

Survey of total arsenic and inorganic arsenic in apple and pear juice

Summary

In 2012, Food Standards Australia New Zealand (FSANZ) undertook a small analytical program for total and inorganic arsenic in apple and pear juice, using 96 of the 108 apple juice samples collected in Australia and New Zealand for a separate survey on cyanogenic glycosides¹. In addition to the apple juice samples, four pear juice samples purchased separately by FSANZ from several Queensland stores were included in the survey. In this survey we report the analysed total and inorganic arsenic concentrations of these 100 samples.

Thirty four samples had levels of total arsenic above the level of reporting of 2.5 µg/kg (0.0025 mg/kg). The highest total arsenic concentration was 16 µg/kg (0.016 mg/kg) in apple juice. In these samples, trace levels of inorganic arsenic were found in 14 apple juice samples and 20 samples had a quantifiable concentration of inorganic arsenic ranging from 2.5 - 11.3 µg/kg (0.0025 – 0.0113 mg/kg). There were no total arsenic detections in the pear juice; therefore no analysis for inorganic arsenic was carried out.

This survey has identified that arsenic species are present in a number of apple juice products available in Australia and New Zealand. Twenty of the 34 samples that had a quantifiable concentration of total arsenic also had a quantifiable concentration of inorganic arsenic. The concentrations reported were similar to concentrations observed in other countries for apple juice.

Acknowledgements

FSANZ would like to thank the following organisations and people:

- ESR New Zealand Laboratory staff for their assistance in arranging the transport of frozen apple juice samples to Symbio Alliance laboratories for analysis.
- State and Territory jurisdictions for their assistance with survey planning and sample collection.
- The staff at Symbio Alliance for the collection, transportation, preparation and analysis of arsenic levels in apple and pear juice samples.

¹ The apple juice samples were originally obtained for a separate FSANZ survey of apple juice for total hydrocyanic acid (HCN) (*Survey of cyanogenic glycosides in plant-based foods- report not released publicly as of 20/2/13* – link to be provided when available).

Aims

The aim of this survey was to provide data on the presence of inorganic arsenic in apple and pear juices. Data on inorganic and total arsenic levels in apple juice, a commonly consumed beverage, will greatly assist FSANZ in preparing more up to date dietary exposure estimates for total and inorganic arsenic in the future. Whilst pear juice is not a common beverage, it is commonly added to canned fruits, fruit purees and other processed foods. Fruit juice was not analysed for total arsenic in the latest 23rd Australian total Diet Study (ATDS), or in earlier studies, therefore the level in Australian and New Zealand fruit juices was unknown (FSANZ 2013).

Introduction

Arsenic is a colourless, odourless element found in water, air, food and soil as a naturally occurring substance or due to contamination from human activity. Arsenic occurs in organic and inorganic forms. The organic forms are generally considered to be of relatively low toxicity because they are better metabolised than inorganic forms. Inorganic forms are considered to present a greater hazard and are human carcinogens (FAO/WHO, 2010). The main forms of inorganic arsenic are arsenic trioxide (AsIII) and arsenic pentoxide (AsV). Because both occur naturally in soil and ground water, small amounts are unavoidably found in some food and drinks. The ratio of organic and inorganic arsenic can vary widely depending on the source of contamination and the commodities in which it is present (Canadian Food Inspection Agency (CFIA) 2010).

Acute toxicity as a result of high exposure to inorganic arsenic can result in gastrointestinal disturbances such as vomiting (WHO 2001). Chronic toxicity from high exposure to inorganic arsenic from drinking water has been associated with cancer (WHO 2001).

Arsenic compounds were widely used in pesticides (e.g. lead arsenate) and in some veterinary drugs, but there are currently no registered uses for food crops or for animal production in Australia and New Zealand (APVMA 2013, Ministry for Primary Industry 2014). Inorganic arsenic is registered for use in the protection of timber and wood based products from borers, termites and fungal attack and arsenic derivatives are used in herbicides for turfs, lawns and cotton.

There is evidence in the literature that arsenic, including inorganic arsenic, is present at low levels in apple and other juices (USFDA 2011 & 2013a, NRC 1993).

Regulatory limits

The Australia New Zealand Food Standards Code (the Code) does not provide a maximum level (ML) for total or inorganic arsenic in fruit or fruit products. However, FSANZ regularly monitors levels of contaminants in a range of foods through the Australian Total Diet Study (ATDS) and targeted surveys. The most recent [\(23rd\) ATDS](#) included testing of total and inorganic arsenic in a range of foods, but did not include fruit juice.

There are no regulatory limits for arsenic in apple juice. In 2008, the United States Food and Drug Administration's (USFDA) established a level of concern for total arsenic in pear and apple juice of 0.023 mg/kg (23 µg/kg), which was calculated using a daily consumption of juice of 13 g/kg body weight/day (all juice consumption for male and female 2+ years at the 90th percentile) and a non-cancer guidance value established by the US EPA for inorganic arsenic of 0.3 µg/kg body weight per day (USFDA 2008). However, because arsenic is considered to be a human carcinogen, the USFDA considers that there is a basis for concern for cancer risks at lower levels of exposure. In July 2013, the USFDA proposed an 'action level' of 10 µg/kg for inorganic arsenic in apple juice (USFA 2013b). This is the same

level set by the U.S. Environmental Protection Agency (USEPA) for arsenic in drinking water (USEPA 2013).

Apple juice consumption in Australia and New Zealand

Apple juice is commonly consumed as a beverage in Australia and New Zealand. Children in particular are frequent consumers of apple juice. Pear juice, while not commonly consumed as a beverage, is often used as a liquid in canned fruit and other shelfstable fruit products.

Australia²

In the 1995 National Nutrition Survey approximately 12% of the total population consumed apple juice on the day of the survey. For consumers of apple juice, mean consumption was 161 g per day, 467 g at the 90th percentile. In the 2007 Australian National Children's Nutrition and Physical Activity survey, 45% of children aged 2-16 years reported consuming apple juice on the day of the survey. For consumers of apple juice mean consumption was 141 g per day, 328 g at the 90th percentile.

New Zealand²

In the 1997 National Nutrition Survey of the whole New Zealand population 5% of respondents reported consuming apple juice on the day of the survey. For consumers of apple juice, mean consumption was 293 g per day, 499 g at the 90th percentile. The 2002 National Children's Nutrition Survey, which surveyed children aged 5-14 years, showed that 19% of respondents reported consuming apple juice on the day of the survey. For consumers of apple juice, consumption was 168 g and 495 g per day at the mean and 90th percentile respectively.

Materials and Methods

Sampling

FSANZ engaged Symbio Laboratories to analyse the apple and pear juice samples for total and inorganic arsenic. A total of 100 fruit juice samples (96 apple and 4 pear) were analysed for total arsenic. These samples had been collected previously for another survey. In April/May 2012, one hundred and eight individual juice samples were collected in Australia and New Zealand for analysis by ESR New Zealand as part of a joint FSANZ and New Zealand Ministry for Primary Industries (MPI) survey of total hydrocyanic acid (HCN) in apple juice. These samples comprised juices made with local ingredients and a combination of both local and imported ingredients, reconstituted and non-reconstituted juices and both shelf stable juices and juices requiring refrigeration. The apple aroma (flavour) extract that is often collected from the vapour during the production of apple juice concentrate was not included for analysis.

The New Zealand samples were purchased primarily in Christchurch, The others were obtained directly from manufacturing plants. Australian samples were purchased in nine geographical locations covering the eight Australian states and territories, making up a representative sample of the range of apple juice available on the marketplace. All samples were frozen as soon as they were received by ESR.

At the completion of the ESR analyses, 96 frozen retention samples of apple juice (approximately 80 mL each) were air-freighted from ESR New Zealand to Symbio Laboratories in Queensland. Product and sample details were forwarded to FSANZ and

² Apple juice and blended juices containing apple juice were included in consumption estimates.

Symbio. Forty eight apple juice samples were from Australian retailers and 48 from New Zealand retailers. For unknown reasons, twelve of the original 108 samples collected in New Zealand were not freighted to Australia. Four pear juice samples were collected from retail stores in Queensland, Australia and added to the survey.

Sample preparation and analysis

Sample preparation

Each of the frozen 80 mL apple juice samples were defrosted in a refrigerator and then agitated or mixed thoroughly prior to analysis. The pear juice samples were stored as per the directions on the label prior to being agitated and analysed. All concentrates were made up as ready to consume and analysed as such.

Total arsenic method of analysis

Total arsenic was analysed using a NATA accredited method. An aliquot from each sample was mixed with nitric acid and digested before the addition of purified water, filtering and loading for inductively coupled plasma mass spectrometry (ICP/MS) with a collision cell device.

A limit of detection (LOD) of 0.5 µg/kg (0.0005 mg/kg) for total arsenic was provided for ready to drink juice (i.e. reconstituted). The limit of reporting/quantification (LOR/LOQ) for the reconstituted ready to drink juice was 2.5 µg/kg (0.0025 mg/kg). Detections between the LOD and LOR were reported as "Trace".

Inorganic arsenic method of analysis

The method used for inorganic arsenic analysis was a Symbio Alliance in-house method. An aliquot from each of the 34 samples with total arsenic greater than 2.5 µg/kg was combined with an extraction solvent (methanol/water) and agitated with an ultrasonic probe before being centrifuged and the supernatant filtered and loaded on high performance/pressure liquid chromatography (HPLC)-ICP/MS with collision cell device.

The LOD and LOR/LOQ for inorganic arsenic were 0.5 µg/kg and 2.5 µg/kg (0.0005 and 0.0025 mg/kg) respectively. Detections between the LOD and LOR were reported as "Trace". Inorganic arsenic in this report is defined as the combined value of AsIII plus AsV (unless otherwise specified).

All samples with total arsenic detections greater than the LOR/LOQ for total arsenic were further analysed for inorganic arsenic.

Results

Scenarios for reporting

Mean and/or median concentration of total or inorganic arsenic was reported for those samples that had detections and using three bounded scenarios (Table 1):

Scenario 1 - Lower bound (LB) reporting

For the purpose of calculating mean and median concentrations of total and inorganic arsenic, samples reported as <LOD of 0.5 µg/kg (i.e. not detected) were assumed to be zero. All results reported as 'Trace' (i.e. between LOD and LOR) were assumed to be at the

LOD, i.e. 0.5 µg/kg. This is known as the lower bound estimate and is the least conservative estimate of the true mean arsenic concentration of the samples analysed.

Scenario 2 - Middle bound (MB) reporting

The mean and median concentrations of total arsenic are also provided where concentrations reported <LOD were assumed to be ½ LOD (0.25 µg/kg) and the midpoint between LOD and LOR (1.5 µg/kg) was assumed for concentrations reported as 'Trace'. For inorganic arsenic, the mean and median concentrations are provided by also reporting 'Trace' as 1.5 µg/kg

Scenario 3 - Upper bound (UB) reporting

For the purpose of calculating mean and median concentrations of total and inorganic arsenic, samples reported as <LOD of 0.5 µg/kg (µg/kg) were assumed to be 0.5 µg/kg. All results reported as 'Trace' (i.e. between LOD and LOR) were assumed to be at the LOR of 2.5 µg/kg. This is known as the upper bound estimate and is a more conservative estimate of the true mean arsenic concentration of the samples analysed.

Table 1 Scenarios for reporting

	No detection	Trace
Lower bound	0	0.5 µg/kg (LOD)
Mid bound	0.25 µg/kg (½ LOD)	1.5 µg/kg ((LOD +LOR)/2)
Upper bound	0.5 µg/kg (LOD)	2.5 µg/kg (LOR)

Summary of occurrence and ranges

Total arsenic concentration in Australian and New Zealand apple juice samples are provided in [Attachment 1](#). The concentrations ranged from <0.5 (LOD) to 16 µg/kg. Total arsenic concentrations >LOR were reported in 34 samples, and these samples were analysed for inorganic arsenic, where 20 of these had reportable concentrations of inorganic arsenic. Inorganic arsenic concentrations ranged from <2.5 to 11.3 µg/kg. Total arsenic was not detected in pear juice samples and consequently no pear juice samples were analysed for inorganic arsenic.

There was little discernible difference in the total or inorganic arsenic concentrations between samples purchased in Australia or New Zealand. Table 2 provides the minimum and maximum concentrations (µg/kg) of total and inorganic arsenic in apple juice by country of purchase. Tables 3 and 4 provide mean and median concentrations for Australian and New Zealand samples for total arsenic and inorganic arsenic where sample concentrations reported as <LOD or trace have been assigned different concentrations (see Table 1).

Of the 96 apple juice samples, 16 (17%) had no detectable total arsenic concentrations, 50 (52%) had "Trace" amounts and 34 (31%) had levels at or above 2.5 µg/kg (>LOR). Twenty seven per cent of samples purchased in Australia had total arsenic concentrations >LOD compared to 44% of apple juice samples purchased in New Zealand. Approximately 69% of juice samples did not contain quantifiable concentrations of total arsenic.

The 34 samples with total arsenic concentrations >LOR were analysed for inorganic arsenic species. The concentrations are presented, by species, in Attachment 1. Trace levels of inorganic arsenic were found in 14 apple juice samples and 20 samples had a quantifiable concentration of inorganic arsenic. Of these 54% of the samples purchased in Australia were reported to have inorganic arsenic concentrations >LOD compared to 62% of the samples purchased in New Zealand.

The highest concentrations of total arsenic found in Australian and New Zealand purchased apple juice were 13 and 16 µg/kg respectively. A concentration of 8.7 µg/kg was the highest inorganic arsenic concentration detected in Australian purchased apple juice. The highest inorganic arsenic concentration (11.3 µg/kg) was in an apple juice sample purchased in New Zealand. The sample with the highest inorganic arsenic (11.3 µg/kg) had a total arsenic concentration of 13.3 µg/kg; the sample with the highest total arsenic (15.7 µg/kg) had a lower inorganic arsenic concentration of 10.3 µg/kg.

Table 2 – Minimum and maximum concentrations (µg/kg) of total and inorganic arsenic in apple juice by country of purchase

	Total Arsenic µg/kg			Inorganic Arsenic µg/kg		
	Aust	NZ	Combined	Aust	NZ	Combined
Sample size	48	48	96	13	21	34
Detections (>LOD)	27%	44%	35%	54%	62%	62%
Minimum	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Maximum	13.0	16.0	16.0	8.7	11.3	11.3

Median and means by scenario

Reported Lower bound average concentrations

The mean total arsenic concentration for apple juice samples purchased in Australia (n=48) was 1.3 µg/kg and 2.6 µg/kg for New Zealand purchased samples (n=48) and 1.9 µg/kg for the combined samples (n=96). The median concentration was zero for samples purchased in Australia, and New Zealand and for the combined samples (Table 3).

The mean inorganic arsenic (AsIII plus AsV) concentration for apple juice samples purchased in Australia (n=13) was 2.4 µg/kg, 3.4 µg/kg for New Zealand purchased samples (n=21) and 3.0 µg/kg for the combined samples (n=34). The median concentration was 2.5 µg/kg for samples purchased in Australia, 2.6 µg/kg for New Zealand and 2.5 µg/kg for the combined samples (Table 4).

Reported Middle bound average concentrations

The mean total arsenic concentration for Australian purchased apple juice was 1.5 µg/kg. The mean concentration for New Zealand purchased apple juice was 2.7 µg/kg. The mean for all samples was 2.1 µg/kg. The median concentration was 0.25 µg/kg for samples purchased in Australia and New Zealand and for the combined samples (Table 3)

The mean inorganic arsenic (AsIII plus AsV) concentration for apple juice samples purchased in Australia (n=13) was 2.5 µg/kg, 3.5 µg/kg for New Zealand purchased samples (n=21) and 3.1 µg/kg for the combined samples (n=34). The median concentration was 2.5 µg/kg for samples purchased in Australia, 2.6 µg/kg for New Zealand and 2.5 µg/kg for the combined samples (Table 4).

Reported Upper bound average concentrations

The mean total arsenic concentration for Australian purchased apple juice was 1.7 µg/kg. The mean concentration for New Zealand purchased apple juice was 2.8 µg/kg. The mean for all samples was 2.3 µg/kg. The median concentration was 0.5 µg/kg for samples purchased in Australia, and New Zealand and for the combined samples.

The mean inorganic arsenic (AsIII plus AsV) concentration in samples where total arsenic was reported as \geq LOR, for apple juice samples purchased in Australia (n=13) was 2.7 $\mu\text{g}/\text{kg}$, 3.6 $\mu\text{g}/\text{kg}$ for New Zealand purchased samples (n=21) and 3.2 $\mu\text{g}/\text{kg}$ for the combined samples (n=34). The median concentration was 2.5 $\mu\text{g}/\text{kg}$ for samples purchased in Australia, 2.6 $\mu\text{g}/\text{kg}$ for New Zealand and 2.5 $\mu\text{g}/\text{kg}$ for the combined samples.

Table 3 – Mean and median concentrations ($\mu\text{g}/\text{kg}$) for total arsenic in apple juice for LB, MB UB scenarios and where concentrations $>$ LOR

		Total Arsenic $>$ LOR ($\mu\text{g}/\text{kg}$) n=34	Lower bound	Middle bound	Upper bound
			$<$ LOD = 0 ($\mu\text{g}/\text{kg}$)	$<$ LOD = 1/2 LOD ($\mu\text{g}/\text{kg}$)	$<$ LOD = LOD ($\mu\text{g}/\text{kg}$)
Australia	mean	4.8	1.3	1.5	1.7
	median	3.9	0.0	0.3	0.5
New Zealand	mean	5.3	2.6	2.7	2.8
	median	4.0	0.0	0.3	0.5
Combined	mean	5.5	1.9	2.1	2.3
	median	4.0	0.0	0.3	0.5

Results are derived from individual samples.

$<$ LOD means result less than the limit of detection (LOD) (0.5 $\mu\text{g}/\text{kg}$)

Trace means detection between the LOD and the level of reporting (LOR) (2.5 $\mu\text{g}/\text{kg}$).

Mean and median results have been rounded to two significant figures.

Table 4 – Mean and median concentrations ($\mu\text{g}/\text{kg}$) of inorganic arsenic for LB, MB UB scenarios and inorganic arsenic concentrations in apple juice samples with total arsenic concentration \geq LOR (2.5 $\mu\text{g}/\text{kg}$)

		Inorganic Arsenic $>$ LOR ($\mu\text{g}/\text{kg}$) n=20	Lower bound	Middle bound	Upper bound
			$<$ LOD = 0 ($\mu\text{g}/\text{kg}$)	$<$ LOD = 1/2 LOD ($\mu\text{g}/\text{kg}$)	$<$ LOD = LOD ($\mu\text{g}/\text{kg}$)
Australia	mean	4.5	2.4	2.5	2.7
	median	3.3	2.5	2.5	2.5
New Zealand	mean	5.4	3.4	3.5	3.6
	median	4.8	2.6	2.6	2.6
Combined	mean	5.1	3.0	3.1	3.2
	median	3.7	2.5	2.5	2.5

Results are derived from individual samples.

$<$ LOD means result less than the limit of detection (LOD) (0.5 $\mu\text{g}/\text{kg}$)

Trace means detection between the LOD and the level of reporting (LOR) (2.5 $\mu\text{g}/\text{kg}$).

Mean and median results have been rounded to two significant figures.

Ranges for inorganic arsenic only include samples that contained reportable levels of total arsenic.

Analysis of inorganic arsenic by species

Inorganic arsenic was analysed by species (AsIII and AsV). AsIII concentrations ranged from $<$ LOD (0.5 $\mu\text{g}/\text{kg}$) to a 'Trace' amount (1.5 $\mu\text{g}/\text{kg}$) (midpoint between LOD and LOR (i.e. $(0.5+2.5)/2$ $\mu\text{g}/\text{kg}$)). Fourteen (41%) samples had trace amounts of AsV and 20 (59%) of samples analysed for inorganic arsenic had concentrations greater than 2.5 $\mu\text{g}/\text{kg}$.

Discussion

The results of this survey are similar to the total and inorganic arsenic concentrations reported in the US for apple juice. The USFDA (2011) reported 77% of the apple juice samples with total arsenic concentrations $>$ LOD also had levels of inorganic arsenic $>$ LOD compared to 62% for this survey. The US reported total arsenic levels in the range of 1.3 – 36 $\mu\text{g}/\text{kg}$ compared to the range of 2.5 – 15.7 $\mu\text{g}/\text{kg}$ for Australian and New Zealand

purchased apple juice. Two of the 87 US samples had reported total arsenic concentrations greater than 11 µg/kg.

Our survey reported a mean concentration of total arsenic in apple juice of 5.4 µg/kg compared to the US mean concentration of 6.7 µg/kg. Inorganic arsenic concentrations in the US survey ranged from 2.8 – 9.8 µg/kg compared to 2.4 – 11.3 µg/kg in our survey.

Whilst the levels of total arsenic and inorganic arsenic observed in this survey were at, or close to, the level of detection, a small percentage of them had more substantial levels of inorganic arsenic. As some adults and children consume large quantities of apple juice this should be investigated further.

Total arsenic concentrations were quantified in 34 of the samples (Attachment 1) and further analysis identified a small number of samples containing inorganic arsenic (Table 4). These data can be used as input into any estimates of dietary exposure to total and inorganic arsenic as part of a future risk assessment.

From the small dataset available, it appears that the concentration of arsenic in apple juice is not normally distributed. This could be due to a range of factors, such as geological conditions and environmental factors. In addition, sampling may not be fully representative of the food supply. Statistical analysis of this data in combination with other data sets of arsenic species in juices is warranted to investigate the possibility of extrapolating inorganic arsenic estimates for juice from total arsenic results. In particular, the proportional relationship between total arsenic and inorganic arsenic should be further investigated.

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Attachment 1

Total arsenic concentration in Australian and New Zealand apple juice samples.

Sample Number	Country of origin	Main ingredient (e.g. apple juice from concentrate [99.9%])	Source of apple juice	AsIII mg/kg	AsV mg/kg	AsIII+AsV mg/kg	Total Arsenic mg/kg
1	New Zealand & Imported	Reconstituted apple juice (100%), flavour, Vitamin C	Concentrate	< LOD	0.0025	0.0025	0.0032933
2	New Zealand	Apple juice 100% vitamin c (300)	Juice				Trace
3	New Zealand & Imported	Reconstituted apple juice (100%), flavour, vitamin c	Concentrate	< LOD	Trace	Trace	0.0025271
4	New Zealand & Imported	Reconstituted apple juice (100%), flavour, vitamin c	Concentrate	Trace	0.0098	0.0098	0.014511
5	Aust & Imported	Pressed Apple Juice, Vitamin C	Juice				Trace
6	New Zealand & Imported	Apple Juice from Concentrate (99.9%), Antioxidant (300), Flavour	Concentrate	< LOD	0.0103	0.0103	0.0157626
7	Imported concentrate	Apple Juice from Concentrate (99.9%), Antioxidant (300), Flavour, Preservative (223)	Concentrate	< LOD	0.0029	0.0029	0.004397
8	New Zealand & Imported	reconstituted NZ organic apple juice (100%), Vitamin C, natural flavour	Concentrate	< LOD	Trace	Trace	0.0034561
9	New Zealand & Imported	Pressed Apple Juice (97.9%), Reconstituted Apple Juice (2%), Vitamin C, Flavour and Preservative (202)	Pressed Juice and concentrate	< LOD	Trace	Trace	0.0030751
10	New Zealand	Apple Juice and Puree (100%) Pectin, Vitamin C (300)	Juice and puree				Trace
11	New Zealand	99% Pure NZ Apple, less than 1% Vitamin C. No Preservatives.	Juice				Trace

Sample Number	Country of origin	Main ingredient (e.g. apple juice from concentrate [99.9%])	Source of apple juice	AsIII mg/kg	AsV mg/kg	AsIII+AsV mg/kg	Total Arsenic mg/kg
12	Australia	Pear juice (100%)					< LOD
13	Australia	Pear juice (100%)					< LOD
14	Australia	Pear juice					< LOD
15	Australia	Pear juice					< LOD
16	New Zealand	Pressed apple juice	Pressed Juice				Trace
17	Australia	Apple juice	Juice	< LOD	Trace	Trace	0.0027496
18	New Zealand	Farm pressed apple juice	Pressed juice				< LOD
19	New Zealand	Farm pressed apple juice	Pressed juice				< LOD
20	New Zealand	Farm pressed apple juice	Pressed juice				Trace
21	New Zealand	Organic apple juice	Juice				Trace
22	New Zealand	100% Apple Juice	Juice	< LOD	0.0026	0.0026	0.0036685
23	South Africa	100% apple juice from concentrate	Concentrate				Trace
24	New Zealand	Farm pressed apple juice	Pressed juice				Trace
25	New Zealand	Farm pressed apple juice	Pressed juice				Trace
26	Unknown	Natural crushed apple juice	Pressed juice				Trace
27	New Zealand	100% Pure apple juice	Juice				< LOD
28	New Zealand	99% New Zealand pure organic apple juice	Juice				Trace
29	New Zealand & Imported	Apple Juice from Concentrate (99.9%), Antioxidant (300), Flavour, Preservative (223)	Concentrate	< LOD	0.0034	0.0034	0.0052013
30	New Zealand	APPLE JUICE 100% VITAMIN C (300)	Juice	< LOD	Trace	Trace	0.0040461
31	New Zealand & Imported	Reconstituted apple juice (100%), flavour, Vitamin (C)	Concentrate				Trace
32	New Zealand & Imported	RECONSTITUTED APPLE JUICE (100%), FLAVOUR, VITAMIN ©	Concentrate	< LOD	0.0038	0.0038	0.0050666

Sample Number	Country of origin	Main ingredient (e.g. apple juice from concentrate [99.9%])	Source of apple juice	AsIII mg/kg	AsV mg/kg	AsIII+AsV mg/kg	Total Arsenic mg/kg
33	Aust & Imported	Pressed Apple Juice, Vitamin C	Pressed juice				Trace
34	Australia	Apple juice	Juice				Trace
35	New Zealand & Imported	RECONSTITUTED APPLE JUICE (100%), FLAVOUR, VITAMIN ©	Concentrate	< LOD	Trace	Trace	0.0034461
36	New Zealand	Apple Juice and Puree (100%) Pectin, Vitamin C(300)	Juice and puree	< LOD	0.0052	0.0052	0.0068016
37	New Zealand & Imported	Apple Juice from Concentrate (99.9%), Antioxidant (300), Flavour	Concentrate				Trace
38	New Zealand	99% Pure NZ Apple, less than 1% Vitamin C. No Preservatives.	Juice and puree				Trace
39	New Zealand	Apple Juice (99.9%)	Juice	< LOD	0.0066	0.0066	0.0088371
40	New Zealand	Apple Juice (99.9%)	Juice	< LOD	0.0048	0.0048	0.0057669
41	New Zealand & Imported	Pressed Apple Juice (97.9%), Reconstituted Apple Juice (2%), Vitamin C, Flavour and Preservative (202)	Pressed Juice and concentrate				Trace
42	New Zealand & Imported	reconstituted NZ organic apple juice (100%), Vitamin C, natural flavour	Concentrate				Trace
43	New Zealand	Pressed apple juice	Pressed Juice				Trace
44	New Zealand	Organic apple juice	Juice				Trace
45	New Zealand & Imported	Apple juice from concentrate	Concentrate	< LOD	Trace	Trace	0.0030952
46	New Zealand & Imported	Apple juice from concentrate	Concentrate	< LOD	0.0113	0.0113	0.0133245
47	New Zealand	Apple Juice and Puree (100%) Pectin, Vitamin C(300)	Juice and puree				Trace
48	Imported concentrate	Apple Juice from Concentrate (99.9%), Antioxidant (300), Flavour, Preservative (223)	Concentrate				Trace

Sample Number	Country of origin	Main ingredient (e.g. apple juice from concentrate [99.9%])	Source of apple juice	AsIII mg/kg	AsV mg/kg	AsIII+AsV mg/kg	Total Arsenic mg/kg
49	New Zealand	99% Pure NZ Apple, less than 1% Vitamin C. No Preservatives.	Juice				Trace
50	New Zealand & Imported	Pressed Apple Juice (97.9%), Reconstituted Apple Juice (2%), Vitamin C, Flavour and Preservative (202)	Pressed Juice and concentrate	< LOD	0.0025	0.0025	0.0035845
51	New Zealand & Imported	RECONSTITUTED APPLE JUICE (100%), FLAVOUR, VITAMIN C	Concentrate	< LOD	Trace	Trace	0.00254345
52	Australia	Apple juice	Juice				< LOD
53	Imported	Apple juice from concentrate (99.9%)	Concentrate	< LOD	0.0025	0.0025	0.0041365
54	Imported	Apple juice from concentrate (99.9%)	Concentrate	< LOD	0.0087	0.0087	0.0132
55	Tasmania	Reconstituted organic apple juice (99.9%)	Concentrate				< LOD
56	Both Aust. & Imported	Cloudy Apple Juice	Not specified				Trace
57	Imported	Reconstituted apple juice (99%)	Concentrate	< LOD	0.008	0.008	0.0107458
58	Australia	Apple juice (99.9%)	Not specified				Trace
59	Australia	Reconstituted apple juice (99.9%)	Concentrate				< LOD
60	From Imported & Aust	Reconstituted apple juice (99.9%)	Concentrate	< LOD	0.0031	0.0031	0.0046278
61	Australia	Apple Juice (99.9%)	Not specified				< LOD
62	Both Aust. & Imported	Apple juice and reconstituted apple juice	Concentrate				Trace
63	Imported	Reconstituted apple juice	Concentrate				Trace
64	Australia	100% Australian apples: Apple Juice	Juice				< LOD
65	Australia	Apple Juice (99.9%)	Juice				< LOD
66	Australia	100% crushed apple juice	Juice	< LOD	0.0035	0.0035	0.0047445

Sample Number	Country of origin	Main ingredient (e.g. apple juice from concentrate [99.9%])	Source of apple juice	AsIII mg/kg	AsV mg/kg	AsIII+AsV mg/kg	Total Arsenic mg/kg
67	Australia	100% apple juice	Juice				< LOD
68	Imported	Reconstituted apple juice (99.9%)	Concentrate				Trace
69	Both Aust. & Imported	Reconstituted apple juice	Concentrate				Trace
70	From Imported & Aust	Reconstituted apple juice	Concentrate	< LOD	Trace	Trace	0.0026632
71	Imported	Reconstituted apple juice	Concentrate				Trace
72	Australia	Reconstituted organic apple juice	Concentrate				Trace
73	Both Aust. & Imported	Reconstituted apple juice	Concentrate				Trace
74	Both Aust. & Imported	Reconstituted organic apple juice	Concentrate				Trace
75	Australia	Apple juice	Not specified				< LOD
76	From Imported & Aust	Reconstituted Apple Juice	Concentrate				Trace
77	Imported	Reconstituted Apple Juice 99.8%	Concentrate				Trace
78	South Africa	Apple Juice from Concentrate (100%)	Concentrate	< LOD	Trace	Trace	0.0025277
79	Both Aust. & Imported	Apple Juice from Australian apples and reconstituted apple juice	Both				Trace
80	Australia	Cloudy Apple Juice	Not specified				Trace
81	Not provided	Reconstituted Organic Apple Juice	Concentrate				< LOD
82	Australia	Apple Juice 100%	Juice				Trace
83	Imported	Apple Juice	Not specified				Trace
84	Imported	Apple Juice	Not specified				Trace
85	Imported	Apple Juice	Not specified	< LOD	0.0025	0.0025	0.0038929
86	From Imported & Aust	Reconstituted apple juice (99.7%)	Concentrate	< LOD	Trace	Trace	0.0038323
87	Both Aust. & Imported	Reconstituted apple juice (99.9%)	Concentrate	< LOD	0.0033	0.0033	0.0047033

Sample Number	Country of origin	Main ingredient (e.g. apple juice from concentrate [99.9%])	Source of apple juice	AsIII mg/kg	AsV mg/kg	AsIII+AsV mg/kg	Total Arsenic mg/kg
88	Australia	100% cold pressed apples	Juice				Trace
89	Imported	Reconstituted apple juice (99.9%)	Concentrate				Trace
90	From Imported & Aust	Reconstituted Apple Juice (99.4%)	Concentrate				Trace
91	From Imported & Aust	Reconstituted Apple Juice (99.7%)	Concentrate				Trace
92	Unclear	Reconstituted Organic Apple Juice	Concentrate				Trace
93	Both Aust. & Imported	Pressed Apple Juice	Juice				Trace
94	Australia	Apple Juice & reconstituted Apple Juice 99.9%	Concentrate	< LOD	Trace	Trace	0.0025775
95	Both Aust. & Imported	Reconstituted apple juice 99.3%	Concentrate				Trace
96	Imported	Organic New Zealand apple juice from concentrate 100%	Concentrate	< LOD	Trace	Trace	0.0026877
97	Australia	Apple juice 99.9%	Juice				Trace
98	Imported	Reconstituted Apple juice	Concentrate	< LOD	Trace	Trace	0.0026461
99	Unclear	Apple Juice	Not specified				Trace
100	Not provided	Apple Juice	Not provided	< LOD	0.0051	0.0051	0.0078036