Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Children's Food Project

Report on Sampling 2007-2008

RDIMS # 1789613-v5

Chemical Evaluation | Évaluation chimique
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Executive Summary

The main objectives of the 2007-2008 Children's Food Project were:

- to assess the compliance status for pesticide residues in foods consumed by children aged 3 to 15 years;
- to sample ethnic foods;
- to provide data to Health Canada that can be used for risk assessment of foods consumed by children.

In the 2007-2008 Children's Food Project, a total of 836 processed food samples were purchased in the Ottawa area. The samples included a variety of grain products, dairy products, processed vegetable and fruit products, prepared lunches/dinners and honey. All samples were obtained from grocery stores; specifically, one national chain (including organic and kosher products) and a number of smaller ethnic grocery stores (Chinese, Indian, Latin American and Middle Eastern). The samples were analyzed for pesticide residues and metals. A total of 2 199 analytical tests were performed.

Samples were analyzed for pesticide residues using a multi-residue method that detects 300 individual carbamate, organochlorine and organophosphate compounds. Specific single-residue analysis methods were used to detect alar, amitraz, and ethylene thiourea (ETU). Samples were also analyzed for metals using an analytical method that detects 15 different metals – aluminum, arsenic, boron, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, selenium, tin, titanium, and zinc.

Of the 836 samples tested, 621 (74.3%) contained no detected pesticide residues. The remaining 215 samples (25.7%) had detected levels of pesticide residues, with 36 (4.3%) containing more than one chemical residue type. Of the 215 samples with detected pesticide residues, 12 (1.4% of all samples) contained a pesticide residue in excess of its Maximum Residue Limit (MRL) and were therefore in violation of paragraph 4(d) of the *Food and Drugs Act* (FDA). None of the violative pesticide residues were found to pose a human health risk. The majority of samples tested for pesticide residues (greater than 98.6%) were in compliance with Canadian MRLs.

The 836 samples were also analyzed for metals. Many of the metals analyzed occur naturally in food and are essential nutrients. Increased levels of metals such as aluminum, copper and tin may occur in food as a result of their use 1) as food additives, 2) as components of pesticides and 3) in food processing. Heavy metals that may pose a health risk include arsenic, cadmium, mercury and lead. The levels of most metals detected in this study were below established guidelines. Higher than expected arsenic levels were found in several rice products. Health Canada provided a health risk assessment to CFIA indicating that the arsenic levels detected did not pose a health risk to Canadian children (including sensitive populations).

1 Introduction

The use of agricultural chemicals has created lively public debate concerning the impact of these chemicals on the health of Canadians. Canadians have been encouraged by governments and the health care community to eat a more wholesome and nutritious diet. In general, the public has embraced this recommendation and has demonstrated a willingness to increase consumption of fresh fruits, vegetables, and grains as one way to improve personal health. This willingness is due in part to the unprecedented availability of these commodities year-round, made possible by an intricate network of farmers, commodity handlers, importers, food processors and retailers.

One approach to increase the availability of fresh commodities is through the selective use of pesticides and other agricultural chemicals. These chemicals increase yield, expand the geographical regions in which crops can be grown, extend shelf life and improve the appearance of many foods. However, a consequence of using agricultural chemicals during food production is that some foods may contain chemical residues, which may be of concern to Canadian consumers.

All foods contain metals as they are ubiquitous in nature. Exposure of the raw food commodity to metals in the environment may contribute to higher levels present in processed foods. Metals may result from pesticide applications (copper), constituents of pesticides and fertilizers. Metals may also be components of food additives, food processing aids, and vitamin preparations and are used for mineral fortification of foods.

As all Canadians are potentially exposed to chemical residues through the foods they consume, the question arises as to how much of these compounds are present and whether these levels are safe for different segments of the population such as the average Canadian adult, senior or child.

Two federal organizations share the responsibility for regulating the levels of chemical residues in food. Health Canada's Pest Management Regulatory Agency (PMRA) is responsible for 1) registering pesticides that can be used domestically and 2) establishing Maximum Residue Limits (MRLs) for pesticide residues in foods, whether grown domestically or imported into Canada. Health Canada is also responsible for setting MRLs and tolerances for other agricultural chemicals such as metals and veterinary drug residues. The role of the Canadian Food Inspection Agency (CFIA) is to verify compliance with these MRLs. Through monitoring programs and special surveys, the CFIA acquires incidence information and specific residue information or data on particular commodity/chemical residue combinations.

The main program used by the CFIA to monitor the compliance of the food supply for chemical residues is the National Chemical Residue Monitoring Program (NCRMP) <http://www.inspection.gc.ca/english/fssa/microchem/chemchime.shtml>. Under this program, the CFIA monitors fresh fruits and vegetables, processed products and foods of animal origin for compliance with established limits for agricultural chemical residues including pesticide residues, veterinary drug residues, metals and environmental contaminants. The NCRMP has been in place since 1978, when Agriculture Canada

initiated a modest sampling program. It is now part of the CFIA's core activities, with millions of dollars per year in funding. The NCRMP produces essential residue information demonstrating that the Canadian food supply is safe.

The results obtained from monitoring and surveys are compared to the applicable standards established by Health Canada at the time of sampling. The following resources are used for assessment:

- for pesticides (excluding ethylene thiourea), MRLs were established and regulated under the Pest Control Products Act (PCPA) and can be found on Health Canada's *Consumer Product Safety* website http://www.hc-sc.gc.ca/cps-spc/pest/protect-proteger/food-nourriture/mrl-lmr-eng.php;
- for ethylene thiourea, fruits, vegetables and cereals are not adulterated by reason only that they contain 0.05 ppm or less [Division 1 (General) of the Food and Drug Regulations (FDR)];
- all detected pesticide residues that lack specific MRLs must be in compliance with the Canadian general MRL of 0.1 ppm;
- for metals, tolerances and MRLs found in the various divisions of the FDR (i.e. Division 15 (Adulteration of food), Division 16 (Food additives), etc...).

As part of the "Building Public Confidence in Pesticide Regulation and Improving Access to Pest Management Products" initiative, the CFIA receives additional funding to undertake limited monitoring of pesticides in foods consumed by children. The general objective of the Children's Food Project is to ensure continued compliance of pesticide residues in children's foods, with specific aims to:

- gather data to identify any potential pesticide residues in children's foods
- identify foods representing a potential health risk from pesticide residues
- determine compliance with pesticide residue MRLs
- determine compliance with metal tolerances and MRLs

1.1 Summary of past Children's Food Projects

In January 2003, the CFIA initiated the "Young Children's Food Chemical Residues Project" to test children's foods for pesticide residues. The focus of the 2003 project was on foods consumed by very young children up to the age of 18 months. The foods tested in this project were in compliance 99.76% of the time. A project carried out in 2004 expanded the scope of its testing to include other agricultural chemicals such as metals and some veterinary drug residues in foods targeted at children between the ages of 2 and 10 years. The foods tested in the 2004 study were all in compliance (100%) with Canadian regulations.
The 2004-2006 report (<http://www.inspection.gc.ca/english/fssa/microchem/resid/2003-2004/todenfe.shtml> was aimed at foods consumed by children aged 6 months to 15 years of age. The compliance rate observed in the 2004-2006 survey was 98.8%. The 2006-2007 project <http://www.inspection.gc.ca/english/fssa/microchem/resid/2006-2007/babrese.shtml> focused on foods consumed by the same age groups as in 2004-

2006 (6 months to 15 years) but sampled different types of foods, as the range of foods available for this age group is very large. The compliance rate observed was 100%.

A summary of the different food categories examined in the 2007-2008 project can be found in Appendix A.

1.2 The 2007-2008 Children's Food Project considerations

1.2.1 General considerations

Food can be broken down into three major categories: 1) fresh fruit and vegetables; 2) foods of animal origin, such as meat, honey and dairy products, and 3) manufactured foods, such as canned food, cereals, beverages, dried foods, etc. In the NCRMP, emphasis is on foods of animal origin and on the raw agricultural product (i.e., "the apple"), which is analyzed as the unwashed, whole unpeeled, raw commodity. Alternatively, the Children's Food Project collects information on chemical residue levels in manufactured foods frequently consumed by children (e.g., apple juice and apple bars). Manufactured foods are also the focus of targeted surveys under the Food Safety and Consumer Action Plan <http://www.healthycanadians.ca/pr-rp/plan_e.html>. Together, the data from these programs help health authorities assess the potential exposure of children to agricultural chemicals.

The multitude of foods available and targeted at children, as well as the different consumption patterns of children of different age groups, makes it impossible for the CFIA to test all of the different foods every year. This program, therefore, focuses on the foods consumed by different age groups in different years.

1.2.2 International initiatives

The USDA has established a specialized pesticide residue program entitled the Pesticide Data Program (PDP). Through cooperation with state agriculture departments and other federal agencies, PDP manages the collection, analysis, data entry and reporting of pesticide residues on agricultural commodities in the US food supply, with an emphasis on commodities highly consumed by infants and children. The PDP policy is guided by the requirements of the 1996 Food Quality Protection Act and by recommendations made in 1993 by the US National Academy of Sciences in Pesticides in the Diets of Infants and Children. The latest PDP report, published in 2008, summarizes the data collected in 2007 http://www.ams.usda.gov/science/pdp/.

In the European Union, the sampling of children's foods is carried out as part of regular monitoring programs at either the community level or within individual member states. For instance, the United Kingdom's Pesticide Residues Committee (PRC) measures the UK food supply for its level of compliance with EU MRLs. The targeted pesticides and commodities and the sampling program are defined by the EU <http://www.pesticides.gov.uk/prc_home.asp >. The PRC publishes quarterly reports of its findings.

1.2.3 Analytical methods

To analyze the large number of samples whose pesticide treatment history is generally unknown, the CFIA uses analytical methods capable of simultaneously determining a number of pesticide residues. These multi-residue methods (MRMs) include pesticides banned in Canada, pesticides that have established Canadian MRLs and pesticides with no established MRLs. The most commonly used MRMs, specifically, the CFIA's gas chromatography/mass spectrometry (GC/MS) and high performance liquid chromatography (HPLC) - fluorescence detection methods, can also detect many metabolites, impurities and alteration products of pesticides. It is important to note that although a pesticide may not be registered for use domestically, residues may be present in imported foods.

There are many chemicals used in agriculture not currently detected by MRMs currently in place. Single-residue methods (SRMs) or selective MRMs are used to detect chemicals excluded from MRMs. An SRM usually determines one analyte while a selective MRM measures a small number of chemically-related residues. SRMs are usually more resource- and cost-intensive per residue test.

To become accredited, an analytical method must: a) be relevant for its intended purpose and b) meet certain validation parameters. Typical validation characteristics considered include:

- recovery
- selectivity
- specificity
- accuracy
- linearity/range
- precision
- repeatability/reproducibility
- limit of quantitation (LOQ)
- limit of detection (LOD)

The LOD and LOQ parameters can be adjusted to suit the purpose of the study. Maintaining a low LOQ and LOD requires considerable effort on the part of the analytical laboratory. Consequently, the elevated cost associated with increased sensitivity must be balanced with the objectives of the program. The CFIA's primary mandate is to ensure compliance with established MRLs and as such, the methods used in this study cannot be directly compared to methods used in total diet studies published by Health Canada and the United States Department of Agriculture (USDA).

1.2.4 Limitations of the current study

The CFIA's Children's Food Project was designed to be a case study. It was not designed to gather statistically valid information on the type and levels of chemical residues and metals in children's foods. This would require many more samples, which would either

substantially increase costs or greatly reduce the range of foods that could be sampled in a given year.

Due to the limited scope of this study and the limitations of the design, no association between the number of samples taken of a particular food and the relative importance of this type of food in the typical diet can be made. No statistical methods were used to establish a sampling plan that takes into consideration the prevalence of a food available (e.g., apples) to the different samples obtained (e.g., the different types of fruit bars containing apples) as an ingredient.

No particular product was targeted and samples were picked at random. They represent a snapshot of the foods available in stores during a particular period of the year. The sampling plan was not designed to capture the seasonality of available products and no distinctions were made between different brands. Each sample was unique and few duplicate samples were tested. The results from the survey should not be taken as an indication of the compliance of any particular product or brand.

The results of this case study should not be directly compared to the results of the US PDP or the UK PRC described above in section 1.2.2. The aims of those programs differ from the information in this report in several ways, including:

- choice of pesticide residues and contaminants investigated;
- nature of the sampling protocol: random vs. targeted;
- methods used, MRM vs. SRMs;
- analytical performance, such as the LOD;
- degree of preparation of the food (i.e., washing, peeling or cooking).

2 Design of the 2007-2008 Children's Food Project

2.1 Objectives

The overall objective of the 2007-2008 Children's Food Project was to:

- estimate pesticide exposure and to assess the compliance status for pesticide residues in foods consumed by children aged 3 to 15 years, with a focus on ethnic food;
- collect residue data for foods consumed by children for risk assessment purposes.

2.2 Sampling/testing in 2007-2008 Project

As a result of the previous Children's Food Chemical Residue surveys, the 2007-2008 Children's Food Project integrated various changes to sampling and testing. Samples were purchased from one national grocery store (including the organic and kosher food samples) and from five ethnic grocery stores (Chinese, Indian, Latin American, Middle Eastern and Turkish). All stores were located in the Ottawa area. The number of samples purchased from each grocery store was related to the variety of products and/or brands

available and it does not reflect the relative demographic composition of or the relative amounts of food consumed by Canadian children.

New items for the 2007-2008 survey include: mixes for baked goods (cakes, muffins, brownies, pancakes); dairy products (yogurt and cheese); dried fruits; fruit snacks; crackers; dry pasta; prepared spaghetti sauces; prepared canned spaghetti; snack bars; breakfast cereals; chips; soups and foods available mainly in ethnic markets.

2.3 Criteria for inclusion

The 2007-2008 Children's Food Project was designed to provide a snapshot of the foods consumed by Canadian children aged 3-15 years, including children that may consume foods traditionally sold in ethnic markets. Meat-containing foods and fresh fruits and vegetables were excluded from the study as these commodities are well-represented by routine monitoring and by directed sampling programs. The focus was placed on processed fruit and vegetable products, grain-, and dairy-based products. Ethnic foods were included into the survey if they were representative of a cultural staple food or food geared towards children (i.e. packaging).

2.4 Survey details

A list of food groups aimed at younger consumers was created and a number of food categories were identified. The samples analyzed in this report were available on retail shelves during the period of November and December 2007. They included traditional foods, as well as foods specifically labelled organic. Both domestic and imported foods were sampled. Of the 836 samples analyzed in the 2007-2008 survey, 293 domestic were manufactured in Canada and 543 were imported.

The samples were packaged in a variety of formats: foil pouches, cans, boxes, cartons, bags, and glass. They were fresh, frozen, refrigerated or shelf-stable products.

Figure 1 below illustrates the number of different samples for each targeted food group in the study. As mentioned above, this distribution does not reflect the relative share of these commodities in the Canadian diet. Figure 2 illustrates a further breakdown of the survey samples within each major food group into more specific food categories.

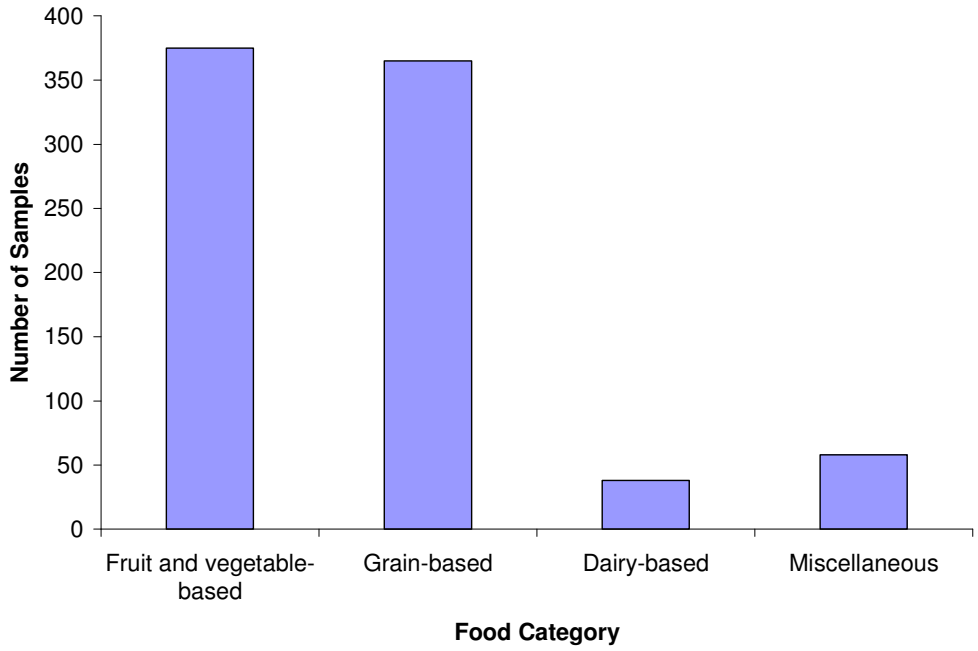

Figure 1 Number of samples in each food group category

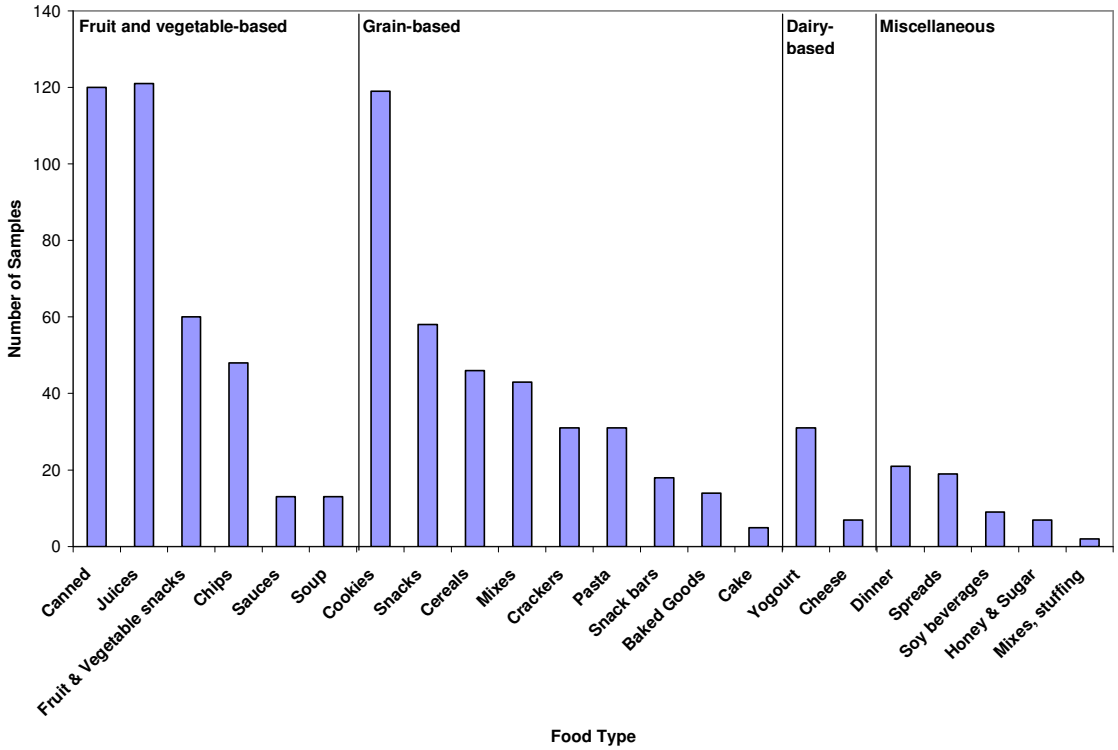

Figure 2 Further breakdown of food categories used in study

2.5 Specifics of the analytical methods used

Sample analyses in the Children's Food Project were performed by a third party laboratory. While the contract laboratory was not required to use CFIA methodologies, methods used must have third party accredited standard operating procedures (SOPs) and meet the minimum LODs, LOQs and reporting limits set out by the CFIA.

2.5.1 MRM - Pesticides

The MRM used by the contract laboratory in this study for pesticide residue analysis in processed products had to meet or exceed the requirements of the CFIA reference method entitled 'Determination of Pesticides in Honey, Fruit Juice and Wine (With Solid Phase Extraction Clean-Up and GC/MSD and HPLC Fluorescence Detection)'. The scope of this method included 300 pesticide residues (listed in Appendix B). The LOQ in the CFIA reference method is 0.010 ppm for carbamates and between 0.017 ppm - 0.034 ppm for all other pesticides. The MRM used by the contract laboratory for pesticide residue analysis in dairy products had to meet or exceed the requirements of the CFIA reference method entitled 'The Determination of Organochlorine Pesticides and Polychlorinated BiPhenyls PCB's in Dairy, Raw Milk, Egg and Egg Products by GC/ECD'. The limits of quantitation range from 0.01 ppm to 0.05 ppm. Table B-2 in Appendix B lists all of the pesticide analytes included in the third party laboratory method.

2.5.2 MRM - Metals

The CFIA does not provide a reference method for multi-metals analysis. However, third party laboratories must meet the minimum LODs for metals specified by the CFIA. These can be found in Appendix C. The following metals have minimum LOD requirements: aluminum, arsenic, boron, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, selenium, tin, titanium and zinc.

2.5.3 SRM - Pesticides

There were relatively few single residue tests performed in the Children's Food Project. The CFIA-validated SRM LODs and LOQs for alar, amitraz, and ethylene thiourea (ETU) are outlined in Appendix D.

2.6 Analysis summary

Table 1 shows the distribution of analytical tests performed on the 836 samples in the 2007-2008 Children's Food Project.

Table 1 Number of analytical tests performed in Children's Food Project

Food Category	Tests				
	Alar	**Amitraz**	**ETU**	**Metals**	**Pesticide *MRM**
Fruit and vegetable-based	177	177	173	375	375
Grain-based	-	-	-	365	365
Dairy-based	-	-	-	38	38
Miscellaneous	-	-	-	58	58
Total	177	177	173	836	836

*** MRM can detect the 300 pesticide residues listed in appendix B.**

3 Results and Discussion

3.1 General discussion

The results obtained in this case study are presented graphically below. The supporting information is available in tabular form in the different appendices.

When discussing the results of this study, it is important to remember the limitations for determining the origin of the chemical species analyzed. The application of pesticides to a food crop is a deliberate action whereas the presence of metals in food can be the result of multiple processes, including: 1) endogenous levels 2) plant exposure from natural sources like soil and water and 3) direct addition (as a pesticide or component of a pesticide product, a food additive or from food fortification). No distinction or conclusions can be made in the discussion of the results regarding the origin of the metal tested (i.e., if the food was fortified with minerals and vitamins).

3.2 Results for pesticide residues

3.2.1 Distribution of residues

Figure 3 illustrates the distribution of samples found to contain no detected pesticide residues, non-violative residue levels (detected residues that are at or below the MRLs) and violative residue levels (detected residues that exceed the MRLs at the time of analysis).

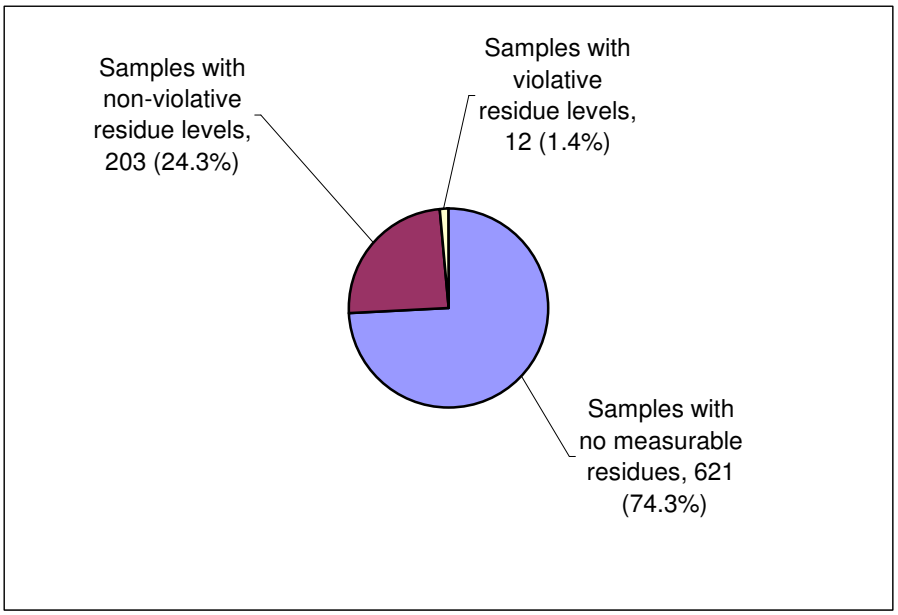

Figure 3 Distribution of sample analysis results

A total of 1 363 tests for pesticide residues were carried out on 836 samples. A total of 215 samples (25.7%) contained detected residues of at least one pesticide residue. Of the 215 samples with detected residues, 12 samples (1.4% of all samples) were in violation of the general MRL. The overall compliance rate was 98.6%. This is comparable to the overall compliance rates for the NCRMP in the last five years. The results also indicate that there are similarities between the compliance rates for domestic and imported children's foods (99.7% for domestic products, 98.0% for imported products).

The 2007-2008 Children's Food Project included samples from 45 countries. The observed pesticide residue results are not considered indicative of the pesticide residues for all foods imported from these various countries. Table 2 presents a summary of the pesticide testing results by sample origin. Included in the summary are the total number of samples, the number of 'positive' samples (samples with one or more detected residue), the number of violations observed and the compliance rate. Of the 45 countries of origin of the samples tested, 27 had detected pesticide residues. Seven countries exhibited quantifiable residues in all samples tested and 18 countries had no samples with detected residues.

The highest violation rates were associated with smaller (i.e. France and Croatia) sample size countries, however, no firm conclusions can be made about compliance rates for these countries. It is noteworthy that no country of origin could be assigned to 63 samples ("unknowns"), accounting for 6.51% of the positive samples and 8.3% of the violations. Care should be used when interpreting country-specific overall compliance rates in Table 2 as sample size varies among countries.

Table 2 Distribution of residues by sample origin

Sample origin	Number samples	Number positive samples	Positive samples (% total)	Number violations	% Overall compliance
Algeria	1	0	0.0	0	100
Argentina	7	0	0.0	0	100
Australia	1	0	0.0	0	100
Belgium	2	0	0.0	0	100
Brazil	1	0	0.0	0	100
Bulgaria	5	3	60.0	0	100
Canada	293	65	22.2	1	99.7
Chile	1	0	0.0	0	100
China	19	0	0.0	0	100
Colombia	5	0	0.0	0	100
Costa Rica	1	0	0.0	0	100
Croatia	1	1	100	1	0.0
Dominican Republic	1	0	0.0	0	100
Ecuador	3	1	33.3	0	100
Egypt	13	1	7.7	0	100
El Salvador	1	0	0.0	0	100
France	1	1	100	1	0.0
Greece	5	5	100	0	100
Hong Kong	7	2	28.6	0	100
India	28	5	17.9	1	96.4
Iran	9	1	11.1	1	88.8
Italy	20	11	55.0	0	100
Japan	1	0	0.0	0	100
Korea	5	0	0.0	0	100
Lebanon	50	6	12.0	0	100
Malaysia	13	8	61.5	1	92.3
Mexico	28	10	35.7	1	96.4
Morocco	1	0	0.0	0	100
Peru	1	1	100	0	100
Poland	3	2	66.7	0	100
Portugal	1	1	100	0	100
Saudi Arabia	14	9	64.3	1	92.8
Slovenia	1	0	0.0	0	100
South Africa	3	3	100	0	100
Spain	6	3	50.0	2	66.6
Switzerland	1	0	0.0	0	100
Syrian Arab Republic	7	0	0.0	0	100
Taiwan	10	1	10.0	0	100
Thailand	36	19	52.7	0	100
Tunisia	3	0	0.0	0	100

Sample origin	Number samples	Number positive samples	Positive samples (% total)	Number violations	% Overall compliance
Turkey	21	6	28.6	0	100
United States	131	30	22.9	0	100
United Arab Emirates	1	1	100	0	100
United Kingdom	8	4	50.0	1	87.5
Unknown	63	14	22.2	1	98.4
Vietnam	3	1	33.3	0	100
Total	**836**	**215**	**25.7**	**12**	**98.6**

Approximately 4.3% of all samples had more than one detected pesticide residue. Of the 215 samples with detected pesticide residues, 27 of the samples had two different residues, eight samples had three different residues and one sample had four different residues (see Appendix E). The distribution of samples with detected residues is illustrated in Figure 4.

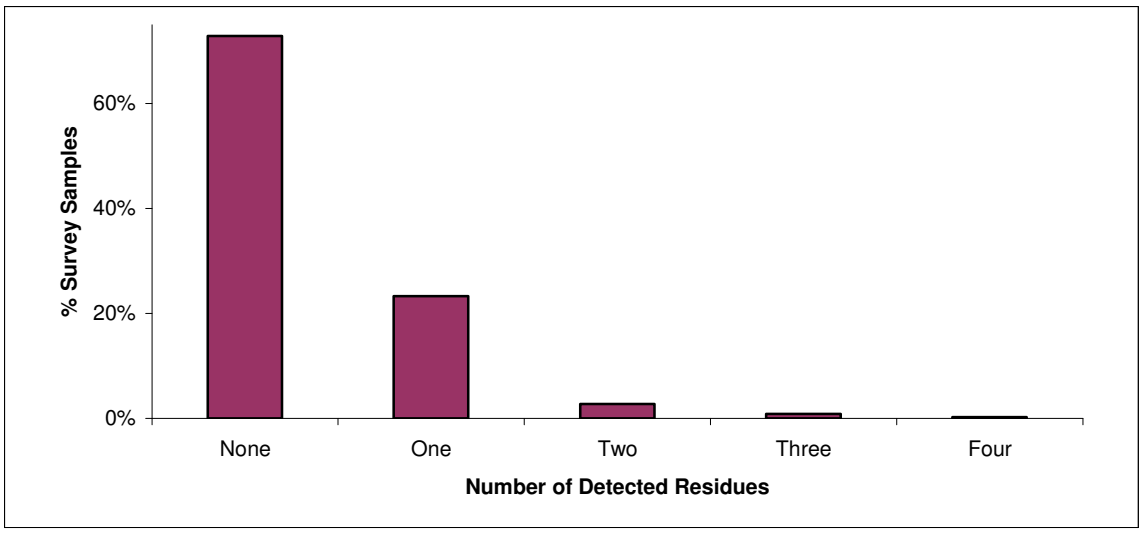

Figure 4 Distribution of samples with one or more detected residues

Table F-1 in Appendix F lists the details of the samples that contain more than one distinct pesticide residue, including the country of origin. The majority of samples with multiple pesticide residues were found in fruit-based snacks (canned apples, dates, dried fruit, and raisins), cookies, chips and juices. The data in Table 3 indicate that the highest rate of compliance is associated with dairy-based products.

Table 3 Distribution of pesticide residues by food category

Food category description	Number samples	Number positive samples	% positive samples	Number violations	% compliance
Fruit and vegetable-based	375	114	30.4	4	98.9
Grain-based	365	94	25.8	7	98.1
Dairy-based	38	38	0.0	0	100
Miscellaneous	58	7	12.1	1	98.3

3.2.2 Discussion of specific results from this survey

The following food types had no detected pesticide residues:

- baked goods
- yogurt
- cheese
- cake
- honey
- soy beverages
- mixes for desserts, pancakes and baking

The nature of the pesticide residue observed in the different food categories is presented in Table 4. The results in Table 4 indicate that the majority of the pesticide residues were found in cookies, canned fruit and vegetables, juices and fruit snacks. The most commonly detected analytes were the following: *o*-phenylphenol (48), pirimiphos-methyl (37), malathion (31), captan (25), and chlorpropham (12).

Table 4 Pesticide residues found by food type

Specific food type	Number of samples	Number of positive samples	*Number of residues detected	Detected residues, (# of samples with detected residues)
Canned Fruits and Vegetables	120	37	39	Captan, chlorpyrifos (2), endosulfan, ethion (2), ethylene thiourea, *o*-phenylphenol (27), permethrin, pirimiphos-methyl, profenofos and triaziphos (2)
Juices	121	34	43	*o*-phenylphenol (6), captan (16), carbaryl (2), chlordane trans, diphenylamine (2), ethylene thiourea (3), fenbuconazole, imazalil, malathion (8), o,p'-DDD (o,p'-TDE), o,p'-DDT, propargite
Fruit Snacks	60	22	32	*o*-phenylphenol (5), bromopropylate (3), captan (6), chlorpyrifos, cypermethrin (3), cyprodinil, dicofol, diphenylamine (2), esfenvalerate, ethion, fenvalerate, fludioxonil, imazalil, iprodione, malaoxon, malathion (2), pirimicarb
Chips	48	17	24	Chlorpropham (11), dieldrin , diphenylamine, ethion (2), malathion, *p,p'*-DDE (6), *o*-phenylphenol, pirimiphos-methyl
Sauces	13	1	1	*o*-phenylphenol
Soup	13	3	3	Chlorpropham, *o*-phenylphenol, piperonyl butoxide
Cookies	119	48	59	*o*-phenylphenol (2), biphenyl, bromopropylate, captan, chlorpyrifos (6), chlorpyriphos-methyl, dicofol, diphenylamine, ethion, fenitrothion (6), imazalil, malathion (9), myclobutanil, p,p'-DDE, piperonyl butoxide (4), pirimiphos-methyl (21), procymidone
Snacks	58	17	18	Biphenyl (4), malathion (3), p,p'-DDE (2), piperonyl butoxide (4), pirimiphos-methyl (5)
Cereals	46	5	6	Captan, malathion (2), diphenylamine, chlorpyriphos-methyl, dichlorvos
Mixes	43	4	4	Chlorpyriphos-methyl (2), malathion, piperonyl butoxide
Crackers	31	9	12	Chlorpyrifos, chlorpyriphos-methyl, ethion, malathion, metalaxyl, pirimiphos-methyl (7)
Pasta	31	8	8	*o*-phenylphenol (3), malathion (3), pirimiphos-methyl (2)
Snack Bars	18	3	4	Diphenylamine (3), malathion
Baked Goods	14	0	0	-
Cake	5	0	0	-
Yogurt	31	0	0	-
Cheese	7	0	0	-
Dinner	21	3	3	Biphenyl, fenpropathrin, *o*-phenylphenol
Spreads	19	3	4	Myclobutanil, *o*-phenylphenol, triadimenol, piperonyl butoxide
Soy Beverages	9	0	0	-
Honey	7	0	0	-
Mixes, Stuffing	2	1	1	Azoxystrobin
Total	836	215	261	-

*Note 1: As a food item may be contaminated with more than one type of residue, the number of analytes detected could exceed the number of positive samples.

There were a total of 12 residue violations in 836 samples. These included: 2-phenylphenol (*o*-phenylphenol) (1), dicofol (1), ethion (1), fenitrothion (1), fenvalerate (1), malathion (1), pirimiphos-methyl (5) and triadimenol (1). All of the violations are due to pesticide residue levels exceeding the general 0.1 ppm MRL. Table 5 summarizes all of the violations in the 2007-2008 Children's Food Project.

Table 5 List of pesticide violations in 2007-2008 Children's Food Project

Sample #	Sample type	Origin	Program	Analyte	Amount (ppm)	Description of violation
CF0682	COOKIES	Mexico	Pesticides-MRM	2-phenylphenol	0.138	Exceeds general MRL
CF0653	DATES	Saudi Arabia	Pesticides-MRM	Dicofol	0.297	Exceeds general MRL
CF0486	VEGETABLE, CANNED	India	Pesticides-MRM	Ethion	0.270	Exceeds general MRL
CF0458	COOKIES	Malaysia	Pesticides-MRM	Fenitrothion	0.105	Exceeds general MRL
CF0730	RAISINS	Iran	Pesticides-MRM	Fenvalerate	0.151	Exceeds general MRL
CF0658	DATES	Unknown	Pesticides-MRM	Malathion	0.954	Exceeds general MRL
CF0839	COOKIES	Croatia	Pesticides-MRM	Pirimiphos-methyl	0.109	Exceeds general MRL
CF0831	CRACKERS	United Kingdom	Pesticides-MRM	Pirimiphos-methyl	0.132	Exceeds general MRL
CF0846	COOKIES	France	Pesticides-MRM	Pirimiphos-methyl	0.152	Exceeds general MRL
CF0830	CRACKERS	Spain	Pesticides-MRM	Pirimiphos-methyl	0.239	Exceeds general MRL
CF0677	COOKIES	Spain	Pesticides-MRM	Pirimiphos-methyl	0.343	Exceeds general MRL
CF0805	SPREAD	Canada	Pesticides-MRM	Triadimenol	0.127	Exceeds general MRL

Most of the foods that were sampled in this survey are processed or manufactured foods that contain multiple ingredients. In these cases it is not possible to determine which of the ingredient(s) is responsible for the presence of the pesticide residue and therefore it is not possible to trace back any of the observed pesticide residues to one or more specific ingredient(s).

3.2.3 Conclusions

The overall compliance rate for domestic and imported children's foods is high (99.7% for domestic products and 98.0% for imported products). No pesticide residues were detected in baked goods, yogurt, cheese, cake, honey, soy beverages and mixes (for desserts, pancakes and baked goods). Most of the detected but compliant levels of pesticide residues were found in fruit snacks, cookies, chips and juices. Five of the violations resulted from pirimiphos-methyl residues in grain-based products. Of the samples that contained multiple pesticide residues, none had pesticide violations. All of the violations were due to pesticide residue levels exceeding the general 0.1 ppm MRL.

A direct comparison between the results of this survey and those obtained in the NCRMP from 2007-2008 is limited by the nature of the sampling strategy used in this survey (i.e. much smaller overall sample size, different distributions of domestic and imported products, and the sampling of finished grain products which is not normally performed in the NCRMP). However, the following general conclusions can be made:

- the compliance rate for pesticide residues observed in this study is similar to the compliance rates observed in the NCRMP for the past five years;
- the residues observed in both domestic and imported samples are very similar;
- Pirimiphos-methyl residue levels were found in the Children's Food Project, but are rarely detected in the NCRMP (pirimiphos-methyl is used in stored cereal grains in the US[1]);
- Malathion, captan, pirimiphos-methyl, and *o*-phenylphenol were the most commonly detected pesticide residues. In almost all cases the levels detected were in compliance with Canadian regulations.

3.3 Results for metals

3.3.1 Background

Although some metals occur in food naturally, they may also be present in food as a result of agricultural chemical use, environmental contamination, or from the use of processing aids and nutritional supplementation. Metals such as chromium, copper, iron, manganese, selenium and zinc are essential minerals required for good health. While inadequate amounts of an essential mineral in the diet can be detrimental to human health, high levels of these metals may result in toxic effects. Metals of particular concern to human health include arsenic, cadmium, lead and mercury.

Ongoing lead exposure can lead to anaemia, kidney toxicity and may result in damage to the central nervous system and brain. Young children and the developing foetus are most susceptible to lead toxicity. Health effects from mercury exposure will vary depending on the chemical form. Elemental mercury, when inhaled, can cause damage to the respiratory tract, mouth and lungs. Inorganic mercury may cause gastrointestinal and kidney damage. Ongoing exposures to organic mercury compounds, such as methyl mercury, can be detrimental to a child's developing brain and sensory changes are observed in both children and adults. Arsenic is considered a human cancer-causing agent. Ongoing exposure can lead to cardiovascular and circulatory effects.[2] Cadmium exposure (namely inorganic cadmium) can produce adverse health effects on the kidney, stomach and bones. Cadmium may also play a role in human carcinogenesis and hypertension[3].

Children's foods may contain metals originating from a variety of sources. Metals can be deliberately applied to food crops as components of pesticide formulations or as a pesticide itself (i.e., copper). These agricultural chemicals are regulated and monitored in the same way as pesticides. Metals may result from food processing or from the addition of food additives. Canned foods tend to have higher levels of metals (i.e. tin and nickel). Food may also become contaminated with toxic metals from fertilizers. Moreover,

metals in children's food may result from environmental contamination. Many toxic metal species can result from industrial waste and persist in the environment. As a result of these potential metal sources, the presence of metal analytes in food is anticipated**.**

3.3.2 Samples for metal analysis

Samples in the Children's Food Project were tested for 15 different metals, including aluminum, arsenic, boron, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, selenium, tin, titanium and zinc. A breakdown of detected metals by food category is presented in Table G-1 in Appendix G.

3.3.3 General metal results observations

The results presented below are a measure of the total metal concentration present in the food and do not distinguish between organic and inorganic forms, or ionic species. As such, these results do not provide direct information about the bioavailability or the toxicity of the metal. The metal results do not reveal the potential source (i.e. endogenous versus deliberate addition from pesticide use or food additive, etc). Nevertheless, the results obtained in this case study may be used to estimate metal levels in children's food and to identify any existing patterns. All samples in the Children's Food Project had detected levels of metals. A number of observations can be made and are presented in Table 6.

Table 6 Observations of metals results

Food Category	Observations
Fruit- & Vegetable-Based	• Tin levels were compliant in all samples, including canned fruit and vegetables
Grain-Based	• Aluminum was found in most cereals, baked goods, dry mixes and cakes. Aluminum is a permitted food additive up to Good Manufacturing Practice (GMP) levels
Dairy-Based	• Iron, titanium and zinc were the prevailing metals detected;
Miscellaneous-Based	• Found to contain the most metals; • Dinner kits were particularly high in aluminum, likely due to food additives

3.3.4 Discussion of metal results

It is important to note that a number of foods tested in this survey are fortified with metals and therefore the results are not representative of natural levels. The results do, however, provide a snapshot of metals in children's foods. In addition, Figures 5-7 represent the average amount (of the positive samples) of detected metal by major food category for the more toxic metals (arsenic, cadmium, mercury and lead).

Aluminum

Aluminum is an element that can be naturally present in foods. Aluminum is also added to foods during processing. The FDR allows aluminum and its salts to be used in foods as food additives (anti-caking agents, firming agents, colouring agents and as stabilizers during heat treatments). Aluminum can also result from pesticide use. Specifically, fosetyl-aluminum, a bactericide or fungicide, is applied on a variety of crops, including citrus fruits, strawberries, cocoa, and various vegetable crops. It is impossible to determine the source of the aluminum present in food. The detected amount may be associated with a natural source and/or result from the use of a pesticide or food additive. There were 747 (89.4%) samples with detected amounts of aluminum. The level of aluminum observed in this survey ranged from 0.022 ppm to 1219 ppm. The highest levels of aluminum were detected in breakfast foods and mixes. None of the samples had levels of aluminum exceeding levels acceptable in Canada.

Arsenic

Arsenic is a natural element present in soil and groundwater. It can also be a component of arsenic-containing fungicides. The levels of arsenic allowed in foods are specified in Table I of Division 15 of the FDR. This includes a 0.1 ppm arsenic tolerance in fruit juice, fruit nectar, beverages when ready-to-serve and water in sealed containers other than spring or mineral water. In addition, a 3 ppm arsenic tolerance exists for food colours. The permitted level of arsenic in fruit juices and nectars was not exceeded in any of the 121 juice samples tested. There were 415 (49.6%) samples with detected amounts of total arsenic (total arsenic comprises both the organic and inorganic forms). The levels of arsenic ranged from 0.005 ppm to 0.473 ppm. Figure 5 illustrates the average level of arsenic detected in the four major food categories. Dairy-based products had the lowest average amount of arsenic amongst the four major food categories.

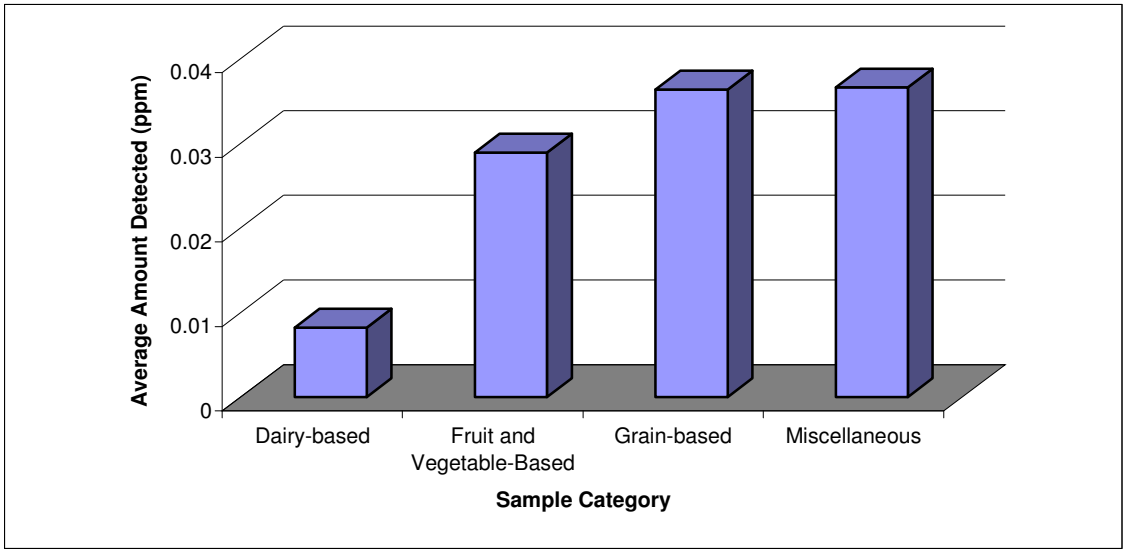

Figure 5 Average level of arsenic detected in the major food categories

The highest levels of arsenic (> 0.200 ppm) were detected in chips, crackers, snacks, pasta, breakfast cereals and dinners. The top five arsenic-containing samples were rice-based products. It is widely known that arsenic is common in Asian soils and irrigation water. The presence of arsenic in these mediums may pose an increased food safety risk as food crops are grown in this environment. The Food and Agriculture Organization of the United Nations (FAO) is promoting more effective irrigation and agricultural practices in the region to significantly reduce the amount of arsenic in food crops. Ground waters are often a sink for arsenic and much of the continents' water irrigation supply comes from ground water.[4] The arsenic detected in these rice products is likely a result of high levels of arsenic in rice.

The results for arsenic were evaluated to determine if the levels represented a risk to human health (including sensitive populations). Based on imput from Health Canada (HC), the levels of arsenic detected in these foods do not pose a human health risk. HC noted that several breakfast cereal and pasta samples did surpass Health Canada's toxicological reference values (TRVs), especially for high-end consumers. Although several results may surpass HC's TRVs, it is important to note that these results are for total arsenic. Total arsenic may encompass several arsenic compounds, including inorganic and organic forms. Inorganic arsenic is the most toxic forms of arsenic to human health are the inorganic forms. The health risk assessment (HRA) conducted by HC makes a conservative assumption that the total arsenic detected is of the inorganic form only to ensure public safety. The CFIA has undertaken method development to determine both total arsenic and inorganic arsenic simultaneously to refine the HC HRA.

Boron

There are no established Canadian tolerances or guidelines for boron in food. Boron is a natural element and ubiquitous in nature. It is found in most commodities and is reportedly being used (as boric acid) on whole fruit as a fungicide[5].

Boric acid deposits on fruit resulting from its use as an agricultural compound may degrade to elemental boron. Given the natural levels of boric acid and boron in plants, elemental boron from agricultural chemical use would be indistinguishable from background levels. It is naturally present in crops such as pome fruit, stone fruit and grapes[5].

There were 763 (91.3%) samples with detected amounts of boron. The levels of boron ranged from 0.11 ppm to 57.53 ppm. Boron and boric acid are of low toxicity.

Cadmium

There are no Canadian tolerances or guidelines established for cadmium levels in food. There were 492 (58.9%) samples with detected amounts of cadmium. The levels of cadmium ranged from 0.002 ppm to 0.360 ppm. Samples with the highest amount of cadmium (greater than 0.2 ppm) were chips (5), pasta (1) and snack foods (1). Figure 6 illustrates the average level of cadmium detected in the four major food categories. Dairy-based products had the lowest average amount of cadmium amongst the four major food categories.

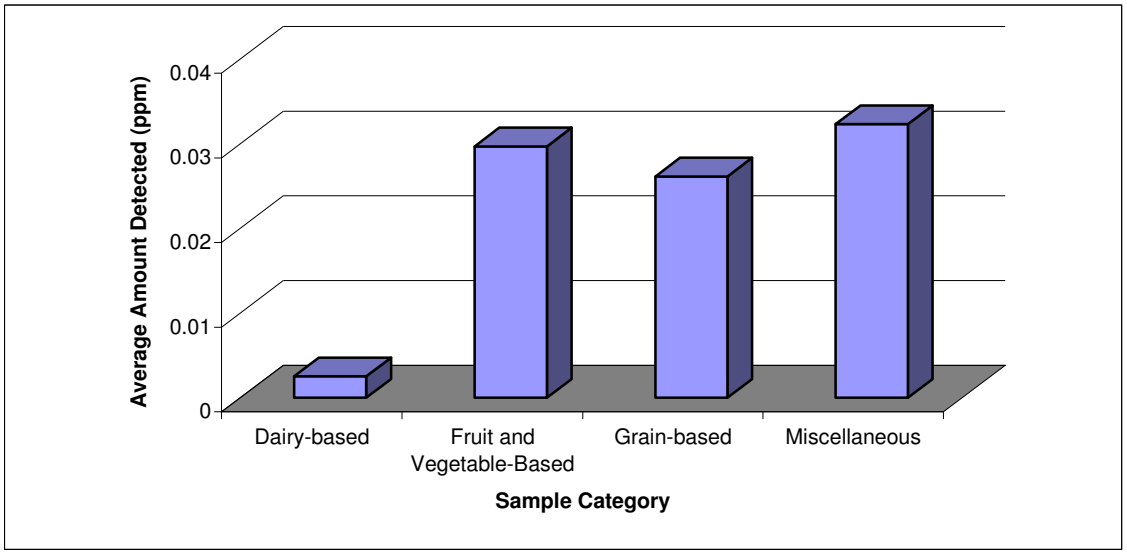

Figure 6 Average level of cadmium detected in the major food categories

Chromium

Chromium is an essential mineral in the human diet. There are no Canadian tolerances or guideline levels for chromium in food. There were 639 (76.4%) samples with detected amounts of chromium. The levels of chromium ranged from 0.01 ppm to 1.097 ppm. There were no specific patterns observed with respect to country of origin or food type.

Copper

Copper is used as a fungicide. There is a MRL of 50 ppm established for copper compounds used as pesticides in all fresh fruits and vegetables. This MRL also applies to all processed foods derived from fruit and vegetables. There were 808 (96.7%) samples with detected amounts of copper. None of the 375 fruit and vegetable-based food samples had violative levels of copper. The levels of copper ranged from 0.03 ppm to 23.83 ppm.

Iron

Iron is a natural component of most living organisms and is an essential nutrient in the human diet. There are no Canadian tolerances or guidelines for iron in food. There were 808 (96.7%) samples with detected amounts of iron. The levels of iron in foods ranged from 0.33 ppm to 286.60 ppm. Grain-based products had the highest levels of iron (39.7 ppm) in comparison to the average iron levels of all positive project samples combined (24.8 ppm). This result may be explained by the potential use of iron-fortified flour.

Lead

Lead exposure may occur from a number of environmental and food sources. There are several tolerances and guidelines for lead in food that can be found in Division 15 of the FDR. Included are limits of 1.5 ppm lead in tomato paste and tomato sauce, 0.5 ppm in

fish protein and whole tomatoes, and 0.2 ppm in fruit juice, fruit nectar, beverages when ready-to-serve and water in sealed containers other than spring or mineral water. Evaporated milk, condensed milk and concentrated infant formula have a lead tolerance of 0.15 ppm and ready-to-serve infant formula has a lead tolerance of 0.08 ppm. Health Canada has also established a lead guideline of 0.5 ppm in maple syrup.

Of the 836 project samples, 391 (46.8%) had detected levels of lead. Figure 7 illustrates the average level of lead detected in the four major food categories. There were no violations of the Canadian guidelines. The levels of lead in food ranged from 0.002 ppm to 0.977 ppm. Dairy products were found to contain the least average amount of lead.

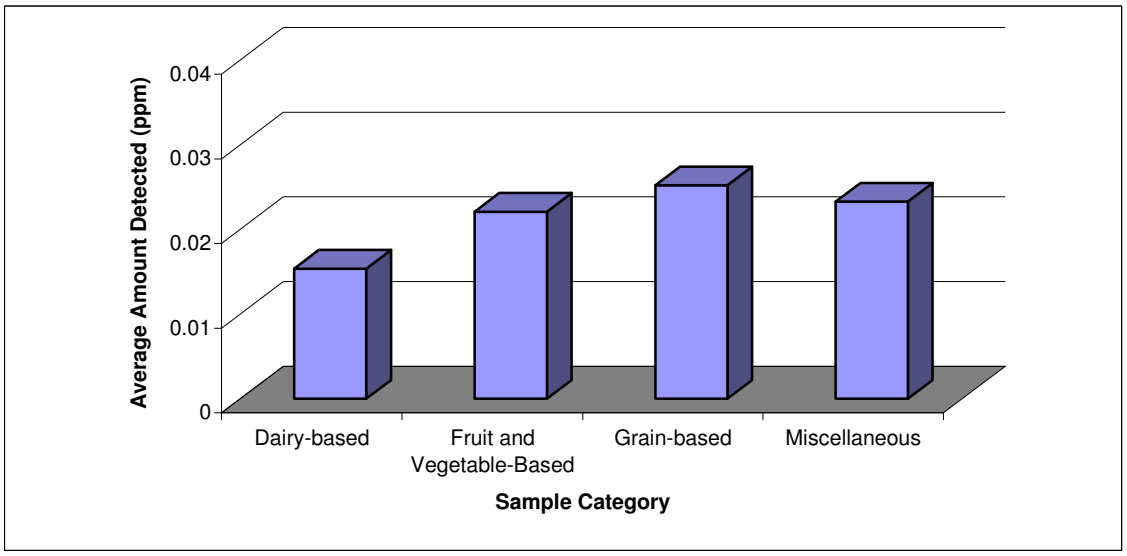

Figure 7 Average level of lead detected in the major food categories

Mercury

The only tolerance in Canada for mercury is that of 0.1 ppm in the edible portion of fish. No detected amounts of mercury were found in any of the project samples.

Manganese

Manganese is an essential trace mineral in the human diet. At present, there are no Canadian tolerances or guidelines for manganese in food. A total of 827 (98.9%) samples had detected levels of manganese. The levels ranged from 0.021 ppm to 51.83 ppm. Of the samples with detected amounts of manganese, grain-based products had the highest average amount of detected manganese (8.27 ppm) and dairy-based products had the lowest (0.17 ppm). Cereals generally contain higher amounts of manganese than other food crops and this explains the amounts detected in grain-based products.

Nickel

Sources of nickel intake include sugars, preserves, nuts, beans, peas, oatmeal, chocolate and grains. Food processing equipment and food packaging (i.e. cans) may also

contribute nickel in food. There are currently no tolerances or guidelines for nickel in Canadian foods. Of the 836 project samples, 739 (88.4%) samples had detected levels of nickel. The levels ranged from 0.01 ppm to 6.89 ppm. Grain-based products had the highest average level (0.42 ppm). This could be explained by the endogenous levels of nickel found in most grains.

Selenium

There are no tolerances or guidelines for selenium in Canadian foods. Selenium is an essential trace mineral in the human diet. There were 517 (61.8%) samples with detected levels of selenium. The levels ranged from 0.02 ppm to 2.64 ppm. The highest levels of selenium were detected in pasta samples. Pasta (both whole wheat and white) is a major source of dietary selenium.

Tin

Tin is a heavy metal that may be toxic at high concentrations. A tolerance of 250 ppm is established for tin in canned foods. There were 628 (75.1%) samples with detected amounts of tin. The levels ranged from 0.02 ppm to 180.70 ppm. All samples with tin levels greater than 20 ppm were canned products. All samples were compliant with Canadian regulations.

Titanium

Titanium is a trace element found in most foods. According to Division 15 of the FDR, titanium dioxide can be used at levels consistent with Good Manufacturing Practices as anticaking agents and as a component in food colours. There are no tolerances or guidelines for titanium in Canadian foods. There were 713 (85.2%) samples with detected amounts of titanium. The levels ranged from 0.10 ppm to 16.72 ppm.

Zinc

Zinc is an essential trace element in the human diet. There are no tolerances or guidelines for zinc in Canadian foods. Of the 836 project samples, 834 (99.8%) had detected amounts of zinc. The levels ranged from 0.13 ppm to 169.80 ppm. The samples with the highest levels of zinc were mainly grain-based. Zinc is an important element in cereal grains.

4 Project conclusions

The results of the 2007-2008 Children's Food Project indicate that the majority of samples analyzed (74.3% of 836 samples) contained no detected pesticide residues. There were 215 (25.7%) samples with detected pesticide residues, of which 203 (94.4%) were compliant with Canadian regulations. The overall compliance rate for pesticide residues was 98.6%. This compliance rate is similar to the compliance rates found for the much larger number and scope of samples tested under the NCRMP.

There were no violations of the specific metal tolerances established in food. Additionally, most metal levels did not exceed expected levels (from data collected in the NCRMP). However, elevated amounts of arsenic were found in some rice products. Health Canada concluded that the levels of arsenic found in these and all other samples did not pose a significant health risk to Canadian children. In order to better assist Health Canada to refine their risk assessment for arsenic (specifically for the more toxic inorganic species of arsenic), the CFIA has undertaken method development for arsenic speciation.

Due to the limited scope and number of samples collected in the project, no clear relationships can be made between compliance rate and food type or country of origin. The data obtained from studies like the Children's Food Project are, however, instrumental in the assessment of the dietary exposure to pesticide residues and metals in foods consumed by Canadian children. Together, the data obtained from the Children's Food Project and the National Chemical Residue Monitoring Program represent a typical overview of the nature of chemical species in the Canadian food supply and allows sound conclusions to be drawn about its safety.

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Appendix A

Table A-1 Summary of the commodities sampled in the project

Food Category	Food Type	Sample Description	Number of Samples
Fruit- and vegetable-based Foods	Canned	Fruits and vegetables	120
	Juices	Apple, orange, grape, other	121
	Fruit Snacks	Dried fruits (raisins and prunes); "fruit roll-up", "fruit-to-go", "fruit" minis, juice bars, fresh figs and dates, apple slices, pre-packaged baby carrots; fruit pastes	60
	Chips	Potato chips (regular, BBQ, ketchup flavours), cheese sticks, nachos, pork rinds, rice chips, nachos, shrimp, jackfruit, yucca, plantain	48
	Sauces	Spaghetti	13
	Soup	Tomato, vegetable, chicken noodle, chick pea, pepper	13
Grain-based Foods	Cookies	Chocolate, vanilla, ginger, arrowroot, date, fig, tea, wafers	119
	Snacks	Rice cakes, ice cream cones, popcorn, pretzels, cupcakes, sesame seed snacks, nuts, pudding, jelly, breadsticks	58
	Cereals	Breakfast cereals, frozen waffles, frozen pancakes, frozen French Toast, Toaster strudel,	46
	Mixes	Cake, muffin, brownie, dessert, rolls, cookies,	43
	Crackers	Wheat, rice, shrimp, matzo, oat, muesli, cheesy	31
	Pasta	Dry pasta (rice noodles and vermicelli, penne, spaghetti, elbows), ready-to-eat canned pasta with sauce	31

Food Category	Food Type	Sample Description	Number of Samples
	Snack Bars	Granola bars, rice squares	18
	Baked Goods	Bagels, English muffins, muffins	14
	Cake	Soft flour, yam, rice	5
Dairy-based Foods	Yogurt	Yogurt soda, sparkling yogurt, yogurt drinks, labneh, fruit-flavoured yogurt	31
	Cheese	Mozzarella, cheddar, fresh cheese with fruit	7
Miscellaneous Foods	Dinner	Hamburger/chicken/tuna helper, Mexican food kits (burrito, fajita, taco), macaroni and cheese, paella, mini pizzas, lunch mates, falafel, couscous, dumpling mix, chicken drumsticks	21
	Spreads	Peanut butter, dulce de leche, vanilla, chocolate hazelnut, tahini, taboulie, salsa, hummus, molasses, halawa, baba ganoush	19
	Soy Beverages	Original, unsweetened, vanilla	9
	Honey	Wildflower, amber, organic, blueberry, buckwheat	7
	Mixes, stuffing	Chicken, turkey	2

Appendix B

Table B-1 List of pesticides (300) included in third party method for pesticide analysis in processed products

Analyte	Cycloate	Fluchloralin	Parathion
2-phenylphenol	Cyfluthrin (I,II,III,IV)	Flucythrinate	Parathion-methyl
3-OH Carbofuran	Cyhalothrin-lambda	Fludioxonil	Pebulate
Acephate	Cypermethrin	Flumetralin	Penconazole
Acibenzolar-s-methyl	Cyprazine	Fluorochloridone	Pendimethalin
Alachlor	Cyproconazole	Fluorodifen	Pentachloroaniline
Aldicarb	Cyprodinil	Flusilazole	Permethrin cis
Aldicarb Sulfone	Cyromazine	Fluvalinate	Permethrin trans
Aldicarb sulfoxide	Dacthal (chlorthal-dimethyl)	Folpet	Phenthoate
Aldrin	delta-HCH (delta-lindane)	Fonofos	Phorate
Allidochlor	Deltamethrin	Heptachlor	Phorate sulfone
Ametryn	delta-trans-allethrin	Heptachlor epoxide endo	Phosalone
Aminocarb	Demeton-O	Heptanophos	Phosmet
Aramite	Demeton-S	Hexachlorobenzene	Phosphamidon
Aspon	Demeton-S-methyl	Hexaconazole	Piperonyl butoxide
Atrazine	Des-ethyl Atrazine	Hexazinone	Pirimicarb
Azinphos-ethyl	Desmetryn	Imazalil	Pirimiphos-ethyl
Azinphos-methyl	Di-allate	Iodofenphos	Pirimiphos-methyl
Azoxystrobin	Dialofos	Iprobenfos	Prochloraz
Benalaxyl	Diazinon	Iprodione	Procymidone
Bendiocarb	Diazinon o analogue	Iprodione metabolite	Prodiamine
Benfluralin	Dichlobenil	Isazophos	Profenofos
Benodanil	Dichlofluanid	Isofenphos	Profluralin
Benzoylprop-ethyl	Dichloran	Isopropalin	Prometon
BHC Alpha	Dichlormid	Isoprothiolane	Prometryne
BHC beta	Dichlorvos	Kresoxim-methyl	Pronamide
Bifenox	Diclobutrazole	Leptophos	Propachlor
Bifenthrin	Diclofenthion	Lindane (gamma-BHC)	Propanil
Biphenyl	Diclofop-methyl	Linuron	Propargite
Bromacil	Dicofol	Malaoxon	Propazine
Bromophos	Dicrotophos	Malathion	Propetamphos
Bromophos-ethyl	Dieldrin	Mecarbam	Propham
Bromopropylate	Diethatyl-ethyl	Metalaxyl	Propiconazole
Bufencarb	Dimethachlor	Metazachlor	Propoxur
Bupirimate	Dimethoate	Methamidophos	Prothiophos

Buprofezin	Dinitramine	Methidathion	Pyracarbolid
Butachlor	Dioxacarb	Methiocarb	Pyrazophos
Butralin	Dioxathion	Methiocarb Sulfoxide	Pyridaben
Butylate	Diphenamid	Methomyl	Quinalphos
Captafol	Diphenylamine	Methoprotryne	Quinomethionate
Captan	Disulfoton	Methoxychlor	Quintozene
Captan metabolite	Disulfoton sulfone	Methyl - trithion	Schradan
Carbaryl	Edifenphos	Methyl Pentachlorophenyl sulphide	Secbumeton
Carbetamide	Endosulfan alpha	Metobromuron	Simazine
Carbofenthion	Endosulfan beta	Metolachlor	Simetryn
Carbofuran	Endosulfan sulfate	Metribuzin	Sulfallate
Carboxin	Endrin	Mevinphos-cis	Sulfotep
Chlorbenside	EPN	Mevinphos-trans	Sulprophos
Chlorbenzilate	EPTC	Mexacarbate	TCMTB
Chlorbromuron	Erbon	Mirex	Tebuconazole
Chlorbufam	Esfenvalerate	Monocrotophos	Tecnazene
Chlordane cis	Etaconazole	Monolinuron	Terbacil
Chlordane trans	Ethalfluralin	Myclobutanil	Terbufos
Chlordimeform	Ethion	Naled	Terbumeton
Chlorfenson	Ethofumsate	Nitralin	Terbutryne
Chlorfenvinphos (e+z)	Ethoprophos	Nitrapyrin	Terbutylazine
Chlorflurenol-methyl	Ethylan	Nitrofen	Tetrachlorvinphos
Chloridazon	Etridiazole	Nitrothal-isopropyl	Tetradifon
Chlormephos	Etrimfos	Norflurazon	Tetraiodoethylene
Chloroneb	Fenamiphos	Nuarimol	Tetramethrin
Chloropropylate	Fenamiphos sulfone	o,p'-DDD (o,p'-TDE)	Tetrasul
Chlorothalonil	Fenamiphos sulfoxide	o,p'-DDE	Thiobencarb
Chlorpropham	Fenarimol	o,p'-DDT	Tolclofos-methyl
Chlorpyrifos	Fenbuconazole	Octhilinone	Tolyfluanid
Chlorpyriphos-methyl	Fenchlorophos (Ronnel)	Omethoate	Triadimefon
Chlorthiamid	Fenfuram	Oxadiazon	Triadimenol
Chlorthion	Fenitrothion	Oxadixyl	Tri-allate
Chlorthiophos	Fenpropathrin	Oxamyl	Triazophos
Chlozolinate	Fenpropimorph	Oxycarboxin	Tribufos
Clomazone	Fenson	Oxychlordane	Tricyclazole
Coumaphos	Fensulfothion	Oxyflurofen	Trifloxystrobin
Crotoxyphos	Fenthion	p,p'-DDD (p,p'-TDE)	Triflumizole
Crufomate	Fenvalerate	p,p'-DDE	Trifluralin
Cyanazine	Flamprop-isopropyl	p,p'-DDT	Vernolate
Cyanophos	Flamprop-methyl	Paraoxon	Vinclozolin

Table B-2: List of pesticides (32) included in third party method for pesticide analysis in dairy products

Alachlor	Endosulfan beta	o,p'-DDE
Aldrin	Endosulfan sulfate	o,p'-DDT
BHC Alpha	Endrin	Oxychlordane
BHC beta	Fenchlorophos (Ronnel)	p,p'-DDD (p,p'-TDE)
Chlordane cis	Heptachlor	p,p'-DDE
Chlordane trans	Heptachlor epoxide endo	p,p'-DDT
Chlorpyrifos	Hexachlorobenzene	Permethrin cis
Cyfluthrin (I,II,III,IV)	Lindane (gamma-BHC)	Permethrin trans
Dicofol	Methoxychlor	Quizalofop-ethyl
Dieldrin	Mirex	Tefluthrin
Endosulfan alpha	o,p'-DDD (o,p'-TDE)	

Appendix C

Table C-1 Minimum detection limits required for metals in dairy and processed products

Metal analyte	Dairy (ppm)	Processed products (ppm)
Aluminum	0.02	0.2
Arsenic	0.005	0.005
Boron	0.2	0.2
Cadmium	0.005	0.005
Chromium	0.02	0.02
Copper	0.05	0.5
Iron	0.5	0.5
Mercury	0.01	0.005
Manganese	0.05	0.05
Nickel	0.02	0.02
Lead	0.005	0.005
Selenium	0.02	0.02
Tin	0.2	0.2
Titanium	0.2	0.2
Zinc	0.2	0.2

Appendix D

Table D-1 **Limits of detection and quantitation for single residue methods validated by the CFIA**

Compound	LOD (ppm)	LOQ (ppm)
Alar	0.014	0.040
Amitraz	0.0050	0.010
ETU	0.01	0.040

Appendix E

Table E-1 Samples with detected pesticide residues

Sample Number	Commodity	Country	Pesticide Residue	Amount (ppm)	Violation
CF0001	APPLES, CANNED	CAN	Captan	0.022	
CF0005	FRUIT SNACKS	USA	2-phenylphenol	0.0253	
CF0006	FRUIT SNACKS	CAN	Captan	0.018	
CF0008	FRUIT SNACKS	CAN	Diphenylamine	0.0395	
CF0009	FRUIT SNACKS	CAN	Captan	0.056	
CF0010	FRUIT SNACKS	USA	Imazalil	0.0067	
CF0012	FRUIT SNACKS	USA	2-phenylphenol	0.0042	
CF0013	FRUIT SNACKS	USA	2-phenylphenol	0.0086	
CF0015	FRUIT SNACKS	CAN	Captan	0.023	
CF0016	FRUIT SNACKS	CAN	Captan	0.038	
CF0022	JUICE, GRAPE	USA	Malathion	0.0024	
CF0030	Mixes, Baked Goods	USA	Chlorpyriphos-methyl	0.0092	
CF0033	Mixes, Baked Goods	USA	Chlorpyriphos-methyl	0.0133	
CF0043	Cookies	CAN	Diphenylamine	0.0034	
CF0051	Cookies	CAN	Procymidone	0.0112	
CF0059	Crackers	CAN	Pirimiphos-methyl	0.0036	
CF0072	Snack Bars	CAN	Malathion	0.0097	
CF0072	Snack Bars	CAN	Diphenylamine	0.0028	
CF0073	Snack Bars	CAN	Diphenylamine	0.0027	
CF0075	Snack Bars	CAN	Diphenylamine	0.0046	
CF0092	PASTA	CAN	Malathion	0.0044	
CF0093	PASTA	CAN	Malathion	0.0055	
CF0095	PASTA	ITA	Pirimiphos-methyl	0.007	
CF0102	MIXES, PANCAKE	CAN	Malathion	0.0072	
CF0104	PEANUT BUTTER	CAN	Piperonyl butoxide	0.0036	
CF0105	PASTA	CAN	2-phenylphenol	0.0048	
CF0107	PASTA	CAN	2-phenylphenol	0.0044	
CF0113	MIXES, STUFFING	CAN	Azoxystrobin	0.0246	
CF0119	Soup	CAN	Piperonyl butoxide	0.0033	
CF0126	Soup	CAN	Chlorpropham	0.0086	
CF0128	Sauce	CAN	2-phenylphenol	0.0022	
CF0134	BREAKFAST CEREAL	CAN	Malathion	0.0053	
CF0143	BREAKFAST CEREAL	CAN	Malathion	0.0069	
CF0170	PASTA	USA	2-phenylphenol	0.0198	
CF0177	Crackers	USA	Malathion	0.0224	
CF0177	Crackers	USA	Pirimiphos-methyl	0.0065	
CF0177	Crackers	USA	Chlorpyriphos-methyl	0.034	
CF0178	Crackers	USA	Chlorpyrifos	0.0024	

Sample Number	Commodity	Country	Pesticide Residue	Amount (ppm)	Violation
CF0178	Crackers	USA	Metalaxyl	0.0018	
CF0184	PASTA	CAN	Malathion	0.0344	
CF0192	Cookies	USA	Malathion	0.0056	
CF0206	FRUIT SNACKS	CAN	2-phenylphenol	0.011	
CF0208	FRUIT SNACKS	CAN	Diphenylamine	0.0145	
CF0212	JUICE, OTHER	USA	Malathion	0.0032	
CF0213	JUICE, OTHER	USA	Captan	0.019	
CF0214	JUICE	CAN	Malathion	0.003	
CF0216	JUICE	CAN	Malathion	0.0034	
CF0217	JUICE, APPLE	CAN	Malathion	0.0026	
CF0217	JUICE, APPLE	CAN	Captan	0.176	
CF0218	JUICE	CAN	Captan	0.073	
CF0219	JUICE	CAN	Malathion	0.0029	
CF0221	JUICE	CAN	Captan	0.013	
CF0222	JUICE	CAN	o,p'-DDT	0.0138	
CF0222	JUICE	CAN	o,p'-DDD (o,p'-TDE)	0.0016	
CF0222	JUICE	CAN	Captan	0.013	
CF0224	JUICE	CAN	Captan	0.014	
CF0225	JUICE	CAN	Malathion	0.0022	
CF0227	JUICE	CAN	Malathion	0.0024	
CF0227	JUICE	CAN	Captan	0.014	
CF0231	JUICE, APPLE	CAN	Captan	0.172	
CF0235	JUICE, GRAPE	USA	Carbaryl	0.0131	
CF0239	JUICE, OTHER	USA	Captan	0.024	
CF0251	JUICE, APPLE	USA	Captan	0.053	
CF0251	JUICE, APPLE	USA	Diphenylamine	0.0117	
CF0254	JUICE, APPLE	UNK	Captan	0.226	
CF0256	JUICE, APPLE	USA	Captan	0.02	
CF0259	JUICE, APPLE	CAN	Captan	0.087	
CF0260	JUICE	CAN	2-phenylphenol	0.0029	
CF0262	JUICE	CAN	2-phenylphenol	0.0029	
CF0265	CHIPS	USA	Chlorpropham	0.1994	
CF0266	CHIPS	USA	Chlorpropham	0.2074	
CF0267	CHIPS	CAN	Chlorpropham	0.681	
CF0268	CHIPS	CAN	Chlorpropham	0.5756	
CF0268	CHIPS	CAN	Diphenylamine	0.0032	
CF0274	CHIPS	USA	Ethion	0.0027	
CF0275	Crackers	USA	Ethion	0.0105	
CF0277	CHIPS	USA	Chlorpropham	0.3534	
CF0278	CHIPS	CAN	p,p'-DDE	0.0028	
CF0279	CHIPS	UNK	Chlorpropham	0.0819	
CF0280	CHIPS	CAN	Chlorpropham	0.1113	
CF0280	CHIPS	CAN	p,p'-DDE	0.0092	
CF0281	CHIPS	USA	Pirimiphos-methyl	0.0024	
CF0281	CHIPS	USA	2-phenylphenol	0.0188	
CF0283	CHIPS	CAN	Chlorpropham	0.0178	
CF0285	CHIPS	CAN	p,p'-DDE	0.0022	

Sample Number	Commodity	Country	Pesticide Residue	Amount (ppm)	Violation
CF0288	CHIPS	CAN	Chlorpropham	0.0575	
CF0288	CHIPS	CAN	p,p'-DDE	0.0024	
CF0290	CHIPS	CAN	Malathion	0.0044	
CF0291	CHIPS	CAN	p,p'-DDE	0.0025	
CF0291	CHIPS	CAN	Dieldrin	0.0082	
CF0291	CHIPS	CAN	Chlorpropham	0.0047	
CF0293	CHIPS	CAN	Ethion	0.012	
CF0293	CHIPS	CAN	p,p'-DDE	0.0033	
CF0295	CHIPS	CAN	Chlorpropham	0.0152	
CF0306	SNACKS	USA	p,p'-DDE	0.0017	
CF0311	SNACKS	USA	Malathion	0.0059	
CF0323	TOMATILLOS, CANNED	MEX	Chlorpyrifos	0.0034	
CF0324	PEPPERS, HOT, CANNED	PER	2-phenylphenol	0.009	
CF0325	Soup	MEX	2-phenylphenol	0.0094	
CF0328	PEPPERS, HOT, CANNED	MEX	Ethion	0.0094	
CF0333	ZUCCHINI FLOWER, CANNED	MEX	Permethrin	0.0253	
CF0343	SNACKS	MEX	Piperonyl butoxide	0.0676	
CF0345	SNACKS	MEX	Piperonyl butoxide	0.2342	
CF0346	SNACKS	MEX	Piperonyl butoxide	0.2645	
CF0350	Cookies	PRT	Pirimiphos-methyl	0.0533	
CF0356	SNACKS	ECU	Malathion	0.0181	
CF0358	Cookies	MEX	Biphenyl	0.0052	
CF0358	Cookies	MEX	p,p'-DDE	0.0041	
CF0359	Cookies	MEX	Malathion	0.0219	
CF0359	Cookies	MEX	Piperonyl butoxide	0.0312	
CF0368	Cookies	TUR	Pirimiphos-methyl	0.0322	
CF0368	Cookies	TUR	Malathion	0.0823	
CF0371	MANGO, CANNED	IND	2-phenylphenol	0.0118	
CF0373	BEAN, CANNED	IND	2-phenylphenol	0.0147	
CF0374	DRUMSTICKS, CANNED	IND	2-phenylphenol	0.0242	
CF0376	SNACKS	IND	p,p'-DDE	0.0019	
CF0380	Cookies	CAN	Malathion	0.0085	
CF0381	Cookies	CAN	Captan	0.04	
CF0396	SNACKS	HKG	Biphenyl	0.0104	
CF0400	SNACKS	HKG	Biphenyl	0.022	
CF0410	SNACKS	USA	Biphenyl	0.0222	
CF0412	PASTA	THA	Pirimiphos-methyl	0.017	
CF0417	SNACKS	VNM	Biphenyl	0.0024	
CF0418	MANGO, CANNED	THA	2-phenylphenol	0.0131	
CF0423	COCONUT, CANNED	THA	2-phenylphenol	0.036	
CF0424	Cookies	USA	Chlorpyriphos-methyl	0.0209	
CF0424	Cookies	USA	Malathion	0.0252	
CF0433	Cookies	MYS	Malathion	0.0203	
CF0437	RAMBUTAN, CANNED	THA	2-phenylphenol	0.0281	
CF0438	BANANA BLOSSOM, CANNED	THA	2-phenylphenol	0.0117	

Sample Number	Commodity	Country	Pesticide Residue	Amount (ppm)	Violation
CF0439	FRUIT COCKTAIL, CANNED	THA	2-phenylphenol	0.0187	
CF0440	LYCHEE, CANNED	THA	2-phenylphenol	0.0361	
CF0441	LONGAN, CANNED	THA	2-phenylphenol	0.009	
CF0442	JACKFRUIT, CANNED	THA	2-phenylphenol	0.0275	
CF0443	JACKFRUIT, CANNED	THA	2-phenylphenol	0.0234	
CF0445	Cookies	TWN	Chlorpyrifos	0.0029	
CF0447	Crackers	MYS	Pirimiphos-methyl	0.008	
CF0449	Cookies	MYS	Fenitrothion	0.0531	
CF0457	Cookies	MYS	Fenitrothion	0.0679	
CF0458	Cookies	MYS	Fenitrothion	0.1051	Section 4(d)
CF0459	Cookies	MYS	Fenitrothion	0.0392	
CF0460	Cookies	MYS	Fenitrothion	0.0661	
CF0461	Cookies	MYS	Fenitrothion	0.0508	
CF0486	VEGETABLE, CANNED	IND	Ethion	0.2699	Section 4(d)
CF0486	VEGETABLE, CANNED	IND	Chlorpyrifos	0.006	
CF0493	VEGETABLE, CANNED	GBR	Triazophos	0.03	
CF0505	BREAKFAST FOODS	UNK	Diphenylamine	0.0045	
CF0508	BREAKFAST FOODS	UNK	Chlorpyriphos-methyl	0.0038	
CF0510	BREAKFAST FOODS	USA	Dichlorvos	0.0458	
CF0510	BREAKFAST FOODS	USA	Captan	0.01	
CF0535	Mixes, Baked Goods	CAN	Piperonyl butoxide	0.02	
CF0551	JUICE, APPLE	CAN	Captan	0.041	
CF0569	DINNER	CAN	Fenpropathrin	0.0094	
CF0582	SPREAD	CAN	2-phenylphenol	0.0066	
CF0597	JUICE	CAN	2-phenylphenol	0.0114	
CF0598	JUICE, ORANGE	POL	2-phenylphenol	0.005	
CF0599	JUICE, OTHER	ZAF	Diphenylamine	0.004	
CF0599	JUICE, OTHER	ZAF	2-phenylphenol	0.0068	
CF0606	JUICE, OTHER	LBN	2-phenylphenol	0.0063	
CF0618	JUICE, OTHER	TUR	Carbaryl	0.0071	
CF0622	JUICE, OTHER	ZAF	Propargite	0.0101	
CF0622	JUICE, OTHER	ZAF	Fenbuconazole	0.0041	
CF0623	JUICE, OTHER	BGR	Chlordane trans	0.0028	
CF0626	JUICE, OTHER	BGR	Imazalil	0.007	
CF0627	JUICE, OTHER	TUR	Captan	0.028	
CF0629	JUICE, OTHER	BGR	Captan	0.05	
CF0642	Cookies	SAU	Chlorpyrifos	0.0023	
CF0642	Cookies	SAU	Myclobutanil	0.0191	
CF0643	Cookies	ITA	Pirimiphos-methyl	0.0074	
CF0644	Cookies	ITA	Piperonyl butoxide	0.0174	
CF0648	Cookies	SAU	Ethion	0.0179	
CF0648	Cookies	SAU	Dicofol	0.0134	
CF0649	Cookies	SAU	Pirimiphos-methyl	0.0024	
CF0650	Cookies	SAU	Chlorpyrifos	0.0103	
CF0651	Cookies	SAU	Chlorpyrifos	0.002	

Sample Number	Commodity	Country	Pesticide Residue	Amount (ppm)	Violation
CF0652	Cookies	SAU	Chlorpyrifos	0.0134	
CF0653	DATES	SAU	Malathion	0.0233	
CF0653	DATES	SAU	Bromopropylate	0.003	
CF0653	DATES	SAU	Dicofol	0.2967	Section 4(d)
CF0653	DATES	SAU	Ethion	0.0073	
CF0657	BEAN, CANNED	UNK	Triazophos	0.0031	
CF0658	DATES	UNK	Malaoxon	0.0589	
CF0658	DATES	UNK	Malathion	0.954	Section 4(d)
CF0663	FRUIT, DRIED	THA	Bromopropylate	0.0967	
CF0666	FRUIT, DRIED	TUR	Captan	0.285	
CF0666	FRUIT, DRIED	TUR	Cypermethrin	0.0067	
CF0667	FRUIT, DRIED	TUR	Captan	0.22	
CF0667	FRUIT, DRIED	TUR	Cypermethrin	0.0073	
CF0667	FRUIT, DRIED	TUR	2-phenylphenol	0.0104	
CF0668	Cookies	CAN	Imazalil	0.0062	
CF0670	SNACKS	USA	Malathion	0.0044	
CF0670	SNACKS	USA	Piperonyl butoxide	0.0076	
CF0673	SNACKS	USA	Pirimiphos-methyl	0.004	
CF0675	Cookies	SAU	Bromopropylate	0.0132	
CF0676	Cookies	SAU	Chlorpyrifos	0.0068	
CF0677	Cookies	ESP	Malathion	0.006	
CF0677	Cookies	ESP	Pirimiphos-methyl	0.3427	Section 4(d)
CF0682	Cookies	MEX	Pirimiphos-methyl	0.0822	
CF0682	Cookies	MEX	2-phenylphenol	0.1376	Section 4(d)
CF0682	Cookies	MEX	Malathion	0.0113	
CF0683	Cookies	GRC	Pirimiphos-methyl	0.016	
CF0684	Cookies	GRC	Pirimiphos-methyl	0.0119	
CF0694	Cookies	ITA	Piperonyl butoxide	0.0245	
CF0697	SNACKS	ITA	Pirimiphos-methyl	0.0139	
CF0701	Cookies	CAN	2-phenylphenol	0.061	
CF0709	BEANS, CANNED	CAN	2-phenylphenol	0.0032	
CF0712	Cookies	ARE	Pirimiphos-methyl	0.0097	
CF0717	DINNER	EGY	Biphenyl	0.0209	
CF0719	LYCHEE, CANNED	THA	2-phenylphenol	0.0196	
CF0722	JACKFRUIT, CANNED	THA	2-phenylphenol	0.0243	
CF0723	LONGAN, CANNED	THA	2-phenylphenol	0.0353	
CF0730	RAISINS	IRN	Esfenvalerate	0.0926	
CF0730	RAISINS	IRN	Bromopropylate	0.0284	
CF0730	RAISINS	IRN	Fenvalerate	0.1505	Section 4(d)
CF0732	FRUIT, DRIED	UNK	Pirimicarb	0.0156	
CF0738	BEAN, CANNED	LBN	2-phenylphenol	0.0087	
CF0739	ZUCCHINI, CANNED	LBN	2-phenylphenol	0.0093	
CF0740	BEANS, CANNED	CAN	2-phenylphenol	0.0057	

Sample Number	Commodity	Country	Pesticide Residue	Amount (ppm)	Violation
CF0743	Cookies	ITA	Pirimiphos-methyl	0.0164	
CF0744	Cookies	ITA	Pirimiphos-methyl	0.0164	
CF0744	Cookies	ITA	Malathion	0.017	
CF0745	Cookies	ITA	Pirimiphos-methyl	0.0161	
CF0746	Cookies	ITA	Pirimiphos-methyl	0.0181	
CF0751	BEANS, CANNED	CAN	2-phenylphenol	0.0091	
CF0752	PINEAPPLE, CANNED	THA	2-phenylphenol	0.005	
CF0754	BAMBOO SHOOTS, CANNED	THA	2-phenylphenol	0.0301	
CF0755	BANANA BLOSSOM, CANNED	THA	2-phenylphenol	0.032	
CF0760	FRUIT, DRIED	UNK	Cypermethrin	0.042	
CF0763	FRUIT, DRIED	UNK	Iprodione	0.364	
CF0764	RAISINS	UNK	Fludioxonil	0.0287	
CF0764	RAISINS	UNK	Cyprodinil	0.2953	
CF0766	RAISINS	UNK	Chlorpyrifos	0.0845	
CF0787	VEGETABLE, CANNED	LBN	Endosulfan Total	0.0068	
CF0788	VEGETABLE, CANNED	LBN	Profenofos	0.0607	
CF0795	EGGPLANT, CANNED	TUR	Pirimiphos-methyl	0.0065	
CF0805	SPREAD	CAN	Triadimenol	0.1269	Section 4(d)
CF0805	SPREAD	CAN	Myclobutanil	0.096	
CF0807	GUAVA, CANNED	THA	2-phenylphenol	0.019	
CF0808	VEGETABLE, CANNED	LBN	2-phenylphenol	0.003	
CF0817	MANGO, CANNED	THA	2-phenylphenol	0.0145	
CF0823	Cookies	GRC	Pirimiphos-methyl	0.0196	
CF0823	Cookies	GRC	Piperonyl butoxide	0.0426	
CF0824	Cookies	GRC	Pirimiphos-methyl	0.0126	
CF0826	PEACH, CANNED	ESP	2-phenylphenol	0.007	
CF0829	SNACKS	GRC	Pirimiphos-methyl	0.037	
CF0830	Crackers	ESP	Pirimiphos-methyl	0.239	Section 4(d)
CF0831	Crackers	GBR	Pirimiphos-methyl	0.1323	Section 4(d)
CF0832	Crackers	GBR	Pirimiphos-methyl	0.0733	
CF0833	Crackers	GBR	Pirimiphos-methyl	0.0155	
CF0839	Cookies	HVR	Pirimiphos-methyl	0.1087	Section 4(d)
CF0842	Cookies	POL	Pirimiphos-methyl	0.0027	
CF0846	Cookies	FRA	Pirimiphos-methyl	0.1521	Section 4(d)
CF0848	Cookies	UNK	Pirimiphos-methyl	0.0058	
CF0854	SNACKS	ITA	Pirimiphos-methyl	0.0323	
CF0855	SNACKS	ITA	Pirimiphos-methyl	0.0067	
CF0862	Cookies	UNK	Pirimiphos-methyl	0.0026	
CF0863	Cookies	UNK	Pirimiphos-methyl	0.0041	

Appendix F

Table F-1 Samples containing more than one pesticide residue

Sample ID No.	Commodity	Country of Origin	Number of residues detected
CF0001	APPLES, CANNED	Canada	2
CF0072	SNACK BARS	Canada	2
CF0177	CRACKERS	U.S.A.	3
CF0178	CRACKERS	U.S.A.	2
CF0217	JUICE, APPLE	Canada	2
CF0222	JUICE	Canada	3
CF0227	JUICE	Canada	2
CF0251	JUICE, APPLE	U.S.A.	2
CF0268	CHIPS	Canada	2
CF0280	CHIPS	Canada	2
CF0281	CHIPS	U.S.A.	2
CF0288	CHIPS	Canada	2
CF0291	CHIPS	Canada	3
CF0293	CHIPS	Canada	2
CF0358	COOKIES	Mexico	2
CF0359	COOKIES	Mexico	2
CF0368	COOKIES	Turkey	2
CF0424	COOKIES	U.S.A.	2
CF0486	VEGETABLE, CANNED	India	2
CF0510	BREAKFAST FOODS	U.S.A.	2
CF0599	JUICE, OTHER	South Africa	3
CF0622	JUICE, OTHER	South Africa	3
CF0642	COOKIES	Saudi Arabia	2
CF0648	COOKIES	Saudi Arabia	2

Sample ID No.	Commodity	Country of Origin	Number of residues detected
CF0653	DATES	Saudi Arabia	4
CF0658	DATES	Unknown	2
CF0666	FRUIT, DRIED	Turkey	2
CF0667	FRUIT, DRIED	Turkey	3
CF0670	SNACKS	U.S.A.	2
CF0677	COOKIES	Spain	2
CF0682	COOKIES	Mexico	3
CF0730	RAISINS	Iran	3
CF0744	COOKIES	Italy	2
CF0764	RAISINS	Unknown	2
CF0805	SPREAD	Canada	2
CF0823	COOKIES	Greece	2

Appendix G

Table G-1 Breakdown of metal results by food category

Metal Analyte	Total # Samples	Total # Negative	Total # Postive	Min	Max	Mean
Aluminum						
Fruit and vegetable-based	375	73	302	0.101	180.800	7.837
Grain-based	365	9	356	0.119	1219.000	50.126
Dairy-based	38	4	34	0.022	0.995	0.303
Miscellaneous	58	3	55	0.000	397.300	32.732
Arsenic						
Fruit and vegetable-based	375	230	145	0.005	0.230	0.029
Grain-based	365	125	240	0.005	0.457	0.036
Dairy-based	38	32	6	0.006	0.011	0.008
Miscellaneous	58	33	25	0.000	0.473	0.037
Boron						
Fruit and vegetable-based	375	13	362	0.122	56.150	3.606
Grain-based	365	52	313	0.112	57.530	1.998
Dairy-based	38	6	32	0.110	0.425	0.235
Miscellaneous	58	2	56	0.000	37.270	4.693
Cadmium						
Fruit and vegetable-based	375	243	132	0.002	0.242	0.030
Grain-based	365	44	321	0.002	0.360	0.026
Dairy-based	38	36	2	0.002	0.003	0.003
Miscellaneous	58	21	37	0.000	0.192	0.032
Chromium						
Fruit and vegetable-based	375	123	252	0.010	0.426	0.056
Grain-based	365	25	340	0.010	1.097	0.077
Dairy-based	38	28	10	0.010	0.040	0.017
Miscellaneous	58	21	37	0.000	0.283	0.057
Copper						
Fruit and vegetable-based	375	24	351	0.031	23.830	1.344
Grain-based	365	2	363	0.032	17.470	2.097
Dairy-based	38	2	36	0.032	0.569	0.146
Miscellaneous	58	0	58	0.054	18.250	2.077
Iron						
Fruit and vegetable-based	375	27	348	0.329	111.700	12.041
Grain-based	365	1	364	0.358	286.600	39.653
Dairy-based	38	0	38	0.564	11.370	3.713
Miscellaneous	58	0	58	1.183	228.300	21.322
Mercury						
Fruit and vegetable-based	375	375	0	0.000	0.000	0.000
Grain-based	365	365	0	0.000	0.000	0.000
Dairy-based	38	38	0	0.000	0.000	0.000
Miscellaneous	58	58	0	0.000	0.000	0.000

Metal Analyte	Total # Samples	Total # Negative	Total # Postive	Min	Max	Mean
Manganese						
Fruit and vegetable-based	375	5	370	0.027	31.360	3.155
Grain-based	365	0	365	0.024	39.470	8.269
Dairy-based	38	4	34	0.021	0.587	0.173
Miscellaneous	58	0	58	0.051	51.830	5.260
Nickel						
Fruit and vegetable-based	375	59	316	0.010	3.435	0.208
Grain-based	365	13	352	0.010	6.894	8.269
Dairy-based	38	25	13	0.010	0.096	0.028
Miscellaneous	58	0	58	0.012	5.513	0.303
Lead						
Fruit and vegetable-based	375	187	188	0.002	0.344	0.022
Grain-based	365	203	162	0.002	0.977	0.025
Dairy-based	38	30	8	0.002	0.042	0.015
Miscellaneous	58	25	33	0.000	0.159	0.023
Selenium						
Fruit and vegetable-based	375	256	119	0.020	2.035	0.156
Grain-based	365	42	323	0.021	2.638	0.210
Dairy-based	38	3	35	0.021	0.298	0.088
Miscellaneous	58	18	40	0.000	0.962	0.230
Tin						
Fruit and vegetable-based	375	83	292	0.020	180.700	9.525
Grain-based	365	81	284	0.021	19.290	0.790
Dairy-based	38	11	27	0.020	0.064	0.032
Miscellaneous	58	33	25	0.000	4.353	0.685
Titanium						
Fruit and vegetable-based	375	115	260	0.100	12.810	1.312
Grain-based	365	6	359	0.163	10.290	1.900
Dairy-based	38	0	38	0.256	6.603	2.221
Miscellaneous	58	2	56	0.000	16.720	1.889
Zinc						
Fruit and vegetable-based	375	2	373	0.129	169.800	4.827
Grain-based	365	0	365	0.130	94.500	12.663
Dairy-based	38	0	38	1.177	29.650	8.039
Miscellaneous	58	0	58	0.561	59.090	10.131