



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Bisphenol A and BPA alternatives in selected canned foods and jarred infant food – April 1, 2023 to March 31, 2024

Food chemistry – Targeted surveys – Final report



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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.

Bisphenol A (BPA) is a chemical used to make Bisphenol A diglycidyl ether (BADGE) epoxy resins and hard plastic containers¹. Its use in the food industry is common, as BADGE epoxy resins are often coated on the inside of cans to prevent direct contact between the food and the metal. These compounds can migrate into food, particularly at elevated temperatures (for example, in hot-filled or heat-processed canned foods)^{2,3}.

To prevent the adverse health effects of these compounds^{4,5,6,7}, some manufacturers have turned to BPA alternatives such as Bisphenol F (BPF) and Bisphenol S (BPS)⁸. Limited data is available concerning the use of BPA alternatives in canned and bottled foods, therefore they were included in this survey.

A total of 353 samples were collected from retail stores in 11 cities across Canada. The samples collected included coconut milk, infant formula, ready-to-eat (RTE) curry products, meat, pasta, soup, and jarred infant food. BPA was detected in 33% of the survey samples and other analogues were detected in 8%. No samples had detected levels of BPS. The highest average and maximum BPA levels were reported in canned food samples and the lowest in infant foods. The results from this survey were comparable to those found in previous surveys.

Maximum Levels (MLs) for BPA, BADGE, BPF and BPS have not been established, so levels were assessed by Health Canada on a case-by-case basis using the most current scientific data. The levels observed in this survey were evaluated by Health Canada who determined that none of the samples would pose an unacceptable human health concern, therefore there were no recalls 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 we conducted this survey

The main objectives of this targeted survey were to generate baseline surveillance data on the prevalence of BPA, BADGE and its alternatives in foods on the Canadian retail market, and to compare the prevalence of these compounds in foods targeted in this survey with that of similar products in previous targeted surveys and in scientific literature.

BPA is an industrial chemical used to make BADGE epoxy resins and clear hard plastic known as polycarbonate. It can be found in many items including tableware, storage containers, and food packaging. BADGE epoxy resins are also used as protective linings on the inside of metal containers and metal lids to prevent the corrosion of the metal and subsequent contamination of foods and beverages by dissolved metals. However, as a result of these liners, chemical components of food packaging like epoxy resins and polycarbonate come in contact with food. Residues of BPA can then migrate from the liners into the food, especially at elevated temperatures (such as in hot-fill or heat-processed canned foods)^{1,2,3}. The negative health effects of BPA are well-documented. Exposure to high levels has been shown to be associated with infertility, breast cancer, prostate cancer⁴, and some evidence suggests that it can also contribute to heart problems, liver problems and diabetes⁵. The International Agency for Research on Cancer (IARC) has found some evidence of BADGE's carcinogenic effects in animals, although there is not enough evidence to conclude that it is carcinogenic in humans⁶. Health Canada has stated that the health risk associated with BADGE is considered moderate based on available toxicological information⁷.

Due to these adverse health effects, manufacturers have supported initiatives to reduce BPA exposure from food packaging applications, including development of alternative materials. This targeted survey tested for 2 BPA alternatives: BPF and BPS. These compounds are generally considered to be safer than BPA, although their toxicity is not well-known and some evidence suggests exposure to these compounds can have adverse health effects⁸. Limited data is available on the extent of their usage by manufacturers, which is why the CFIA considered it important to include these compounds in this survey.

What we sampled

A variety of domestic and imported canned products including coconut milk, liquid infant formula, RTE curry products (meals), meat, pasta, soup, and jarred infant foods were sampled between April 1, 2023 and March 31, 2024. Samples of products were collected from local/regional retail locations located in 11 major cities across Canada. These cities encompassed 4 Canadian geographical areas:

- Atlantic (Halifax and Moncton)
- Quebec (Montreal and Quebec City)
- Ontario (Toronto and Ottawa)
- West (Calgary, Saskatoon, Vancouver, Victoria and Winnipeg)

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 ^a origin	Total number of samples
Coconut milk	0	29	0	29
Curry products	1	8	0	9
Infant food	0	119	1	120
Infant formula	0	25	0	25
Meat	30	27	0	57
Pasta	10	14	15	39
Soup	25	46	3	74
Total	66	268	19	353

Table notes

^a 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/IEC 17025 accredited food testing laboratory under contract with the Government of Canada. The results are based on the food products as sold and not necessarily as they would be consumed.

MLs for BPA and BADGE have not been established, so levels were assessed by Health Canada on a case-by-case basis using the most current scientific data.

Results of the survey

Of the 353 samples tested, 118 (33%) had detected levels of BPA, and 27 (8%) had detected levels of other analogues. Table 2 illustrates the range of BPA concentrations detected in the survey samples by product type. No samples contained detected levels of BPS.

Bisphenol A (BPA)

Canned foods (RTE curry products, pasta) had the highest maximum and average BPA levels of all product types. Coconut milk had the highest detection rate of 79%. The highest detected level of BPA was recorded in a sample of canned cheese-based pasta. Only one sample of infant food had low levels of BPA. BPA and the alternatives were not detected in any of the infant formula samples.

Table 2. Results of bisphenol A testing in canned food, coconut milk and jarred infant food

Product type	Number of samples	Number of samples (%) with detected levels	Minimum (ppb)	Maximum (ppb)	Average ^b (ppb)
Coconut milk	29	23 (79)	4.28	200	31.6
Curry products	9	5 (56)	46.6	86.3	72.3
Infant food	120	1 (0.8)	0.97	N/A	N/A
Infant formula	25	0	0	N/A	N/A
Meat	57	33 (58)	1.35	69.7	20.7
Pasta	39	17 (44)	1.06	348	46.2
Soup	74	39 (53)	1.21	93.2	22.1
Total	353	118 (33)	0.97	348	29.0

Table notes

^b Only positive results were used to calculate averages.

ppb = parts per billion.

N/A: not applicable, only one sample contained BPA.

Bisphenol A diglycidyl ether (BADGE)

BADGE was detected in only 24 (7%) samples. Coconut milk had the highest detection rate of 38%. The overall average concentration of BADGE was 58.3 ppb, with a range of 1.15 to 576 ppb. Most (20 out of 24) of the samples that contained BADGE also contained BPA.

Bisphenol F (BPF)

Only 6 (2%) samples had detectable levels of BPF, with 3 of these samples being soup. The overall average concentration of BPF was 8.2 ppb, with a range of 1.34 to 29 ppb. Out of the 6 samples that contained BPF, 3 also contained both BPA and BADGE, and 1 contained BPA.

Bisphenol S (BPS)

All of the survey samples were also tested for BPS. It was not detected in any of the samples.

What the survey results mean

BPA levels in the products tested in this targeted survey were comparable to those previously found in similar product types (Table 3)^{9,10,11,12,13,14,15,17,18}. All maximum and average levels found in this survey were within those reported for other survey years. Some differences observed may be due to the specific type of product tested or sample size. The differences in maximum and average BPA levels observed between the survey years and product types may also be due to the wide range of factors that can affect BPA's migration into foods. Process temperature as well as the presence of sodium chloride, vegetable oils and sugar have been shown to influence the migration of BPA from cans into food¹⁹.

A decrease in the average BPA levels for some product types could be due to decisions made by manufacturers to reduce BPA by using BPA-free epoxy resins as well as controlling processing temperature^{20,21}. Some of these measures may not have been established in other countries, resulting in higher average BPA levels in imported compared to domestic products (2.15 ppb versus 0.51 ppb).

Only 7% of the samples in this survey reported detected levels of BADGE, most of which were coconut milk samples. This is not unexpected as coconut milk has the highest fat content of foods included in this survey, and BADGE is known to migrate readily into fats²².

Table 3. BPA testing results from various survey years

Product type	Survey year	Number of samples tested	Minimum (ppb) ^d	Maximum (ppb)	Average (ppb) ^{c,d}
Coconut milk	2023	29	4.28	200	31.6
Coconut milk	2022	13	2.18	66.8	20.2
Coconut milk	2019	50	3.01	161	25.1
Coconut milk	2018	49	1.42 ^d	367	47.0
Coconut milk	2013	13	4.8	226	75.5
Coconut milk	2012	48	5.4	381	63
Curry products	2023	9	46.6	86.3	72.3
Curry products	2022	6	36.5	N/A	N/A
Curry products	2019	44	7	221	71.7
Curry products	2012	24	88	298	227
Infant food	2023	120	0.97	N/A	N/A
Infant food	2022	58	1.27	2.39	1.64
Infant food	2019	147	0.98	13	2.89
Infant food	2009	100	1.4	9.6	1.77
Infant formula	2023	25	0	0	0
Infant formula	2022	14	0	0	0
Infant formula	2018	138	0.92 ^d	5.89	1.65
Infant formula	2013	31	2.2	7	3.63
Infant formula	2010	127	0	N/A	N/A
Meat	2023	57	1.35	69.7	20.7
Meat	2022	28	1.68	511	97.8
Meat	2017	231	1.2	407	35.6
Pasta	2023	39	1.06	348	46.2
Pasta	2022	16	2.16	137	52.2
Pasta	2021	172	0.91	162	46.1
Pasta	2019	74	1.84	389	68.5
Tomato-based sauces	2018	96	1.01 ^d	95.9	9.78
Pasta	2013	45	6.7	93	19.5
Soup	2023	74	1.21	93.2	22.1
Soup	2022	39	1.13	23.3	8.16
Soup	2019	75	1.75	86	11.2
Soup	2016	48	2.48	401	87.0
Soup	2013	48	1.2	307.0	42.6
Soup	2012	103	5.7	277	11.8

Table notes

^c Only positive results were used to calculate the average BPA levels.

^d Beginning in 2018 new improved detection method was used.

N/A: not applicable, only one sample had detectable levels of BPA.

There are no regulations in Canada for BPA or BADGE levels in food. All levels of BPA and BADGE found in the products tested in this survey were evaluated by HC who determined that none of the samples would pose an unacceptable human health concern, therefore there were no recalls resulting from this survey.

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