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 glycosides[[1]](#footnote-1). 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

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* 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.

## 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](http://www.foodstandards.gov.au/scienceandeducation/publications/23rdaustraliantotald5367.cfm) 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.

#### Australia[[2]](#footnote-2)

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 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](#_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 ≥LOR, for apple juice samples purchased in Australia (n=13) was 2.7 µg/kg, 3.6 µg/kg for New Zealand purchased samples (n=21) and 3.2 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 3 – Mean and median concentrations (µg/kg) for total arsenic in apple juice for LB, MB UB scenarios and where concentrations >LOR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | Total Arsenic >LOR (µg/kg) n=34 | Lower bound | Middle bound | Upper bound |
| **<LOD = 0 (µg/kg)** | **<LOD = 1/2 LOD (µg/kg)** | **<LOD = LOD (µg/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 µg/kg)

Trace means detection between the LOD and the level of reporting (LOR) (2.5 µg/kg).

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

Table 4 – Mean and median concentrations (µg/kg) of inorganic arsenic for LB, MB UB scenarios and inorganic arsenic concentrations in apple juice samples with total arsenic concentration ≥LOR (2.5 µg/kg)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | Inorganic Arsenic >LOR (µg/kg) n=20 | Lower bound | Middle bound | Upper bound |
| **<LOD = 0 (µg/kg)** | **<LOD = 1/2 LOD (µg/kg)** | **<LOD = LOD (µg/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 µg/kg))

Trace means detection between the LOD and the level of reporting (LOR) (2.5 µg/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 µg/kg) to a ‘Trace’ amount (1.5 µg/kg) (midpoint between LOD and LOR (i.e. (0.5+2.5)/2) µg/kg)). Fourteen (41%) samples had trace amounts of AsV and 20 (59%) of samples analysed for inorganic arsenic had concentrations greater than 2.5 µg/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 µg/kg compared to the range of 2.5 – 15.7 µg/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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |

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). [↑](#footnote-ref-1)
2. Apple juice and blended juices containing apple juice were included in consumption estimates. [↑](#footnote-ref-2)