Ministry for Primary Industries
Manatū Ahu Matua

Food Residues Survey Programme (FRSP)

Survey of agricultural compound residues in commercial foods for infants and young children (2016)

MPI Technical Paper No: 2017/32

By MPI Regulation and Assurance Branch

ISBN No: 978-1-77665-550-2 (online)

ISSN No: 2253-3923 (online)

New Zealand Government

Growing and Protecting New Zealand

Disclaimer

While every effort has been made to ensure the information in this publication is accurate, the Ministry for Primary Industries does not accept any responsibility or liability for error of fact, omission, interpretation or opinion that may be present, nor for the consequences of any decisions based on this information.

Requests for further copies should be directed to:

Publications Logistics Officer

Ministry for Primary Industries

PO Box 2526

WELLINGTON 6140

Email: brand@mpi.govt.nz

Telephone: 0800 00 83 33

Facsimile: 04-894 0300

This publication is also available on the Ministry for Primary Industries website at

http://www.mpi.govt.nz/news-and-resources/publications/

Contents

Page

1 Summary

Survey Background

Infants and young children belong to an age group with greater potential exposure to food safety issues. Infants can be exposed to residues through consumption of breast milk, infant and follow-on formulas, foods from complementary feeding and drinking-water used to reconstitute dry products[1]. Complementary feeding begins when breast milk and/or infant formula is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk or formula.

Their diets are less varied than the average adult and, they have a higher food intake than adults when expressed on a per kg body weight basis[2]. Accordingly, their ingestion of residues from foods may be proportionately higher than that of adults.

Internationally, farmers use agricultural compounds to help produce food efficiently and economically, including in organic farming where use of certain agricultural compounds is allowed. It is not unexpected that agricultural compounds used on crops may result in low levels of residues in food, so food regulators around the world set Maximum Residue Limits or Levels (MRLs) allowed to be present.

MRLs are not food safety limits, and they are set well below levels which are known to have any adverse health effect. A level of residue above the MRL is unlikely to pose a health risk[3]. The MRLs ensure the best methods of primary production, known as good agricultural practice (GAP), are used to keep residues in foods as low as possible. The MRLs can differ from country to country, due to different environmental conditions and processing practices, as well as different consumption patterns.

Food safety is a function of exposure to potentially harmful substances. For food safety assessments, the Ministry for Primary Industries (MPI) uses the health based guidance values (HBGV) set by the New Zealand Environmental Authority (EPA), the joint Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) as toxicity reference exposure levels of food chemicals.

All foods grown or produced for sale domestically must comply with New Zealand's MRL standards. In the case of imported foods, they must comply with the Codex MRL or in their absence, the New Zealand MRL standards. In addition, under the Trans-Tasman Mutual Recognition Arrangement (TTMRA), all foods produced in, or imported into, New Zealand and then legally sold, may be sold in Australia, and vice versa[4]. Therefore, foods produced or manufactured in Australia has to comply with the Australia MRL standards, FSANZ Schedule 20 to be sold in Australia and New Zealand.

Survey objective and approach

In 2016, the Food Residues Survey Programme (FRSP) conducted a survey of complementary foods for infants and young children. Complementary foods are foods other than breast milk or infant formula (liquids, semisolids and solids) introduced to an infant to provide nutrients. This survey aimed to provide

[1] EU Commission Scientific Opinion on a maximum residue limit (MRL) of 0.01 mg/kg for pesticides in foods intended for infants and young children (1997)
[2] ibid
[3] Adapted from Food Standards Australia New Zealand (FSANZ) http://www.foodstandards.govt.nz/consumer/chemicals/maxresidue/pages/default.aspx
[4] Trans-Tasman Mutual Recognition Agreement (TTMRA) http://www.foodsafety.govt.nz/policy-law/food-regulation/australia-nz-cooperation/TTMRA.htm

a snapshot of the agricultural chemical exposures presented by consumption of commercially processed foods for infants and young children.

The FRSP was not a compliance enforcement programme, but primarily designed to provide an overview of current agricultural practices that are in place. The New Zealand default MRL is a provision for residues of up to 0.1 mg/kg for agricultural compound/food combinations not specifically listed in the Food Notice[5]. Ninety samples of commercially processed foods suitable for infants and young children were collected and tested for up to 330 agricultural compound analytes. The samples included both imported and domestic brands.

Survey results

In over 28,000 total results (food-residue combinations), there were 72 residue detections (0.3%). Of these, only five results (0.02%) exceeded the New Zealand default MRL, termed as technical non-compliance for this report. All five results were from Australian imports and had no food safety concerns. MPI also compared the results against the applicable Australian MRLs, but none of them exceeded the Australian MRLs. As such, all the results indicated that GAP was in place for the commodities used as ingredients in the Australian samples.

Toxicological assessment and follow up

Regardless of the compliance to applicable MRLs, MPI assessed all residue detections for dietary exposure. All results, except one, presented no food safety concerns. One sample, a processed food meant for ages one to three years, had a low level of methamidophos residue. Although it did not exceed the applicable MRL of 0.1 mg/kg, it exceeded the health based guidance value and presented a potential food safety concern. The sample was traced to an Australian import. MPI carried out further retail sampling and testing of the product and confirmed no additional batches had detections of methamidophos. The additional testing indicated that the low level of residue detected was an isolated incident and no food recall of the product was required. Details of the follow up and findings are in the full report.

As with all risk assessment, there is a degree of uncertainty due to limited consumption data for New Zealand infant and young children and the rapid weight gain during their growth and development. According to the literature and medical sources, most infants double their birthweight by four to six months and triple their birthweight by the time they are one year old[6]. Between ages one and five, a young child will gain on average 2.2 kg per year[7]. Risk assessment is based on the body weight changes more typical in adult age groups to calculate the health exposure over approximately 70 year lifespan[8] of an adult, which adds a level of uncertainty when assessing exposure limits for young children as their body weight rapidly changes from year to year.

The results of this survey, the 2009 New Zealand Total Diet Study (NZTDS) and 2016 NZTDS conclude the risks of agricultural compound residue exposure from commercially processed foods for infants and young children remains low. All the residues detected in the survey did not breach any applicable MRL in the country of manufacture. Although there is no real food safety concern, the results did indicate that food manufacturers and importers can improve their food assurance systems to provide foods for these age groups.

---

[5] http://www.foodsafety.govt.nz/elibrary/industry/register-list-mrl-agricultural-compounds.htm
[6] Maternity and Pediatric Nursing by Susan Scott Ricci, Terri Kyle, ISBM-13:978-0-7817-8055-1, Publication 2009
[7] https://medlineplus.gov/ency/article/002456.htm
[8] http://www.who.int/gho/mortality_burden_disease/life_tables/en/

2 Definitions

Acronyms/Terms	Definitions
ADI	Acceptable Daily Intake
ARfD	Acute Reference Dose
Bw	body weight
Codex Alimentarius	the 'Food Code' established by FAO and the World Health Organization to develop harmonised international food standards, which protect consumer health and promote fair practices in food trade
complementary feeding	(FAO terminology) Giving other foods to young children aged over six months, in addition to breast milk or breastmilk substitutes
EPA	Environmental Protection Authority
FAO	Food and Agriculture Organization of the United Nations
fungicide	agricultural compound used to control plant moulds and other diseases
HBGV	Health based guidance value
herbicide	agricultural compound used to control weeds which compete with crop plants for water, nutrients, space and sunlight.
infants	children under the age of 12 months
insecticide	agricultural compound used to control insects that damage crops
FRSP	Food Residues Survey Programme
LCHRMS	Liquid chromatography high resolution mass spectrometry
LOR	limit of reporting is the smallest concentration (or amount) of analyte, that can be reported with a reasonable degree of accuracy and precision
Matrix	The components of a sample other than the analyte of interest.
MPI	Ministry for Primary Industries
MRL	maximum residue levels or limits
NCCP	National Chemical Contaminant Programme
NCRP	National Chemical Residues Programme
parasiticide	agricultural compound used to control parasites that damage crops
plant growth regulator	agricultural compound that modifies or controls one or more specific physiological processes of a plant or fruit
TTMRA	Trans-Tasman Mutual Recognition Agreement between New Zealand and Australia's commonwealth, state and territory governments. Goods legally sold in one country can be sold in the other. This principle operates regardless of different standards or other sale related regulatory requirements between New Zealand and Australia.
young children	children aged between 1 and 3 years

3 Background

3.1 AGRICULTURAL COMPOUNDS AND THEIR ROLE IN FOOD PRODUCTION

People have been competing with insects, animal pests, diseases and weeds for food throughout history. Insects destroy crops, weeds compete for space and nutrients in fields, fungi and bacteria infect plants and animals and the stored food produced from them. Mice, rats and other animals create great loss and destruction. This battle for food has meant that populations have, for generations, had to wage war against pests and vermin to gain enough food for sustenance and trade.

Agricultural compounds can be natural or synthetic and include veterinary medicines, fertilisers and pesticides (fungicides, herbicides and insecticides). Farmers following either conventional or organic methods of production can use approved chemicals to control pests and weeds, treat their animals, and improve soil fertility.

Agricultural compounds are used to improve the quantity and quality of produce and slow down the rate at which it spoils. Growers and farmers use agricultural compounds to protect the food supply and to maximise the quantity and quality of the food they grow.

Because farming is often an intensive form of production (many similar crops or animals raised in close proximity) the risk of disease, weeds, parasites and other pests spreading is high. Keeping animals and crops free from pests and diseases is important for their health and welfare. Using agricultural compounds and veterinary medicines helps achieve this.

To be effective, agricultural compounds must stay in place long enough to do their job. One consequence of this is that some traces of the chemical may remain in meat, fruit or vegetables at the time they are slaughtered or harvested.

3.2 SAFETY OF AGRICULTURAL COMPOUNDS AND FOOD SAFETY REQUIREMENTS

Like medicines prescribed by doctors, agricultural compounds are used only if their benefits (in food production and storage) outweigh the risks to people and livestock from their residues. They allow countries to economically and efficiently feed their people and livestock and for others, like New Zealand, to maintain an economy based on trade in food. Food makes a significant contribution to our economy because we export about 80%[9] of what we produce.

Because agricultural compounds are used worldwide, their safety must be checked both in New Zealand and internationally. They are only approved for use if it is considered that they pose no greater risk to consumers than foods grown without their use.

No country wants to risk importing food that could carry pests and diseases that might cause harm to its people, animals, plants or environment. Equally, no country would wish its people to be at risk from residues of the chemicals used to control or eliminate these.

[9] Estimates based on Annual Report 2016 by the Plant and Food Research.

The use of agricultural compounds in food production is tightly controlled to meet the sometimes competing goals of least risk to human health, good plant and animal health, and supplies for consumption and trade.

Before MPI registers an agricultural compound for use in New Zealand, it must undergo rigorous testing. The results from these tests determine – among other things – the least amount of a compound to use to give the maximum benefit. They also predict the amount of residue left in the food at harvest or slaughter. Based on this information, acceptable residue limits are recorded in New Zealand law, set in accordance with national and international procedures.

Instructions for safe and proper use are displayed on the agricultural compound product label. Users are legally required to follow the instructions, which include residue controls. Withholding periods (the minimum amount of time that has to pass between application of a chemical and harvest or slaughter) are one example of these controls.

Random checks and monitoring programmes are carried out by MPI to ensure that all instructions are being following and the conditions around them are working.

3.3 THE NEW ZEALAND GOVERNMENT'S TESTING PROGRAMMES

Residue and contaminant monitoring is a vital part of New Zealand's risk-based approach to food safety.

The Ministry for Primary Industries (MPI) has a number of food monitoring programmes under the Animal Products Act and the Food Act focussed on supporting the health and wellbeing of consumers. MPI receives up to half a million test results each year for residues and contaminants in food to verify that food produced and consumed in New Zealand and exported is safe. MPI's food monitoring programmes cover meat, poultry, seafood, honey, dairy products and fresh produce, as well as processed foods.

The rate of compliance across all food monitoring programmes is extremely high and indicates GAP is being carried out in New Zealand.

4 Survey design

The FRSP surveys food available on the domestic market that is not included in MPI's other testing programmes. The programme confirms that food is produced using GAP and complies with the set maximum residues limits or levels (MRLs).

The FRSP ran a survey for commercially prepared foods suitable for infants and young children in 2016. This survey is designed to provide baseline data to augment MPI's other food monitoring programmes.

MPI previously surveyed processed foods for infants and young children in the New Zealand Total Diet Study in 2009 and did not find any significant sources of agricultural compound residues.

4.1 SAMPLE SCOPE

The survey targeted commercial shelf-stable processed foods intended for infants and young children. In this survey, only shelf-stable processed foods that were packaged in cans, jars, flexible pouches and/or cardboard boxes were included.

All processed foods suitable for infants and young children were selected based on sales volume and market distribution data supplied by Nielsen. A 2015 sales volume report[10] was used to determine samples collected, including a range of the most and least popular retail brands. For the purpose of this survey, any processed foods that had labels stating that they were suitable for an infant (up to 12 months of age) and young child (one to three years old) were considered for sample collection.

Ninety samples were collected for testing. This number was determined on the basis of the Codex document CAC/GL 33[11]. Using the 2015 sales volume report, specific food types were collected and tested with a higher number of samples taken from the more popular brands to better reflect New Zealand consumption patterns.

Imported samples made up 68% of all samples collected. Australian imports made up 61% of all samples collected. Samples with an 'organic' label made up 38% of all samples collected. These percentages reflect the New Zealand consumer purchasing habits as per the sales volume report.

Table 1 Collected samples by country of origin

Country of origin	Number of samples
Australia	56
Belgium	1
China	1
Indonesia	1
Netherlands	2
New Zealand	28
United Kingdom	1
Total	90

4.2 SAMPLE COLLECTION PROCESS

All the samples were collected during May 2016 in New Zealand. The samples were purchased from retail stores in one city and online from web-based New Zealand outlets. When certain brands were discontinued, substitution was allowed. For example, if Brand A of an apple puree was discontinued, Brand X, a similar apple puree, would be purchased as a substitute. The samples, along with the manufacture batch details and information, were recorded, packaged, and submitted to the laboratory for analysis.

4.3 SAMPLE ANALYSIS AND REPORTING PROCESS

The individual samples were prepared and analysed using both Liquid Chromatography and Gas Chromatography. A total of five screening methods were used to test for up to 330 agricultural compounds. Appendix 8.1 provides laboratory reference and their accreditation.

[10] Nielsen Ranking report Mat to w/e 04/10/2015

[11] Codex Guidelines (CAC/GL 33) Recommended methods of sampling for the determination of pesticide residues for compliance with MRLs

A total of 29 700 results were reported by the end of September 2016 from analysing 90 samples for 330 agricultural compounds. The results that did not meet the survey reporting criteria were excluded and the remaining 28 633 results were analysed for this survey. (Details are tabulated in Table 2).

4.4 SAMPLE AND RESULT EXCLUSIONS

The infant and follow on formula products made from spray-dried bovine, sheep and goat milk powders were excluded as these were not complementary foods and are covered in other monitoring programmes. All chilled dairy products such as ready to eat yoghurt were also excluded as they were analysed in the NZTDS and no agricultural residues were detected.

A small number of the reported results approximately 3.6% (1 062/29 700) were excluded from the results analysis. The results had either a limit of reporting (LOR) greater than 0.1 mg/kg or not reportable by the laboratory due to matrix interferences.

In chemical analysis, matrices are any components of a sample other than the analyte of interest. The matrix can have a considerable effect on the way the chemical analysis is conducted and the quality of the results obtained. The samples collected had a range of plant and animal origin ingredients that may have the matrix effect on the analyte(s) of interest. Matrix interference is common occurrence in the routine chemical analysis and laboratories are constantly improving analytical methods and reducing interference with various analytical techniques.

4.5 APPLICABLE MRLS AND RESULTS ANALYSIS PROCESS

In the current New Zealand MRL setting process, agricultural compound residue levels are set for specific foods that are ready for sale. These foods may have undergone processing, including post-harvest, post slaughter, specific treatments such as drying, dehydration or concentration. When residues are detected in post- harvest fresh produce and slaughtered animals, the MRLs can be used directly to determine compliance.

When residues are detected in processed foods that contain more than one ingredient, compliance cannot be determined directly. For example, under the FSANZ standard, bifenazate is permitted in apples and apricots. If bifenazate was detected in a fruit based sample that listed apples and apricots as ingredients, an adjusted MRL can be calculated based on the composite percentages of apples and apricots to determine compliance.

However, more than 98% (89/90) of the survey samples were made from more than one ingredient and the exact percentage of ingredients listed on product labels were not consistently displayed for all collected samples. It was not possible to calculate an adjusted MRL for all collected survey samples incorporating multiple ingredients as listed.

For consistency, all detected residues from samples, other than Australian imports, were evaluated against the New Zealand default MRL of 0.1 mg/kg. Any residues that were above the New Zealand default MRL were termed ‘‘technical non-compliant results" for the rest of this report.

4.5.1 Dietary exposure assessments

In addition to using the default New Zealand MRL as a measure of compliance with regards to GAP, MPI also assessed all residue detections individually for dietary exposure.

A dietary exposure assessment is the process of estimating how much of a food chemical a population, or population sub group, consumes and the long term and/or acute impact on their health[12]

All dietary risk assessments were undertaken for chronic (long-term/lifetime) exposure risk of the child. For chemicals with an appreciable short-term toxicity, the acute (short-term) exposure risk was also calculated.

Dietary exposure to (or intake of) food chemicals is estimated by multiplying the reported residue in food by a body weight adjusted food consumption value. According to the literature sources, most infants double their birthweight by four to six months and triple their birthweight by the time they are one year old[13]. Between ages one and five, a young child will gain on average 2.2 kg per year[14]. The risk assessment that we have estimated for the infant and young child foods will decrease as they grow. Risk assessment is based on a fixed body weight to calculate the health exposure over the lifetime of an adult, adds a level of uncertainty when assessing exposure limits for young children as their body weight changes from year to year.

The health significance of the reported residue is then characterised by comparing against a health based guidance value (HBGV). HBGVs are established using data on toxic doses from animal studies as a reference point. Usually the selected reference point is the highest dose shown not to cause any effects in the most sensitive toxic endpoint. Toxic endpoints are outcomes of studies conducted to determine how harmful a substance is. Additional uncertainty factors are added to a reference point (usually 100) to account for any potential differences in toxicity between humans and animals and also the more sensitive individuals within a population.

4.5.2 Food consumption estimates

Intake values for different food types can vary considerably within the young age groups, due to preferences to consume only certain foods or brands. The risk characterisation has therefore been presented as the total number of kg of the selected food required to meet the HBGV rather than based on average consumption values for the specific food type. The intakes were calculated on a body weight basis using standard body weights used in the 2009 New Zealand Total Diet Study; 9 kg for a 6 to 12 months infant and 13 kg for a 1 to 3 year old young child.

To best convey the risk presented by each result, the exposure assessment has been standardised for each sample using the stated portion size on the product label. This varied from 12 g for snack items, to 110-240 g for canned food products.

MPI is aware that the University of Otago has recently completed research on infant diets with publication due shortly. The outcomes of this report will be updated once this research is available to provide more current risk characterisation of the residues found to infants and young children.

4.5.3 Health based guidance values (HBGV)

The established HBGVs for these risk assessments were derived from the New Zealand Environmental Protection Authority (EPA) and the joint Food and Agriculture Organization of the United Nations and World Health Organization (Joint FAO/WHO). The HBGVs are listed in the order of use for this survey:

1. Potential Dietary Exposure (PDE_{food}) from EPA

[12] http://www.foodstandards.gov.au/science/exposure/Pages/dietaryexposureandin4438.aspx

[13] Maternity and Pediatric Nursing by Susan Scott Ricci, Terri Kyle, ISBM-13:978-0-7817-8055-1, Publication 2009

[14] https://medlineplus.gov/ency/article/002456.htm

A $PDE_{(food)}$ is a value determined by a toxicological evaluation by the Environmental Protection Authority (EPA) as part of its responsibility for managing public health under the Hazardous Substances and New Organisms Act 1996 (the HSNO Act). A $PDE_{(food)}$ gives the potential daily exposure a person may be subject to from a substance, via food.

MPI uses a $PDE_{(food)}$ where it is available, rather than the internationally-determined ADI, as required by the HSNO Act in New Zealand. The ADI and $PDE_{(food)}$ are largely equivalent, as they are determined using the same set of toxicology data and through a very similar scientific process. In the EPA reassessment of organophosphates and carbamates, ADI values were assigned to these compounds rather than $PDE_{(food)}$ as a result, and EPA ADI is used for the HBGV for certain compounds.

2. Acceptable Daily Intake (ADI) from FAO/WHO

In the absence of set PDE_{food}, the ADI will be used. An ADI is defined by the World Health Organization (WHO) as: "the daily intake which, during an entire lifetime, appears to be without appreciable risk on the basis of all the known facts at the time". "Without appreciable risk" has been further defined as: "the practical certainty that injury will not result even after a lifetime of exposure". ADIs are established by the WHO and Food and Agriculture Organization (FAO) of the United Nations joint expert committees, which are made up of toxicologists and residue specialists.

3. Acute Reference Dose (ARfD)

Some compounds may also have both long and short term risks. For short term or one off exposure an Acute Reference Dose (ARfD) is established by the FAO/WHO and used to characterise the risk.

4.6 SUMMARY OF RESIDUES DETECTED

Table 2 is a summary of results reported in terms of compliance to the default New Zealand MRL of 0.1 mg/kg.

Table 2 Summary of all results

	Total number	Percentage^~ (%)
Total reported results	29 700	-
Results excluded from analysis	1 067	-
Total results that were analysed which consisted of:	28 633	100.0
1. results reported as 'not detected'	28 561	99.7
2. results reported as' detected'	72	< 0.3
3. 'detected' results above the default MRL (0.1 mg/kg)	5	< 0.02

Notes

^ Percentage is based on total results that were analysed, not total results reported.

~ Due to rounding up, the sum of the individual percentages will not equal to 100 per cent.

The 72 detected results were detected across 23% (21/90) of the samples collected. All five technical non-compliant residues were from samples imported from Australia.

The 72 detected results were from 21 different agricultural compounds, including ten insecticides and ten fungicides. Functions of the reported residues are summarised in Table 3.

Table 3 List of reported residues, common product application and range of levels reported

	Residues identified	Commonly found in	Total number of detections	Reported levels in positive samples^
1	Bifenazate	insecticide	4	0.02 - 0.06
2	Bifenthrin	insecticide	3	0.01 - 0.02
3	Boscalid	fungicide	2	0.03, 0.06
4	Carbendazim	fungicide	3	0.01 – 0.02
5	Chlorantraniliprole	insecticide	5	0.01 - 0.02
6	Chlorpyrifos	insecticide	3	0.01*
7	Chlorpyrifos-methyl	insecticide	1	0.01
8	Diphenylamine	Apple scald inhibitor and approved ingredient in machine lubricant	5	0.05 - 0.15
9	Fenhexamid	fungicide	2	0.02, 0.02
10	Fludioxonil	fungicide	4	0.01 - 0.02
11	Imazalil	fungicide	6	0.02 - 0.08
12	Iprodione	fungicide	6	0.05 - 0.88
13	Methamidophos	insecticide	1	0.02
14	Permethrin	insecticide	1	0.01
15	Piperonyl butoxide	insecticide	3	0.01 - 0.1
16	Propargite	insecticide	5	0.01 - 0.03
17	Propiconazole	fungicide	2	0.01, 0.01
18	Sufloxaflor	insecticide	6	0.01 - 0.02
19	Thiabendazole	fungicide and parasiticide	8	0.01 - 0.1
20	Tebufenozide	fungicide	1	0.01
21	Trifloxystrobin	fungicide	1	0.01
	Total		72	

^where more than two detections are reported, the lowest and highest values will be presented as a range of results
*all three results were 0.01 mg/kg

Table 4 is the summary of the dietary risk assessments on all detected agricultural compound residues in samples. Depending on the residue detected, assessments were based on acute, long term or both types exposure estimate.

When compared to international HBGVs, one sample (FRSP52) with a low level of iprodione presented a potential chronic food safety risk. However, an infant will have to consume 600 grams of the food in question daily over his/her lifetime to reach an appreciable health risk. Furthermore, the infant undergoes rapid weight gain over the first few years of growth and development, which will further lower the food safety exposure limit over time. Details are in Table 4 below.

When compared to international HBGVs, one sample (FRSP82) with a low level of methamidophos presented a potential food safety risk. This sample was a food meant for young child between 12 to 36 months. The child will have to consume 65 grams of the food in question regularly to reach an

appreciable health risk. Our additional re-testing of the implicated product showed that it was an isolated incident and not a systemic issue. As such, there is not enough data to characterize how much food is a child of the stated age likely to consume to reach a level of food safety concern.

There were three Australian imports labelled as organic products that had detections of conventional agricultural compound residues. Residues of carbendazim and chlorpyrifos between 0.01 to 0.02 mg/kg were detected in FRSP48, FRSP52 and FRSP56. The levels of the residues were risk assessed in all samples and they did not pose any food safety concerns.

Table 4 Dietary risk assessment of detected residues and sample details

Sample ID and portion sizes	Agricultural compound residue	Residue concentration (mg/kg)	Dietary risk assessment	
			HBGVs (mg/kg bw/day)	Estimated DAILY amount (kg of food) consumed to reach food safety limit)
FRSP6 # 110g Net	Chlorantraniliprole	0.02	EPA PDE_{food}: 1.58	660
	Sulfoxaflor	0.01	EPA PDE_{food}: 0.028	25.3
FRSP 10 # 120g Net	Iprodione	0.27	WHO ADI: 0.06	2.04
	Diphenylamine	0.15	WHO ADI: 0.08	4.8
	Thiabendazole	0.03	WHO ADI: 0.1	Long term: 30
			WHO ARfD: 1	Acute: 300
	Fludioxonil	0.02	WHO ADI: 0.4	180
	Chlorantraniliprole	0.01	EPA PDE_{food}: 1.58	1440
	Chlorpyrifos	0.01	EPA ADI: 0.003	Long term: 2.7
			WHO ARfD: 0.1	Acute: 90
	Propargite	0.01	WHO ADI: 0.01	9
FRSP 12 ^ 100g Net	Piperonyl butoxide	0.1	WHO ADI: 0.2	225
	Chlorpyrifos-methyl	0.01	EPA ADI: 0.003	Long term: > 33.7
			WHO ARfD: 0.1	Acute: 1100
FRSP 15 # 120g Net	Chlorantraniliprole	0.02	EPA PDE_{food}: 1.58	708
	Sulfoxaflor	0.01	EPA PDE_{food}: 0.028	25.2
FRSP 19* 90g Net	Tebufenozide	0.01	WHO ADI: 0.02	Long term: 54
			WHO ARfD: 0.9	Acute: 810
FRSP 31 # 120g Net	Iprodione	0.05	WHO ADI: 0.06	10.8
	Bifenazate	0.02	WHO ADI: 0.01	4.5
	Imazalil	0.02	WHO ADI: 0.03	Long term: 13.5
			WHO ARfD: 0.05	Acute: 22.5
	Chlorantraniliprole	0.01	EPA PDE_{food}: 1.58	1440
	Sulfoxaflor	0.01	EPA PDE_{food}: 0.028	25.2
	Thiabendazole	0.01	WHO ADI: 0.1	Long term: 90
			WHO ARfD: 1	Acute: 900
FRSP 33 # 120 g Net	Bifenazate	0.05	WHO ADI: 0.01	1.8
	Boscalid	0.03	EPA PDE_{food}: 0.028	8.4
	Fenhexamid	0.02	WHO ADI: 0.2	90
	Sulfoxaflor	0.02	EPA PDE_{food}: 0.028	12.6

Sample ID and portion sizes	Agricultural compound residue	Residue concentration (mg/kg)	Dietary risk assessment	
			HBGVs (mg/kg bw/day)	Estimated DAILY amount (kg of food) consumed to reach food safety limit)
FRSP 34 ^ 120g Net	Iprodione	0.24	WHO ADI: 0.06	2.28
	Diphenylamine	0.1	WHO ADI: 0.08	7.2
	Thiabendazole	0.1	WHO ADI: 0.1	Long term: 9
			WHO ARfD: 1	Acute: 90
	Imazalil	0.08	WHO ADI: 0.03	Long term: 3.36
			WHO ARfD: 0.05	Acute: 5.64
	Boscalid	0.06	EPA PDE_f^{ood}: 0.028	4.2
	Fenhexamid	0.02	WHO ADI: 0.2	90
	Propargite	0.02	WHO ADI: 0.01	4.5
	Fludioxonil	0.01	WHO ADI: 0.4	360
	Trifloxystrobin	0.01	WHO ADI: 0.04	36
FRSP 48 # 120g Net	Carbendazim	0.01	WHO ADI: 0.03	Long term: 27
			WHO ARfD: 0.5	Acute: 450
FRSP 51 # 120g Net	Iprodione	0.88	WHO ADI: 0.06	Long term: 0.600
	Imazalil	0.05	WHO ADI: 0.03	Long term: 5.4
			WHO ARfD: 0.05	Acute: 9
	Thiabendazole	0.05	WHO ADI: 0.1	Long term: 18
			WHO ARfD: 1	Acute: 180
	Propargite	0.03	WHO ADI: 0.01	3
	Fludioxonil	0.02	WHO ADI: 0.4	180
	Bifenthrin	0.01	WHO ADI and ARfD: 0.01	Long term and acute: 9
	Propiconazole	0.01	WHO ADI: 0.07	Long term: 63
			WHO ARfD: 0.3	Acute: 270
FRSP 52 # 120g Net	Carbendazim	0.02	WHO ADI: 0.03	Long term: 13.5
			WHO ARfD: 0.5	Acute: 225
	Chlorpyrifos	0.01	EPA ADI: 0.003	Long term: 2.7
			WHO ARfD: 0.1	Acute: 90
FRSP 56 # 120g Net	Carbendazim	0.01	WHO ADI: 0.03	Long term: 27
			WHO ARfD: 0.5	Acute: 450
FRSP 57 ^ 120g Net	Bifenazate	0.06	WHO ADI: 0.01	1.5
	Sulfoxaflor	0.02	EPA PDE_{food}: 0.028	12.6
FRSP 59 ^ 120g Net	Diphenylamine	0.07	WHO ADI: 0.08	10.32
	Thiabendazole	0.01	WHO ADI: 0.1	Long term: 9
			WHO ARfD: 1	Acute: 90
	Imazalil	0.02	WHO ADI: 0.03	Long term: 13.5
			WHO ARfD: 0.05	Acute: 22.5
	Iprodione	0.25	WHO ADI: 0.06	2.16
	Diphenylamine	0.09	WHO ADI: 0.08	8
	Imazalil	0.03	WHO ADI: 0.03	Long term: 84
			WHO ARfD: 0.05	Acute: 15

Sample ID and portion sizes	Agricultural compound residue	Residue concentration (mg/kg)	Dietary risk assessment	
			HBGVs (mg/kg bw/day)	Estimated DAILY amount (kg of food) consumed to reach food safety limit)
FRSP 64 # 120g Net	Bifenthrin	0.02	WHO ADI and ARfD: 0.01	Long term and acute: 79.5
	Thiabendazole	0.02	WHO ADI: 0.1	Long term: 45
			WHO ARfD: 1	Acute:450
	Chlorpyrifos	0.01	EPA PDE_{food}: 0.003	Long term: 2.7
			WHO ARfD: 0.1	Acute:90
	Propiconazole	0.01	WHO ADI: 0.07	Long term: 63
			WHO ARfD: 0.3	Acute:11520
	Chlorantraniliprole	0.01	EPA PDE_{food}: 1.58	1440
	Propargite	0.01	WHO ADI: 0.01	9
FRSP 65 # 120g Net	Iprodione	0.07	WHO ADI: 0.06	7.68
	Diphenylamine	0.05	WHO ADI: 0.08	12
	Chlorantraniliprole	0.02	EPA PDE_{food}: 1.58	708
	Imazalil	0.02	WHO ADI: 0.03	Long term: 13.5
			WHO ARfD: 0.05	Acute:22.56
	Fludioxonil	0.01	WHO ADI: 0.4	360
	Sulfoxaflor	0.01	EPA PDE_{food}: 0.028	25.2
FRSP 67 ^ 120g Net	Propargite	0.02	WHO ADI: 0.01	5
	Thiabendazole	0.01	WHO ADI: 0.1	Long term: 90
			WHO ARfD: 1	Acute:900
FRSP 69 ^ 120g Net	Bifenthrin	0.01	WHO ADI and ARfD: 0.01	Long term and acute: 9
	Piperonyl butoxide	0.01	WHO ADI: 0.2	Long term: 180
FRSP 79 * 40g Net	Piperonyl butoxide	0.1	WHO ADI: 0.2	Long term:90
FRSP 82 * 220g Net	Permethrin	0.01	WHO ADI: 0.05	64.9
	Methamidophos	0.02	EPA PDE_{food} : 0.0001	0.065
			WHO ARfD: 0.01	Acute:6.5
FRSP 86 * 170g Net	Permethrin	0.01	WHO ADI: 0.05	44.88

Symbols # 4-6 months
^ 6 months and over
*1 to 3 years old
~ rounded up to one decimal place.

4.7 LIMITATIONS

As with all surveys, there are limitations on what can be concluded from the data collated. Results should be representative of the tested samples however not representative of any particular brand tested.

- Representative units: It was not always possible to acquire the same number of units from different manufacturing batches to make up the minimum sample weight of 1.0 kg required for testing. The more popular brands were often represented by samples made up of two or more batches. By comparison, some less popular brands were usually samples made up of units from a single batch.

- Time sensitive: All samples were collected over a period of 30 days or less. The collection period may not have reflected the seasonal variations in ingredients and geographical differences that may contribute to the varying levels of agricultural chemical residues in the food over a period of time.

- Representative consumption data: There is little reported data on the exact consumption amounts for infant and young children age groups in New Zealand. The Ministry of Health does not have recommended serving sizes for children younger than 2 years old. At this age, solid foods are being introduced gradually in to the diet, although the diet is largely still liquid, either breast milk or formula. With developing taste preferences, certain infants may be fussy over not eating or exclusively eating certain foods and intake is often dependant on hunger and satiety cues rather than aiming for specific portion sizes. As a result it has not been possible to robustly estimate mean intake quantities for chronic exposure risk characterisation, and high intake quantities for acute exposure estimates; as would be standard for exposure estimates in older children or adults.

- Different HBGV: Similar to setting MRLs of agricultural chemicals, Australia and New Zealand will have their own health-based guidance values for different agricultural chemicals based on the scientific review of the toxicology data.

- Rapid changing body weights: The methamidophos result (FRSP 82) may have presented a likely long term risk based on estimated body weights in section 4.5.2. In reality, infants and young children go through rapid body weight gains during the first few years of their life. The long term risk assessment should be viewed as a conservative estimation that will likely become invalid as the young child exceed the estimated body weight within the first few years of his or her life.

5 Follow up actions

5.1 METHAMIDOPHOS RESIDUES

When the results of the samples and their risk assessments were confirmed by MPI, the Australian jurisdiction agency and the manufacturer were informed of the findings. The overseas jurisdiction officials carried out their own assessment and concluded that, as the sample did not exceed their country's MRL, there was no breach of their regulatory limits and no further follow up was required. Methamidophos or acephate (which breaks down to methamidophos on application) are active ingredients permitted in insecticides for the production of the listed ingredients in Australia.

MPI re-sampled additional units of the implicated product from retail stores nationwide. MPI re-tested 13 units of the implicated product and the original composite sample (that tested positive) for methamidophos. The 'best before' date for all submitted units were identical, spread across four consecutive hours of production. The units from the first two hours had no detection of methamidophos. The units from the second two hours of production had detections of methamidophos. The time stamps of the positive units were 40 minutes apart. The follow up indicated that the methamidophos was isolated possibly to a batch of incoming ingredients. After MPI original notification, the manufacturer has informed MPI that they stopped production due to low sales volume.

The manufacturer completed their own follow up and shared their findings with MPI. The manufacturer have re-tested three units from the second two hours of production but had no methamidophos detections in any of the units. They also reviewed their residue records over the past 12 months since notification, there were no findings of methamidophos detections in 70 finished products and 65

ingredients. The 65 ingredients tested included actual batches used to manufacture the implicated product.

EPA will phase out methamidophos for use in New Zealand by 2023 and MPI is reviewing the use of methamidophos and acephate by tightening the application use of registered products. MPI is also proposing to reduce the MRL for methamidophos for all other foods to 0.01 mg/kg, which is undergoing public consultation at the time of writing this report.

5.2 RESIDUES OF AGRICULTURAL COMPOUNDS NOT APPROVED FOR ORGANIC LABELS

In New Zealand, there are no specific MRLs for foods labelled as 'organic', so the MRLs established for conventionally produced products were applied to the reported agricultural compound residues detected in the products labelled as organic. The reported agricultural compound residues were approved for conventional agricultural, but not organic farming.

The agricultural compound residues did not exceed the default New Zealand MRL and the dietary risk assessments also showed no significant dietary exposure. As there was no food safety risk identified, MPI determined a recall of these products was not required.

Under the Fair Trading Act in New Zealand, the Commerce Commission enforces the usage of the organic label claim of a food product. MPI has forwarded the findings to the Commerce Commission of New Zealand.

6 Conclusion

Determining MRL compliance of the processed foods with multiple ingredients presented challenges; nevertheless, in general the results showed that GAPs were followed in food production.

In-depth examination of the reported residues using internationally recognised dietary risk assessment methodology showed no significant dietary risks in the complementary foods surveyed, except for the detected level of methamidophos in one product for which the follow-up indicated that it was an isolated incident, not ongoing issue.

For this one product, MPI's dietary risk assessment showed a potential risk dependent on the amount of product consumed; whereas the overseas jurisdiction performed their food safety assessment came to a conclusion that the product complied with their MRL and no breach or food safety risk has occurred.

This survey highlights that compliant raw materials when use for manufacturing processed foods could result in carryover residues in the final product. The carryover residue could potentially pose food safety risks in foods recommended for young children. The current set default MRL of 0.1 mg/kg may not be adequate in addressing good agricultural practices for raw materials production meant for processed foods for young children. MPI regularly review GAP and changes to farm practices to ensure that the set MRLs remains current. The MRL Food Notice is amended a number of times each year to reflect these changes.

MPI previously surveyed processed foods for infants and young children in the 2009 NZTDS and did not find any significant sources of agricultural compound residues. This survey further confirms the 2009 NZTDS findings for a wider range of processed foods suitable for infant and young children.

In conclusion, infants and young children consuming processed complementary feeding foods may have occasional exposure of agricultural compounds, but only at levels that present a negligible risk of exposure to human health.

7 Appendix

Table 5 contains the summary of the five laboratory method and references used in this survey.

Table 5 Multi-residue screening Methods summary

Laboratory Analysis code	Method	Accreditation
CR006	By GC, GCMSMS, LCHRMS using In-house method; in accordance with MS016	NATA [15]
CR007	By GC, GCMS using in-house method	NATA
CR015.2	By LCMSMS, GC, GCMS and GCMSMS using in-house method; in accordance with MS016	NATA
CR015.3	By HPLCMSMS using in-house method	NATA
CR015.4	By LCMS using in-house method	NATA

7.1 AGRICULTURAL COMPOUNDS TESTED IN THIS SURVEY

Up to 330 agricultural compounds were screened for in all samples. The full list of agricultural compounds is available upon request by emailing foodassuranceprogrammes@mpi.govt.nz.

[15] National Association of Testing Authorities, Australia. Laboratory accreditation information link