Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

FOOD SAFETY ACTION PLAN

REPORT

2012 – 2013
TARGETED SURVEYS – CHEMISTRY

Lead in Candy, Chocolate, Dried Herbs and Spices

RDIMS #5740603
Data tables RDIMS #5616205

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Executive Summary

The Food Safety Action Plan (FSAP) aims to modernize and enhance Canada's food safety system. As a part of the FSAP enhanced surveillance initiative, targeted surveys are used to provide data in order to evaluate various foods for specific hazards.

The diet as a source of lead exposure is documented on the Health Canada web page which states that: "Lead is a naturally occurring metal found in rock and soil, and also has many industrial applications. Due to both its natural occurrence and long history of global use, lead is present in air, water and soil, as well as in food, drinking water and household dust. Levels of lead in the environment have declined significantly over the past few decades due to the discontinued use of lead paint, gasoline, and the solder used in food cans. Since the phase-out of leaded gasoline and the subsequent reduction of airborne lead, food and drinking water are currently the primary sources of lead exposure to adults within the general population."

Lead is not permitted to be added to foods; however, due to its widespread presence in the environment, it is detected in all foods, generally at very low levels. Lead can enter the food chain through various pathways, such as uptake from the soil into plants. Contamination of food could also occur during food manufacturing process (e.g., from the use of inappropriate food storage materials, processing equipment, etc.).

Lead concentrations in meat, dairy products, eggs, honey, fruit and vegetables (processed and fresh), and fresh herbs are monitored annually under the Canadian Food Inspection Agency's National Chemical Residue Monitoring Program (NCRMP). The scope of the NCRMP does not routinely evaluate finished and/or manufactured foods, such as candy, chocolate, cocoa powder and dried herbs/spices, for the presence and levels of lead. The main objectives of the current survey were to generate baseline surveillance data on the level of lead in this specific group of commodities available on the Canadian retail market and to compare the prevalence and levels of lead to previous FSAP surveys.

The 2012-2013 FSAP Lead survey targeted domestic and imported candy, chocolate, cocoa powder, dried herbs/spices. A total of 425 samples were collected from grocery and specialty stores in 11 Canadian cities between April 2012 and February 2013. The samples collected included 20 cocoa powder samples, 123 chocolate samples, 148 candy samples and 134 dried herb/spice products.

Of the 425 samples analyzed for lead, 45 (11%) did not contain detectable levels of lead. The remaining 380 samples had lead levels ranging from 0.002 parts per million (ppm) to 4.387 ppm. Currently, no maximum level, tolerance, or standard has been established by Health Canada for lead in the products evaluated as part of this survey, therefore compliance to a numerical

standard could not be assessed.

All food sold in Canada must comply with Part 1, Section 4 of the *Food and Drugs Act*. In the case of lead, the Government of Canada recognizes that there can be multiple sources that account for the presence of lead in food. Whether from natural or man-made sources, all food industries are expected to minimize the presence of lead by any and all processes available to them. This is consistent with the ALARA (As Low As Reasonably Achievable) principle. Given the wide variety of processes, procedures and sources of raw materials, the means of implementing the ALARA principle will be company-specific.

All the data generated were shared with Health Canada's Bureau of Chemical Safety for use in performing human health risk assessments. The Bureau of Chemical Safety determined that none of the samples analysed for lead in this survey a concern to human health therefore no follow-up actions were needed.

1 Introduction

1.1 Food Safety Action Plan

In 2007, the Canadian government launched a five-year initiative in response to a growing number of product recalls and concerns about food safety. This initiative, called the Food and Consumer Safety Action Plan (FCSAP), aims to modernize and strengthen Canada's safety system for food, health, and consumer products. The FCSAP initiative unites multiple partners in ensuring safe food for Canadians.

The Canadian Food Inspection Agency's (CFIA's) Food Safety Action Plan (FSAP) is one element of the government's broader FCSAP initiative. The goal of FSAP is to identify risks in the food supply, limit the possibility that these risks occur, improve import and domestic food controls and identify food importers and manufacturers. FSAP also looks to verify that the food industry is actively applying preventive measures, and that there is a rapid response when/if these measures fail.

Within FSAP, there are 12 main areas of activity, one of which is risk mapping and baseline surveillance. The main objective of this area is to better identify, assess, and prioritize potential food safety hazards through risk mapping, information gathering, and testing of foods from the Canadian marketplace. Targeted surveys are one tool used to test for the presence and level of a particular hazard in specific foods.

Within the current regulatory framework, some commodities (such as meat and fish products) traded internationally and interprovincially are regulated by specific Acts. These are referred to as federally registered commodities. Under the current regulatory framework, the non-federally registered commodities encompass 70% of domestic and imported foods that are regulated solely under the *Food and Drugs Act* and the *Food and Drug Regulations*. Targeted surveys are primarily directed towards non-federally registered commodities.

1.2 Targeted Surveys

Targeted surveys are used to gather information regarding the possible occurrence or prevalence of chemical hazards in defined food commodities. The surveys are designed to answer specific questions. Therefore, unlike monitoring activities, testing for a particular chemical hazard is targeted to commodity types and/or geographical areas.

Due to the vast number of chemical hazards and food commodity combinations, it is not possible, nor should it be necessary, to use targeted surveys to identify and quantify all hazards in foods. To identify food-hazard combinations of greatest potential health risk, the CFIA uses a combination of scientific literature, media reports, and/or a risk-based model developed by the

Food Safety Science Committee (FSSC), a group of federal, provincial and territorial subject matter experts in the area of food safety.

The CFIA regularly monitors the levels of metal analytes, including lead, in a variety of fresh and processed products under the National Chemical Residue Monitoring Program (NCRMP) and the Children's Food Project (CFP) surveys. Targeted surveys focus mainly on products not monitored under these two programs. The purpose of this targeted survey was to establish baseline data on the levels of lead in candy, chocolate, dried herb/spice products available on the Canadian retail market. The scope of this survey is complementary to the NCRMP and Children's Food Project monitoring of processed products, in that it includes additional commodities not routinely monitored under those programs.

1.3 Acts and Regulations

The Canadian Food Inspection Agency Act stipulates that the CFIA is responsible for enforcing Canadian laws and regulations on the production, sale, composition and content of foods and food products as outlined in the *Food and Drugs Act & Regulations*.

Health Canada establishes the health-based maximum levels for chemical contaminants in food sold in Canada. Maximum levels for chemical contaminants in foods may be expressed as either regulatory tolerances or standards. Regulatory tolerances can be found in Sections B.01.046, B.01.047 and Division 15, Table 1 of the *Food and Drug Regulations* (FDR) whereas standards can be viewed on Health Canada's website[1]. As part of Health Canada's risk management strategy for lead, the lead tolerances in Table I of Division 15 of the FDR are being updated[2].

There are no maximum levels for lead in the food products analysed as part of this survey. Nonetheless, they are subject to Section 4(1)(a) of the *Food and Drugs Act*, which essentially prohibits the sale of a food that contains a poisonous or harmful substance.

The U.S. Food and Drug Administration (U.S. FDA) has provided guidance to industry recommending a maximum level for lead in candy of 0.1 parts per million (ppm)[3]. Past incidents of high lead levels in candy, especially in chili- and tamarind-based candy from Mexico, have been reported in the United States (USA)[4,5,6,7,8].

There are no established maximum levels for lead in dried herbs/spices in the United States, Australia, or New Zealand. The European Union does regulate the levels of lead in fresh herbs but not in dried herbs/spices. See Appendix A for a summary of the international regulations/maximum levels/guidelines for lead in spices and fresh/dried herbs.

The *Codex Alimentarius Commission (*CODEX) has set several maximum levels for lead in various foods, ranging from 0.05 ppm to 1.5 ppm, but has not done so for chocolate, candy, and

dried herbs/spices[9]. CODEX has established a code of practice for the prevention and reduction of lead in foods, which states that lead dyes or lead-based printing inks should not be used for packaging candy.[10]

In the absence of a specific Canadian maximum level, elevated levels of lead may be assessed by Health Canada on a case-by-case basis using the most current scientific data available. Follow-up actions are initiated in a manner that reflects the magnitude of the health concern. Actions may include further analysis, notification of the producer or importer, follow-up inspections, additional directed sampling, and recall of products.

2 Survey Details

2.1 Lead

Lead is an element that occurs naturally in the earth. It has many industrial uses and is found in trace amounts throughout the human environment. Everyone is exposed to trace levels of lead through food, drinking water, air, household dust, and soil. The amount of lead in the environment increased during the Industrial Revolution, and again in the 1920s with the introduction of leaded gasoline. Before leaded gasoline was phased out in Canada in the 1990s, air was the main source of exposure to lead for Canadians. It is still a source of low-level lead exposure, but today adults are exposed mainly through food and drinking water[11,12,13]. However, levels of lead in the Canadian environment have gone down significantly over the past 30 years. Recent studies have also shown a decline of over 70% in blood lead levels in Canadians since the 1970s[11,12,13]. For infants and children, the main sources are food and drinking water, household dust, soil and mouthing of products containing lead[11,12,13].

Lead is not deliberately added to food, however, low levels have been found in a variety of foods. Lead may enter the food chain from the soil, water or air, and may also contaminate foods during transport and processing. In Canada and most other countries, food manufacturers have stopped using lead-soldered food cans, which has greatly reduced dietary exposure to lead[11,12,13]. Inappropriate food packaging materials or inks used on packaging materials have previously been identified as a possible source of lead in candy sold in the USA[3,5,6,14]. Lead can also be present in food products as a result of processing or from the addition of contaminated ingredients[15,16,17].

For spices and herbs in particular, differences in background levels of lead may be due to differences in lead uptake by the plant, the portion of the plant that is prepared for consumption (e.g., leaf, seed, etc.), the geographic source of the product, etc. As an example, sources of lead contamination in ground chili spice may occur due to contamination with soil that contains lead, as well as from processing equipment [16,17].

Ongoing exposure to even very small amounts of lead can be harmful, especially to infants and young children, who have considerably higher absorption rates of ingested lead and less effective renal excretion than adults[11,12,13]. Infants and children are at risk because they are vulnerable to the adverse effects of lead on the development of the central nervous system. Other health effects associated with elevated lead exposure include anaemia, kidney toxicity, reproductive and developmental effects.

Health Canada supports reducing dietary lead levels to the lowest possible level[12,18]. This is consistent with the ALARA (as low as reasonably achievable) principle. Given the wide variety of processes, procedures and sources of raw materials, the means of implementing the ALARA principle will be company-specific.

2.2 Rationale

The main objectives of this targeted survey were to generate baseline surveillance data on the level of lead in candy, chocolate, and dried herbs/spices available on the Canadian retail market and to compare levels to previous FSAP reports and other scientific literature.

Candy, chocolate and cocoa powder are commonly consumed by Canadians of all ages. According to Statistics Canada, total sugar intake attributed to candy, chocolate and cocoa powder ranges between 5.3 and 10.3%. Canadian consumption of chocolate was 3.90 kilograms per person per year in 2005[19,23]. A Total Diet Study conducted by the U.S. FDA examined lead levels in 280 food items. Chocolate products analyzed in that study were associated with some of the highest levels of lead[20].

Additionally, those levels were consistent with reports of elevated levels of lead in cocoa by the Cocoa Producer's Alliance, who supply 75% of the world's cocoa beans[21]. A study comparing lead concentrations of cocoa beans grown in Nigeria with finished chocolate products found that lead levels were 60 times higher in finished chocolate products than in the cocoa bean[21]. The contamination of the products was tentatively attributed to environmental contamination from gasoline emissions[22].

Other studies have demonstrated that tamarind seeds, chili, and inks used on candy wrappers may be sources of lead in candies. Out of 140 samples of imported candy (Mexican-style candy) from the U.S. retail market survey, 87.5% were found to exceed the guidance level of 0.1 ppm lead in candy set by the U.S. FDA[15], and the levels of lead in the products were as high as 2.2 ppm. In another study, candy wrappers were reported to contain lead levels reaching 27,125 ppm, and the candy enclosed in these wrappers contained up to 1.17 ppm lead[4]. Leaching of lead from the packaging was suggested as the source of the contamination in these candy products[4]. Candy and chocolate were analyzed in Health Canada's Total Diet Study of trace elements in foods from 1993 to 2007[23]. The levels of lead in these studies ranged from 0.00354 to 0.0239

ppm in candy, and from 0.00892 to 0.01772 ppm[23] in chocolate bars.

The contamination of herbs and spices with lead is also often reported. Although there have been no reports of elevated levels of lead in foods or herbal remedies sold in Canada, media reports and scientific studies have reported on elevated levels in spices[24,25] and in herbal remedies[26,27] sampled in the U.S. and Bulgaria. In some of these cases, the lead levels were high enough to result in temporary illness[5,27]. U.S. authorities recalled turmeric in October 2013 for what they detected to be excessively high levels of lead (between 28 and 42 ppm)[28].

Although spices and dried herbs are not staple foods, they are used as ingredients or flavouring agents in a wide variety of food products. The consumption patterns of spices and dried herbs vary widely by product type and sub-population. Herbs and spices can accumulate metals from lead-contaminated soil or during processing procedures. This can be compounded by the drying process which removes water content and results in increased concentrations of lead.

This survey looks to expand upon previous FSAP surveys for lead in candy, chocolate, cocoa powder, and dried herbs/spices. The data generated has been shared with Health Canada for use in conducting human health risk assessments and in support of Health Canada's work to update Canadian lead tolerances.

2.3 Sample Distribution

The 2012-2013 Lead survey targeted domestic and imported candy, chocolate, herb and spice products. A total of 425 samples were collected from grocery and specialty stores in 11 Canadian cities between April 2012 and February 2013. The 425 samples collected included 148 candy, 134 herbs and spices, 123 chocolate samples, and 20 cocoa powder samples.

The survey samples included 257 imported products (from at least 26 countries), 142 products of unspecified origin, and 26 domestic products. In general, an unspecified country of origin refers to those samples for which the origin could not be determined from the product label or sample information. It is important to note that the products sampled often contained the statement "imported for Company A in Country Y" or "manufactured for Company B in Country Z", and though the labeling meets the intent of the regulatory standard, it does not specify the true origin of the product ingredients. Only those products labeled with a clear statement of "Product of", "Prepared in", "Made in", "Processed in", and "Manufactured by" were considered as being from a specific country of origin.

Table 1. Distribution of samples by product type and origin.

Product type	Number of Samples of Domestic Origin	Number of Imported Samples	Number of Samples of Unspecified* Origin	Total Number of Samples
Candy	18	80	50	148
Chocolate	7	69	47	123
Dried Herb/Spice	1	94	39	134
Cocoa Powder	0	14	6	20
Grand Total	**26**	**257**	**142**	**425**

*Unspecified refers to those samples for which the country of origin could not be assigned from the product label or available sample information

2.4 Method Details

Samples were analyzed by an ISO 17025 accredited food testing laboratory under contract with the Government of Canada. The laboratory used microwave digestion and inductively coupled plasma mass spectroscopy to analyze the samples as sold. The limit of detection (LOD) for lead was 0.001 ppm.

2.5 Limitations

The current targeted survey was designed to provide a snapshot of the levels of lead in candy, cocoa powder, chocolate and dried herb/spice products available for sale in Canada, and had the potential to highlight commodities that warrant further investigation. The limited number of samples analyzed represents a small fraction of the products available to Canadian consumers. Therefore, care must be taken when interpreting and extrapolating these results. Regional differences, impact of product shelf-life, packaging and storage conditions, or cost of the commodity on the open market were not examined in this survey. Country of origin was assigned for most samples based on information provided on the documentation accompanying the sample or indicated on the product label or otherwise designated as “unspecified” if this information was not available.

3 Results and Discussion

3.1 Overview of Lead Results

The diet is a potential source of human exposure to lead as documented by Health Canada. Though lead is not permitted to be added to foods and manufacturers are responsible for measures aimed at reducing the accidental introduction of lead in foods (e.g., from lead solder in steel equipment), lead is expected to be present in foods at very low levels.

Of the 425 samples analyzed for the current survey, 45 samples (11%) did not have detectable levels of lead, while the remaining 380 samples had lead levels ranging from 0.0020 ppm to 4.3874 ppm. Candy samples had both the lowest percentage of samples with detectable lead levels (70%) and the lowest average lead level (0.0129 ppm). Ninety-nine percent of chocolate samples had a detectable level of lead, with an average level of 0.0478 ppm. All samples of both cocoa powder and dried herb/spice samples contained detectable levels of lead and dried herbs/spices had the highest average lead levels (0.3647 ppm). It should be noted that the average lead levels discussed in this report were calculated using only those samples for which lead was detected (i.e. average of the positive results only). See Figures 1, 2, and 3 for visual representations of the distribution of lead levels among product types.

Currently, no maximum level has been established by Health Canada for lead levels in the products tested in this survey, so compliance to a numerical standard could not be assessed. Health Canada's Bureau of Chemical Safety has reviewed the results from this survey and determined that the lead concentrations detected in the current survey did not pose a safety concern. No product recalls were warranted given the lack of a human health concern.

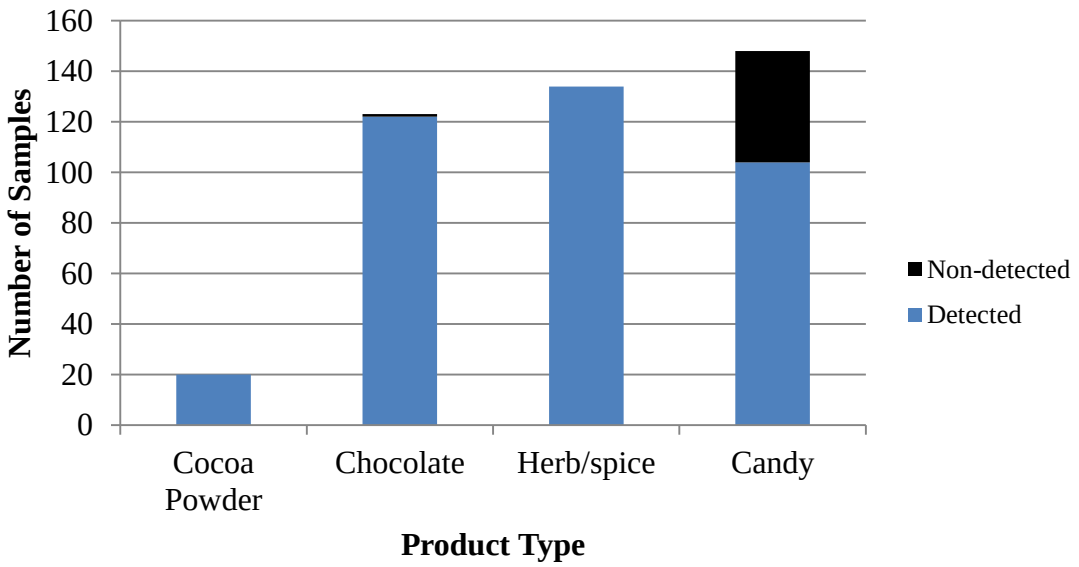
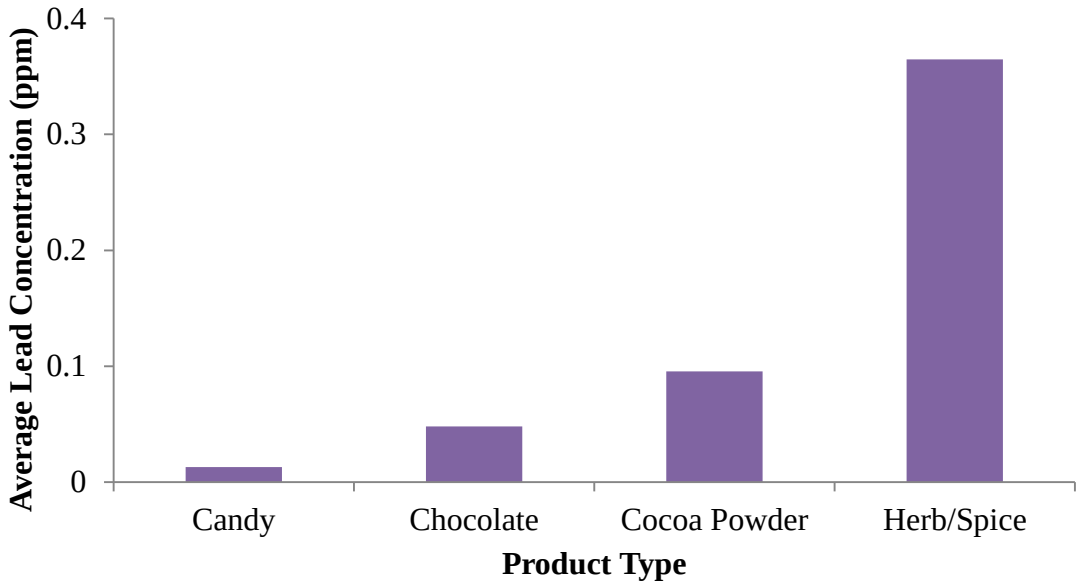
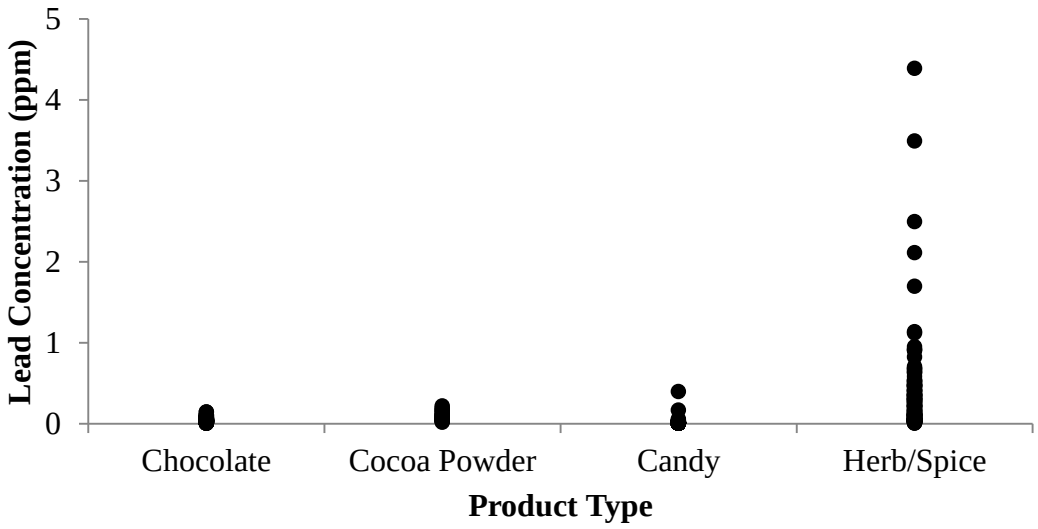


Figure 1. Distribution of samples by product type



*Only the positive results were used to calculate the average lead level

Figure 2. Average lead concentrations by product type (arranged by increasing average lead level)



*Only levels above the limit of detection are depicted in the graph.

Figure 3. Concentration of lead in survey samples by product type

3.2 Candy

A total of 148 domestic and imported candy products were analyzed in this targeted survey. Of these samples, 44 (30%) did not have a detectable level of lead. The remaining 104 samples had lead levels ranging from 0.0020 ppm to 0.3963 ppm.

The candy samples were divided into hard candy (58 samples, e.g. lollipops, mints) and soft candy (90 samples, e.g. jujubes, liquorice, and jelly beans). The minimum, maximum, and average levels of lead in the candy samples tested in this survey are presented in Table 2. On average, the lowest levels of lead were detected in soft candy (0.0108 ppm). The highest maximum (0.3963 ppm) and average (0.0163 ppm) lead levels were detected in hard candy samples. One hard candy sample (candy coated licorice) had a value 7 times higher than the next highest sample See Figure 4 for a visual representation of the distribution of lead levels among the samples grouped under their respected categorical type.

Table 2. Minimum, maximum, and average concentration of lead in candy samples

Candy Type	Number of Samples	Number of Samples with Detectable Levels	Minimum (ppm)	Maximum (ppm)	Average (ppm)
Hard	58	39 (67%)	0.0021	0.3963	0.0163
Soft	90	65 (72%)	0.0020	0.1673	0.0108

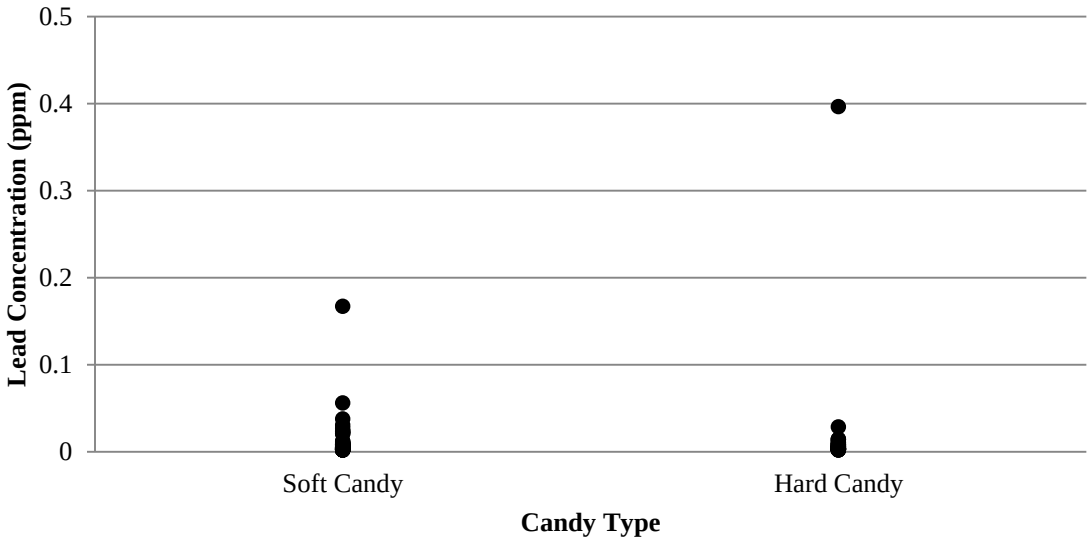


Figure 4. The distribution of lead levels in survey samples

3.3 Chocolate and Cocoa Powder

A total of 123 domestic and imported chocolate products and 20 cocoa powder samples were analyzed in this targeted survey. One sample of milk chocolate did not contain a detectable level of lead, while the remaining 122 samples of chocolate had lead levels ranging from 0.0046 ppm to 0.1433 ppm. All 20 cocoa products had detectable lead levels, which ranged from 0.0142 ppm to 0.2156 ppm.

The chocolate samples were divided into subtypes of milk chocolate (20 samples) and semi-sweet / dark chocolate (103 samples). The minimum, maximum, and average levels of lead in chocolate samples and cocoa powders tested in this survey are presented in Table 3.

Table 3. Minimum, maximum, and average levels of lead in chocolate and cocoa samples (in order of decreasing average levels)

Chocolate Type	Number of Samples	Number of Samples with Detectable Levels	Minimum (ppm)	Maximum (ppm)	Average (ppm)
Cocoa Powder	20	20 (100%)	0.0142	0.2156	0.0954
Semi-Sweet / Dark	103	103 (100%)	0.0059	0.1433	0.0455
Milk	20	19 (95%)	0.0046	0.0184	0.0101

Lead was detected in all types of chocolate. On average, the lowest levels of lead were detected in milk chocolate (0.0101 ppm). The highest average (0.0954 ppm) and maximum (0.2156 ppm) lead levels were detected in cocoa powder. All the results should only be interpreted as cocoa powder available as sold and not as cocoa as consumed. See Figure 5 for a visual representation of the distribution of lead levels among the sample subtypes.

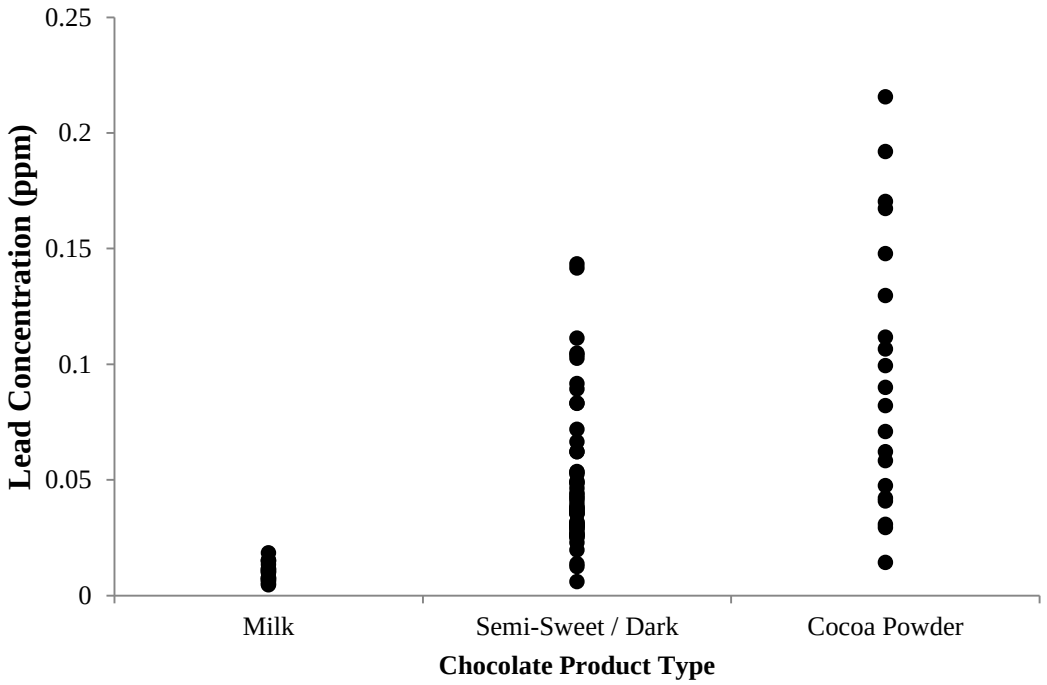


Figure 5. Distribution of lead levels in survey samples (in order of increasing max lead level)

This distribution of lead in chocolate product types is not unexpected as increased lead levels can be related to increased cocoa concentrations. Typically, milk chocolate contains at least 25% cocoa solids and semi-sweet / dark chocolate contains at least 35% cocoa solids.

3.4 Dried Herbs and Spices

All 134 dried herb/spice samples had detectable levels of lead, ranging from 0.0048 ppm to 4.3874 ppm. The dried herb/spice samples were divided into 23 different categories based on the label description. Table 4 presents the minimum and maximum level of lead detected for each category. Samples of onion powder had the lowest average lead concentration, while mint had the highest average lead concentration (4.3874 ppm). See Figure 6 for a visual depiction of the lead distribution among the samples.

Table 4. Minimum, maximum and average concentrations of lead in dried herb and spice samples.

Product Type	Number of Samples*	Minimum (ppm)	Maximum (ppm)	Average (ppm)
Mint	4	0.2165	3.4927	1.2535
Thyme	5	0.4076	2.1111	1.0126
Paprika	7	0.2080	4.3874	1.0091
Ginger	5	0.2981	1.1209	0.6847
Turmeric	7	0.0470	2.4941	0.5559
Basil	6	0.4667	0.7057	0.5480
Oregano	6	0.2978	1.1334	0.5000
Bay Leaves	6	0.1728	0.8237	0.3850
Cardamom	6	0.1003	0.6827	0.3321
Rosemary	5	0.1190	0.4697	0.3307
Parsley	6	0.1345	0.4846	0.2956
Chive	4	0.1212	0.3087	0.2457
Cinnamon	9	0.0268	1.6983	0.2325
Cumin	15	0.0685	0.5304	0.2139
Anise	4	0.0549	0.4110	0.1596
Pepper - Black	5	0.0392	0.3510	0.1368
Dill	4	0.0998	0.1476	0.1329
Pepper - Hot**	9	0.0461	0.2926	0.1264
Garlic	5	0.0146	0.3004	0.0862
Fennel	4	0.0516	0.0985	0.0743
Caraway Seed	5	0.0228	0.1127	0.0557
Coriander	6	0.0048	0.0380	0.0170
Onion	1	0.0084	0.0084	0.0084
Overall	**134**	**0.0048**	**4.3874**	**0.3647**

*All samples had detectable levels of lead

**Includes cayenne and chili powders

The degree of dietary exposure to lead is a function of the lead level in a food, and the rate at which the food is typically consumed (e.g., amount of food per unit time). Consumption rates of herbs and spices are generally low. It is for this reason that herbs and spices, even those with relatively high lead levels, would not contribute significantly to total dietary exposure to lead.

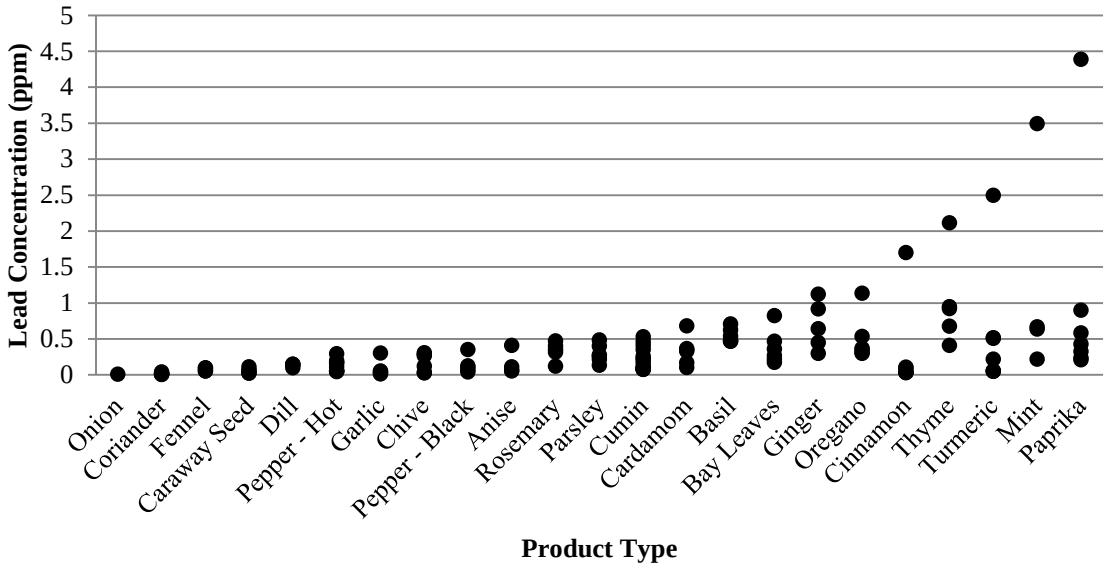


Figure 6. Distribution of lead levels in survey samples for each type of herb and spice (arranged by increasing maximum lead concentration)

3.5 Comparison with previous FSAP results

The 2012-2013 FSAP lead survey generated further baseline surveillance data on the levels of lead in candy, chocolate, cocoa powder and dried herbs/spices. Table 5 provides a summary of lead FSAP survey data for 2011-2012 and 2012-2013.

Table 5. Summary of Lead FSAP survey data for 2011-2012 and 2012-2013

Year	Number of Samples	Number of samples with detectable levels (%)	Minimum (ppm)	Maximum (ppm)	Average (ppm)
Candy					
2012-2013	***148***	***104 (70)***	***0.0020***	***0.3963***	***0.0129***
2011-2012[29]	149	56 (38)	0.01	0.2059	0.0305
Chocolate					
2012-2013	***123***	***122 (99)***	***0.0046***	***0.1433***	***0.0400***
2011-2012[29]	124	99 (80)	0.0101	0.1218	0.0366
Cocoa Powder					
2012-2013	***20***	***20 (100)***	***0.0142***	***0.2156***	***0.0954***
2011-2012[29]	24	24 (100)	0.0222	0.2359	0.0606
Spices					
2012-2013	***134***	***134 (100)***	***0.0048***	***4.3874***	***0.3647***
2011-2012[30]	148	148 (100)	0.0125	8.4760	0.4688

There is a ten-fold difference in the sensitivity of the method between the two survey years. This difference in sensitivity may affect both the percentage of samples with detectable levels and the average lead level. For this reason, comparison will focus on within-year trends and on maximum levels observed.

For both survey years, the percentage of samples with detectable levels of lead was lowest in candy, intermediate in chocolate and highest in cocoa powder and dried herbs/spices. For both survey years, the average lead level increased in the order: candy, chocolate, cocoa powder, dried herbs/spices.

The maximum observed levels of lead are consistent year-to-year for chocolate and for cocoa powder. The level in candy is almost twice as large in the current survey as in the previous survey. In the current survey, the level in dried herbs/spices is about one-half the value in the 2011-2012 survey. The reasons for these differences are not known.

4 Conclusions

The 2012-2013 FSAP lead targeted survey generated baseline data regarding the presence and levels of lead residues candy, chocolate, cocoa powder and a variety of dried herbs /spices available on the Canadian retail market. A total of 425 samples of both domestic and imported origin were collected from 11 cities across Canada.

Forty-five samples (11%) did not have a detectable level of lead. The remaining 380 samples had detectable levels of lead ranging from 0.0020 ppm to 4.3874 ppm. All cocoa powder and samples of dried herbs/spices contained detectable lead levels. Dried herbs/spices also had the highest maximum level detected in a paprika sample (4.3874 ppm). Ninety-nine percent of the chocolate samples contained measurable levels of lead and a maximum lead concentration of 0.2156 ppm. Candy showed the lowest percentage of samples with detectable lead levels at 72%. Compliance with a numerical maximum level was not evaluated in this survey as none have been established by Health Canada for lead levels in candy, chocolate, cocoa powder and dried herbs/spices.

All data generated were shared with Health Canada's Bureau of Chemical Safety for use in performing human health risk assessments. The levels of lead found in the various candy, chocolate, cocoa powder and dried herb/spice products tested in this survey were unlikely to pose a safety concern. No product recalls were warranted given the lack of health concern.

In the case of lead, the Government of Canada recognizes that there can be multiple sources that account for the presence of lead in food. Whether from natural or man-made sources, all food industries are expected to minimize the presence of lead by any and all processes available to them. This is consistent with the ALARA (As Low As Reasonably Achievable) principle. Given the wide variety of processes, procedures and sources of raw materials, the means of implementing the ALARA principle must be company-specific.

5 Appendix A

Summary of regulations, maximum levels, and guidelines for lead in selected commodities

Commodity	Country/Organization	Lead (ppm)
Fresh herbs	European Union (EU)[31]	0.10
Dried herbs	Ireland[32]	10
Ground, dried spices	Ireland[32]	20
Other spices, not ground	Ireland[32]	10

6 References

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