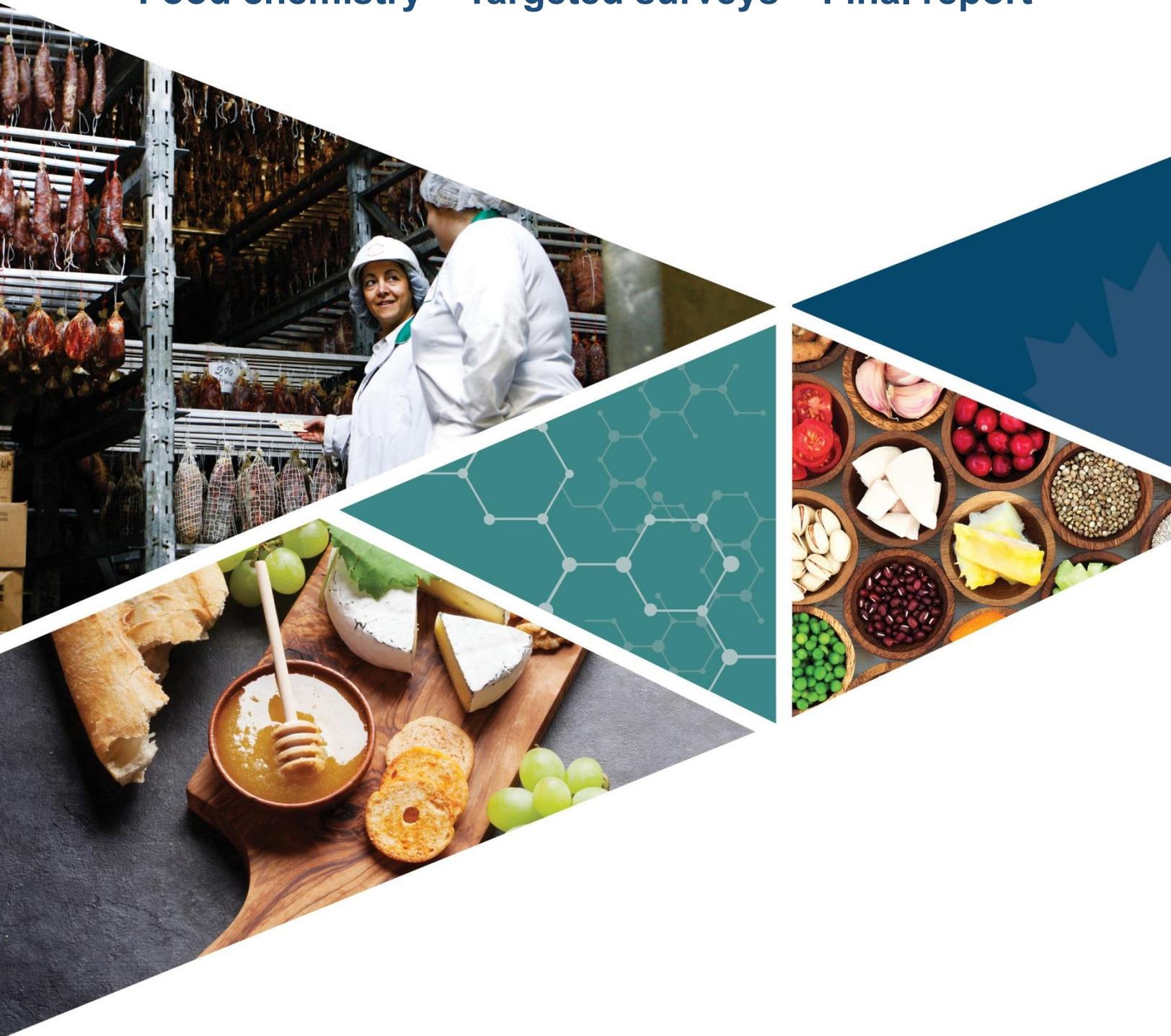


Canadian Food  
Inspection Agency

Agence canadienne  
d'inspection des aliments

# Furan, 2-methylfuran and 3-methylfuran in selected foods – April 1, 2023 to March 31, 2024

## Food chemistry – Targeted surveys – Final report



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Catalogue No.: A104-655/2024E-PDF  
ISBN: 978-0-660-77615-6  
Aussi disponible en français.

# Summary

Targeted surveys provide information on potential food hazards and enhance the Canadian Food Inspection Agency's (CFIA's) routine monitoring programs. These surveys provide evidence regarding the safety of the food supply, identify potential emerging hazards, and contribute new information and data to food categories where it may be limited or non-existent. They are often used by the Agency to focus surveillance on potential areas of higher risk. Surveys can also help to identify trends and provide information about how industry complies with Canadian regulations.

Furan is a chemical that can unintentionally form in foods that undergo thermal treatment such as frying and canning<sup>1</sup>. Precursors to furan are often present in food, these include ascorbic acid, polyunsaturated fatty acids, amino acids and sugars<sup>1,2,3</sup>. Furan occasionally coexists with 2-methylfuran and 3-methylfuran. In this report, the plural term 'furans' refers to the sum of furan, 2-methylfuran and 3-methylfuran, whereas 'furan' refers only to the furan compound. The term "analogue" also used, refers to compounds which have similar but slightly different structures; it is sometimes used in this report to refer to the 3 forms of furan. It should be noted that the furans in this survey do not refer to chlorinated dibenzofurans, the environmental contaminants which are often also referred to as "furans".

Furan may pose a health risk to the consumer, as the International Agency for Research on Cancer (IARC) has classified it as 'possibly carcinogenic to humans'<sup>4</sup>. Additionally, 2-methylfuran and 3-methylfuran have been shown to have a similar toxicity to furan<sup>5</sup>. Although preliminary estimates for consumer exposure are well below what would cause harmful effects, limited information is available concerning furan levels in food. This survey was initiated in consultation with Health Canada to expand upon the data collected by other agencies and to generate further baseline surveillance data on the presence and levels of furan analogues in selected foods available on the Canadian retail market.

A total of 686 samples were collected from retail stores in 6 cities across Canada. The samples collected were foods that were likely to contain these compounds, including infant and toddler food, and noodles. Furans were detected in 60% of the survey samples and levels ranged from 0.45 parts per billion (ppb) to 147 ppb. The highest concentration of furans was found in a sample of meat and vegetable based infant puree. The majority of the samples with detectable levels of furans (68%) contained all 3 analogues. The results from this survey were comparable to those found in previous surveys and scientific literature.

Maximum Levels (MLs) for furans have not yet been established, as the toxicity of furans in humans is not well known, so levels were assessed by Health Canada on a case-by-case basis using the most current scientific data. Health Canada determined the levels of furans in food

observed in this survey are not expected to pose a concern to human health, therefore there were no follow-up actions resulting from this survey.

## What targeted surveys are

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 our 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. We work with federal, provincial, territorial and municipal governments and provide 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.

## Why the survey was conducted

The main objectives of this targeted survey were to generate further baseline surveillance data on the level of furan, 2-methylfuran and 3-methylfuran in domestic and imported products on the Canadian retail market, and to compare the prevalence of furans in foods targeted in this survey with that of similar products in international surveys and to the scientific literature.

Furan may pose a health risk to consumers since the IARC has classified it as 'possibly carcinogenic to humans'<sup>4</sup>. Furan can sometimes form in foods that undergo heat treatments, particularly in foods that contain ascorbic acid, polyunsaturated fatty acids, amino acids and sugars<sup>1,2,3</sup>. In some foods, 2-methylfuran and 3-methylfuran can also form, which have a similar toxicity to furan<sup>5</sup>. Because thermal treatments are widely used for manufacturing shelf-stable food, it is important to establish data on the prevalence of furan, 2-methylfuran and 3-methylfuran in food available on the Canadian retail market.

MLs for furans have not yet been established, as the toxicity of furans in humans is not well known. The U.S. Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA) have studied furan levels in a variety of commodities<sup>6,7</sup>, but limited data is available concerning 2- and 3-methylfuran levels. The objective of this survey was to establish further baseline surveillance data and to expand upon the data collected by other agencies.



## What we sampled

A variety of domestic and imported infant and toddler food (purees and meals), and noodles (instant soup and instant pasta) were sampled from April 1 to March 31 over the 2023 and 2024 survey years. Samples of products were collected from local/regional retail locations in 6 major cities across Canada. These cities encompassed 4 Canadian geographical areas:

- Atlantic (Halifax)
- Quebec (Montreal)
- Ontario (Toronto and Ottawa)
- West (Vancouver and Calgary)

The number of samples collected from these cities was in proportion to the relative population of the respective areas. The shelf life, storage conditions, and the cost of the food on the open market were not considered in this survey.

**Table 1. Distribution of samples based on product type and origin**

Product type	Number of domestic samples	Number of imported samples	Number of samples of unspecified <sup>a</sup> origin	Total number of samples
Infant/toddler food	69	276	16	361
Noodles	5	309	11	325
<b>Total</b>	74	585	27	686

### Table notes

<sup>a</sup> Unspecified refers to those samples for which the country of origin could not be assigned from the product label or available sample information.

## How samples were analyzed and assessed

Samples were analyzed by an ISO 17025 accredited CFIA food testing laboratory. The furans level reported per sample is the sum of the levels of furan, 2-methylfuran and 3-methylfuran, where detected. The results presented represent finished food products as sold and not as they would be consumed, whether the product sampled is considered an ingredient or requires preparation prior to consumption.

In the absence of established tolerances or standards for furans in foods, elevated levels in specific foods may be assessed by Health Canada on a case-by-case basis using the most current scientific data available.

## Results of the survey

Of the 686 samples tested, 413 (60%) had detectable levels of furans. Table 1 shows that the detection rate of furans varied between product types. Detection rate was higher in infant and toddler foods than in noodle products. The highest concentration of furans (147 ppb) was found in a sample of meat and vegetable based infant puree.

Most (68%) of the positive samples contained all 3 furan analogues. In 46 products, furan and 2-methylfuran were both detected, 5 samples contained 2-methylfuran and 3-methylfuran, and 82 samples contained only 1 analogue (26 contained only furan, 50 contained only 2-methylfuran and 6 contained only 3-methylfuran). Of the 3 forms, furan had the highest average concentrations in all product types (30 ppb) and 3-methylfuran had the lowest average (1.9 ppb).

**Table 2. Summary of targeted survey results on furans in selected foods**

Product type	Number of samples	Number of samples (%) with detected levels	Minimum (ppb)	Maximum (ppb)	Average <sup>b</sup> (ppb)
Infant/toddler food	361	316 (88)	0.45	147	33.8
Noodles	325	97 (30)	1	57	15.2
<b>Total</b>	686	413 (60)	0.45	147	29.5

### Table notes

<sup>b</sup> Only positive results were used to calculate the average levels.

Although most infant/toddler food samples tested were positive for furans, the levels observed were relatively low compared to other foods tested to date<sup>8</sup>. Within the infant/toddler food samples, fruit-based purees contained the lowest average levels of furans, whereas products containing meat had the highest. Noodles also contained relatively low levels of furans<sup>8</sup>.

## What the survey results mean

For all product types, furan levels found in this survey were comparable to the levels reported in the scientific literature and previous targeted surveys<sup>6,8,9,10,11,12,13</sup>.

Table 3 only compares levels for furan for product on the Canadian market, as limited data is available concerning 2- and 3-methylfuran levels in foods.

The literature shows that 2-methylfuran and 3-methylfuran can form alongside furan from precursors found in foods, although limited data is available concerning specific precursors or reaction pathways<sup>14,15</sup>. The variety of 2- and 3-methylfuran levels in foods sampled in this

survey is possibly due to differences in ingredients and processing, which may favour the formation of different furan analogues.

**Table 3. Minimum, maximum and average concentration of furan across various studies**

Product type	Study	Number of samples	Minimum (ppb)	Maximum (ppb)	Average <sup>c</sup> (ppb)
Infant/toddler food	CFIA survey, 2023	361	0.47	140	32.5
Infant/toddler food	CFIA survey, 2021	370	0.69	130	26.8
Infant/toddler food (Meat/fish-based)	CFIA survey, 2021	193	0.69	130	41.3
Infant food (Other)	CFIA survey, 2021	177	1.1	67	11.2
Infant food	CFIA survey, 2020	150	1	94	19.5
Meat/fish-based	CFIA survey, 2020	43	9.4	94	48.4
Fruit/vegetable puree	CFIA survey, 2020	107	1	91	7.9
Infant food	CFIA survey, 2017	22	8.26	204	92.9
Infant food (Meat/fish-based)	Becalski et al., 2010	3	121	331	193.3
Infant food (Fruit/vegetable puree)	Becalski et al., 2010	12	8.5	239	69.3
Noodles	CFIA survey, 2023	325	2.5	50	18.2
Noodles	CFIA survey, 2021	175	1.7	74	13.8
Noodles	Lee et al., 2021	30	4.24	13.3 <sup>d</sup>	N/A
Noodles	Sijja et al., 2014	3	3.02	11.4	7.32

**Table notes**

<sup>c</sup> Only positive results were used to calculate the average (hazard) levels.

<sup>d</sup> Concentration range of furan was much larger (up to 218 ppb) for soup base (reported separately).  
N/A: not available.

The furan levels found in infant/toddler foods were within the range reported in the scientific literature and previous targeted surveys<sup>8,9,10,11</sup>. As observed previously, highest amounts of furan were found to be present in meat-containing recipes. Infant food samples collected this survey year included mostly meat, fish and cheese containing products, therefore average level of furan recorded was higher than in previous years that included a large proportion of fruit/vegetable only products<sup>8,9</sup>.

There was limited data available for comparison of the survey results on furans in noodles, specifically in instant noodle-based soup. In this survey the results represent the entire product, including soup-base. When furan levels reported were compared to those from a study that reported levels for both noodles and soup-base and both values were considered, the results were comparable<sup>12</sup>. The results for plain instant noodles were also comparable to the levels

reported in the scientific literature<sup>13</sup>. The results of this survey and the 2021 survey are in very close agreement<sup>8</sup>.

Health Canada's Bureau of Chemical Safety determined the levels of furan, 2-methylfuran and 3-methylfuran in food observed in this survey are not expected to pose a concern to human health; therefore no follow-up actions were required.

# References

1. [Food and Nutrition – Furan.](#) (2016). Canada. Health Canada.
2. Blank, I., Conde-Petit, B., Kerler, J., Limacher, A. (2007). [Formation of furan and methylfuran from ascorbic acid in model systems and food.](#) Food Additives and Contaminants, 24(S1), pp. 122-135.
3. Locas, C.P., Yaylayan, V.A. (2004). [Origin and Mechanistic Pathways of Formation of the Parent furans - A Food Toxicant.](#) Journal of Agricultural and Food Chemistry, 52(22), pp. 6830-6836.
4. [Dry Cleaning, Some Chlorinated Solvents and Other Industrial Chemicals.](#) (1995). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, 63, pp. 393-407.
5. [Risks for public health related to the presence of furan and methylfurans.](#) (2017). EFSA Journal, 15(10).
6. [Exploratory Data on furan in Food.](#) (2005). United States of America. U.S. Food and Drug Administration.
7. [Update on furan levels in food from monitoring years 2004-2010 and exposure assessment.](#) (2011) Italy. European Food Safety Authority.
8. [Furan, 2-methylfuran and 3-methylfuran in Selected Foods 2021 to 2023.](#) (2024). Canada. Canadian Food Inspection Agency.
9. [Furan, 2-methylfuran and 3-methylfuran in Selected Foods 2020 to 2021.](#) (2023). Canada. Canadian Food Inspection Agency.
10. [Furan, 2-methylfuran and 3-methylfuran in Selected Foods 2013 to 2018.](#) (2023). Canada. Canadian Food Inspection Agency.
11. Becalski, A., Hayward, S., Krakalovich, T., Pelletier, L., Roscoe, V., Vavasour, E. (2010). [Development of an analytical method and survey of foods for furan, 2-methylfuran and 3-methylfuran with estimated exposure.](#) Food Additives & Contaminants Part A, 27(6), pp. 764-775.
12. Lee, H.-Y., Lee, K.-G., (2021). [Analysis of furan in various instant noodles by solid-phase microextraction-gas chromatography/mass spectrometry.](#) Food Control, 126:108047.
13. Sijia, W., Enting, W., Yuan, Y. (2014). [Detection of furan levels in select Chinese foods by solid phase microextraction-gas chromatography/mass spectrometry method and dietary exposure estimation of furan in the Chinese population.](#) Food and Chemical Toxicology, 64, pp. 34-40.
14. Limacher, A., Kerler, J., Conde-Petit, B., Blank, I. (2007). [Formation of furan and methylfuran from ascorbic acid in model systems and food.](#) Food Additives & Contaminants, 24, pp. 122-135.
15. Becalski, A., Seamen, S. (2005). [Furan precursors in food: a model study and development of a simple headspace method for determination of furan.](#) Journal of AOAC International, 88(1), pp. 102-106.