

24th Australian Total Diet Study



FOOD STANDARDS
Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa



Phase 1

© Food Standards Australia New Zealand 2014

ISBN: 978-0-642-34583-7

Published April 2014

Food Standards Australia New Zealand (FSANZ) supports and encourages the dissemination and exchange of information. Information in this publication is provided under a Creative Commons Attribution 3.0 Australia (CC BY 3.0) Licence, except for the Food Standards Australia New Zealand logo. An electronic version of this work is available on the FSANZ website at www.foodstandards.gov.au and, for New Zealand, www.foodstandards.govt.nz.



Attribution

You may copy, distribute, transmit and adapt the material in this publication by the CC BY 3.0 licence for commercial and non-commercial purposes; but you must attribute the work in the following manner:

© Food Standards Australia New Zealand.

This attribution must not, in anyway, suggest that FSANZ endorses you or your use of the work.

For more information email info@foodstandards.gov.au

FSANZ Australia

PO Box 7186
Canberra BC ACT 2610
Australia
T +61 2 6271 2222
F +61 2 6271 2278

FSANZ New Zealand

PO Box 10559, The Terrace
Wellington 6143
New Zealand
T +64 4 473 5630
F +64 4 473 9855

Foreword

Food Standards Australia New Zealand (FSANZ) is an independent Australian Government agency responsible for ensuring a safe food supply that protects and supports the health of people in Australia and New Zealand. FSANZ is responsible for developing food standards, which includes establishing limits for the levels of certain chemicals in foods where appropriate.

To determine the level of chemicals in food, FSANZ conducts a number of food surveys, gathering data and estimating the dietary exposure of the Australian population to these chemicals. The Australian Total Diet Study (ATDS) is the most comprehensive analytical food survey conducted in Australia for this purpose.

The first ATDS, formerly known as the 'Australian Market Basket Survey', was conducted in 1970 by the National Health and Medical Research Council (NHMRC). Since then, the Australian Government has conducted regular surveys estimating consumer exposure to chemicals in the food supply, with the last nine studies managed by FSANZ. The first 20 studies examined dietary exposure to pesticide residues and contaminants, with each study concluding that the Australian food supply is safe for consumers.

The ATDS has evolved over the past 40 years in its scope and frequency, with more recent studies focussing on a wider range of food chemicals such as additives and nutrients. Broadening the scope of the ATDS has been invaluable in gathering data to assess the dietary exposure of the Australia population to a wider range of food chemicals, and determining whether there are any public health concerns.

The 24th ATDS is being reported in two stages—phase 1 covers acrylamide, aluminium and perchlorate; while phase 2 will focus on various food packaging chemicals.

I extend my thanks to the staff of FSANZ and other agencies who have contributed to a successful outcome. I am pleased to present phase 1 of the 24th ATDS as part of FSANZ's commitment to the ongoing monitoring of the Australian food supply, ensuring it continues to be one of the safest food supplies in the world.

Ms Philippa Smith AM
Chair

Contents

Foreword	1
Acknowledgements	5
Abbreviations	6
24th ATDS key findings – Phase 1	8
Key findings from this study	8
Executive Summary	10
Introduction	12
Part A – Background	16
Origin of the study	16
Using information from the study	17
Part B – Conducting the study	20
Foods included in the study	20
Food preparation	21
Part C – Estimating dietary exposures	24
What is dietary modelling?	24
Food chemical concentrations	24
Treatment of analytical values below the Limit of Reporting	25
Population groups assessed	26
Food consumption data	26
Food mapping	26
Food contribution calculations	28
Assumptions and limitations in dietary exposure assessment	28

Part D – Acrylamide	32
Acrylamide hazard summary	32
Foods included in the study for acrylamide	33
Analysis of food and beverage samples	33
Acrylamide concentrations in foods	33
Comparison to previous FSANZ survey of chemical contaminants and residues in espresso, instant and ground coffee (2008b)	34
Comparison with other Australian and international studies	34
Acrylamide mapping approach	36
Assumptions made in acrylamide mapping	36
Acrylamide dietary exposure assessment results	37
Foods contributing to estimated acrylamide dietary exposure	37
Risk characterisation	38
Risk management	41
Part E – Aluminium	44
Aluminium hazard summary	44
Foods included in the study for aluminium	45
Analysis of food and beverage samples	45
Aluminium concentrations in foods	46
Aluminium mapping	46
Aluminium dietary exposure results	47
Foods contributing to aluminium dietary exposure	47
Risk characterisation	49
Risk management	51
Part F – Perchlorate	54
Perchlorate hazard summary	54
Foods included in the study for perchlorate	55
Analysis of food samples	55
Risk characterisation	55

References	56
Appendix 1: Foods sampled in the 24th ATDS	60
Appendix 2: Food preparation instructions	65
General instructions	65
Handling purchases for food preparation	66
Preparing and storing samples	66
Glossary	67
Food preparation instructions	68
Appendix 3: Estimating dietary exposures	70
Appendix 4: Detailed information on acrylamide risk assessment and risk characterisation	74
Appendix 5: Detailed information on aluminium risk assessment and risk characterisation	92
Appendix 6: Definitions and glossary of terms	113
Appendix 7: Food consumption data	115
Acrylamide	115
Aluminium	129

Acknowledgements

FSANZ would like to thank:

- officers from state and territory food regulatory agencies for collecting samples and dispatching them to the laboratory
- the National Measurement Institute (NMI) for preparing and analysing samples
- Luc Pelletier from Health Canada for his valuable assistance in peer-reviewing this study.

Abbreviations

3-APA	3-aminopropionamid
ALARA	as low as reasonably achievable
ANCNPAS	Australian National Children's Nutrition and Physical Activity Survey
ATDS	Australian Total Diet Study
BMDL	lower confidence limit of the benchmark dose
BMDL₁₀	lower confidence limit of the benchmark dose for a 10% response
BPA	Bisphenol A
bw	body weight
CCCF	Codex Committee on Contaminants in Foods
CCFA	Codex Committee on Food Additives
CIAA	Confederation of the Food and Drink Industries of the EU
DIAMOND	Dietary Modelling of Nutritional Data – FSANZ's dietary modelling computer program
ESBO	Epoxidised soybean oil
FAO	Food and Agriculture Organization of the United Nations
FSANZ	Food Standards Australia New Zealand
GC-MS	Gas Chromatography – Mass Spectrometry
GEMS	Global Environmental Monitoring System
GMP	Good manufacturing practice
HBGV	health-based guidance value
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ISFR	Implementation Sub-Committee for Food Regulation
kg	kilograms
JECFA	Joint FAO/WHO Expert Committee on Food Additives
JMPR	Joint FAO/WHO Meetings on Pesticide Residues

LC-MS	Liquid Chromatography – Mass Spectrometry
LOQ	Limit of Quantification
LOR	Limit of Reporting
mg	milligram (one thousandth of a gram)
mg/kg	milligrams per kilogram
MOE	Margin of Exposure
NATA	National Association of Testing Authorities
ND	Not detected
NHMRC	National Health and Medical Research Council
NMI	National Measurement Institute
NNS	National Nutrition Survey
NOAEL	No-observed-adverse-effect level
PMTDI	Provisional Maximum Tolerable Daily Intake
PTWI	Provisional Tolerable Weekly Intake
QA	Quality assurance
µg	Microgram (one millionth of a gram)
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

24th ATDS key findings – Phase 1

Key findings from this study

Introduction

- Phase 1 of the 24th ATDS investigated three chemicals: acrylamide, aluminium and perchlorates, in a range of foods and beverages.

Acrylamide

- The levels of acrylamide found in the 24th ATDS were generally lower than, or comparable to, those reported in Australian and international studies.
- Estimated dietary exposures were used to calculate Margin of Exposures (MOEs)¹ using carcinogenic and neurotoxic endpoints. The MOEs indicate that the acrylamide exposure of Australian consumers is consistent with those considered to be of possible concern to human health by the 72nd meeting of the Joint Food and Agriculture Organisation (FAO)/World Health Organisation (WHO) Expert Committee on Food Additives (JECFA) (JECFA, 2011).
- It is important to maintain industry and consumer education measures to ensure acrylamide levels in Australian foods remain as low as reasonably achievable (ALARA).

¹ This is the ratio between a reference point (i.e. a low or no-effect dose) associated with critical endpoint(s) and critical study(ies) based on the most sensitive species and an estimate of human exposure.

Aluminium

- Aluminium was included in the 24th ATDS to supplement data collected during the 23rd ATDS and to provide an updated dietary exposure estimate.
- Estimated dietary exposures were under the Provisional Tolerable Weekly Intake (PTWI)² for all population groups assessed except for 2–5 year old 90th percentile consumers who had an estimated exposure of 110% of the PTWI. Due to the conservative nature of the current PTWI, this small exceedance is unlikely to represent a major public health and safety issue.
- Dietary exposure estimates were higher than those reported in the 23rd ATDS because more processed foods were included. The 24th ATDS included foods likely to have additives containing aluminium, with relatively high levels of aluminium being found in some foods such as cakes, compared to other foods surveyed.

Perchlorate

- Perchlorate levels were screened in eight tap water samples from across Australia and all results were below the limit of reporting (LOR). For this reason, no risk assessment for perchlorates was conducted.

Conclusion

- FSANZ has identified a number of areas for further work or development of risk management options to ensure that the Australian food supply remains safe.

2 Represents permissible human weekly exposure to those contaminants unavoidably associated with the consumption of otherwise wholesome and nutritious foods.

Executive Summary

The 24th ATDS involved the analysis of Australian foods and beverages for concentrations of three food chemicals and 30 food packaging chemicals and printing inks. A total of 94 foods and beverages were sampled over two sampling periods from 2–13 May 2011 (autumn sampling period) and 20 June – 4 July 2011 (winter sampling period). Due to the broad scope of the survey, the report is being released in two phases. This report (phase 1) focuses on acrylamide, aluminium and perchlorates. The phase 2 report will focus on food packaging chemicals including bisphenol A (BPA), epoxidised soy bean oil (ESBO), phthalates, printing inks and perfluorinated compounds.

Dietary exposures to the three chemicals considered in phase 1 were estimated for various age-based Australian population groups by multiplying food chemical concentrations analysed in this study by food consumption amounts as recorded in the most recent Australian National Nutrition Surveys (NNS).

Acrylamide concentrations in foods for the 24th ATDS were generally comparable to, or lower than, those reported in previous Australian surveys and international studies. For acrylamide, there is no health-based guidance value (HBGV) established as acrylamide is a genotoxic carcinogen, so the internationally accepted MOE method was used to characterise the potential risks to public health and safety. The estimated MOEs of between 20 and 480 (depending on the population group, concentration scenario and toxicological endpoint used) are consistent with other international estimates including JECFA (2010).

In order to achieve levels of acrylamide exposure which are as low as reasonably achievable, FSANZ will continue to engage with industry, jurisdictions and consumers with a view to decreasing total dietary exposure to acrylamide for Australian and New Zealand consumers.

Aluminium was included in the 24th ATDS to supplement data collected during the 23rd ATDS and to provide an updated dietary exposure assessment. The focus of sampling for the 24th ATDS was processed foods likely to contain aluminium-containing food additives, while the 23rd ATDS included many foods in which naturally occurring aluminium would be present.

The estimated dietary exposures to aluminium for various population sub-groups were compared to an appropriate HBGV, the PTWI, to assess the potential risks to human health and safety. Although the PTWI was set on the basis of aluminium as a contaminant, it can be used to assess risk when aluminium is used in food additives. Estimated aluminium dietary exposures were below the HBGV for all population groups assessed with the exception of 2–5 year olds at the 90th percentile of aluminium exposure (at 110% PTWI). This slight exceedance is unlikely to represent long-term exposure and because of the conservative nature of the current PTWI, it is unlikely to represent a major public health and safety issue.

The results for aluminium are consistent with those reported by JECFA (2011b) and suggest that most of the Australian population's exposure to aluminium is within internationally recognised safe levels. In view of the slight exceedance of the PTWI for aluminium for children aged 2–5 years (particularly from consumption of baked goods), FSANZ will consider appropriate risk management options and their effects. As part of these considerations, FSANZ will discuss with industry whether the current permissions for aluminium-containing food additives in *Australia New Zealand Food Standards Code* (the Code) are still appropriate for the established technological need; or if they could be decreased to lower potential dietary exposures, particularly those for young children. In addition, alternative food additives that may be available for industry will be explored.

Perchlorate was included in the 24th ATDS to screen levels in tap water samples from across Australia and no detectable levels were found. For this reason no risk assessment was conducted for perchlorates.

FSANZ will continue to monitor both domestic and international developments related to chemicals in food and use this to prioritise future survey work in the form of a nationally coordinated ATDS or smaller scale target surveys as required.

Introduction

The purpose of the ATDS is to estimate the dietary exposure of the Australian population to substances which may be found in food. For the 24th ATDS, these included various food chemicals, chemicals that may migrate from food packaging materials and printing inks. Due to the broad scope of the survey, the report is being released in two phases. This report (phase 1) focuses on the contaminants acrylamide, aluminium and perchlorate. The phase 2 report will focus on packaging chemicals including BPA, ESBO, phthalates, printing inks and perfluorinated compounds.

Acrylamide ($\text{CH}_2=\text{CHCONH}_2$) is a water soluble vinyl monomer of polyacrylamide, an industrial chemical used as a flocculant for the treatment of drinking water and various other purposes (JECFA 2011a). In 2002, it was revealed that acrylamide could form naturally in carbohydrate-rich foods during high temperature cooking such as frying, baking, roasting, toasting and grilling (Codex 2009).

Concern about the health effects of acrylamide formation in food and beverages during processing has led to a range of international studies and survey activities. JECFA (2011a) released a report which collated concentration data from 31 countries taken from surveys conducted between 2004–2009. The estimated dietary exposures and MOEs indicated a human health concern noting that animal studies had shown acrylamide to be both genotoxic and carcinogenic. There is no direct evidence acrylamide causes cancer in humans but food regulators, including FSANZ, agree that we should reduce our exposure.

The 24th ATDS represents the first estimate of exposure to acrylamide from the total diet of Australian consumers. It follows on from previous Australian survey activities in 2004, 2006 and 2009, focusing on carbohydrate-based foods (Croft et al. 2004) non-carbohydrate-based foods (Department of Health South Australia 2006) and coffees (FSANZ 2008b), respectively.

Aluminium is an abundant naturally occurring metal which is also used in food packaging and food processing. Chronic (long-term) exposure to aluminium at high levels is thought to increase the risk of some health issues, such as neurological and reproductive problems. This report represents an updated risk assessment from that provided in the 23rd ATDS. The sampling plan for the 24th ATDS was developed to supplement the 23rd ATDS results and included foods likely to include aluminium-containing food additives, such as baking compounds used in cakes and other baked flour-based products and food colouring additives used in confectionery (WHO 2007b; EFSA 2011).

Perchlorate has been identified as a potential contaminant in drinking water and was included in the 24th ATDS to screen the levels in tap water across the eight Australian states and territories. Excessive exposure to perchlorate is known to have the potential to cause thyroid problems (JECFA 2010). Guideline levels have not been established for perchlorate in drinking water in Australia (NHMRC, NRMCC 2001).

Dietary exposures to the chemicals included in this report were estimated by determining the analytical concentration in food samples and multiplying the concentration by the amount of those foods consumed by various age groups in the Australian population. Estimated dietary exposure was then compared to the relevant HBGV³ where appropriate, to assess the potential risk to the health and safety of the Australian population.

3 Formerly referred to by FSANZ as Reference Health Standards.



Background



A



Part A – Background

The ATDS has traditionally focused on agricultural and veterinary chemicals and metal contaminants. In recent studies, the scope of the ATDS has expanded to include a broader range of substances, including food additives (FSANZ 2005), nutrients (FSANZ 2008a; FSANZ 2011) and, in the current ATDS, acrylamide and packaging chemicals.

Origin of the study

The ATDS (formerly known as the Australian Market Basket Survey) was first commissioned by the NHMRC in 1970. The aim of the survey was to look at the levels of agricultural and veterinary chemicals and metal contaminants in foods that represent a significant part of the Australian diet. Fifteen Market Basket Surveys were undertaken by the NHMRC before FSANZ (formerly the National Food Authority and Australia New Zealand Food Authority) assumed responsibility in 1991. The 24th ATDS is the ninth study to be conducted by FSANZ.

The ATDS is typically conducted every two years. Over time, ATDS findings indicated that the estimated dietary exposure of Australian consumers to agricultural chemicals and contaminants was consistently below the relevant HBGVs. Due to the consistency of the findings, the scope of the ATDS was broadened in 2003 to include food additives and nutrients. The 21st ATDS was the first study to move away from the traditional approach, examining dietary exposure to the food additives benzoates, sulphites and sorbates (FSANZ 2005). The 22nd and 23rd surveys continued to expand in scope, assessing the dietary intake of a number of nutrients in the Australian population (FSANZ 2008a; FSANZ 2011). The 24th ATDS has evolved further, analysing a variety of chemicals in food including acrylamide, aluminium, perchlorate, food packaging chemicals and printing inks. The development of the ATDS over the years to include a broader range of substances has enabled FSANZ to examine a wider variety of public health and safety issues.

The ATDS is managed by FSANZ as part of the Implementation Sub-Committee for Food Regulation (ISFR)⁴ coordinated food survey plan. This plan allows coordination of national survey activities across multiple jurisdictions. The ATDS was conducted with the participation of all states and territories in Australia.

4 ISFR is responsible for overseeing a consistent approach to the implementation and enforcement of food regulations and standards across Australian jurisdictions.

Using information from the study

The ATDS provides a valuable evidence base to inform Australian and New Zealand food standards. Results are also a source of national public health information which informs a variety of international work such as the WHO Global Environmental Monitoring System (GEMS), JECFA, the Codex Committee on Food Additives (CCFA), the Codex Committee on Contaminants in Food (CCCF), the Joint FAO/WHO Meeting on Pesticide Residues (JMPR) and independent researchers in both government and non-government agencies.



Conducting the study



B



Part B – Conducting the study

FSANZ funded and coordinated the study with the assistance of Australian state and territory government food regulatory agencies. Each state and territory nominated a representative liaison officer to coordinate the collection of food samples, packing and shipment to the appointed laboratory for analysis.

Foods included in the study

A total of 94 foods and beverages, including tap water, were surveyed in this study, with 562 composite samples analysed. Each composite sample was made up of three primary (individual) samples from a single state or territory. A full list of foods surveyed is provided in Appendix 1.

Foods were selected based on:

- whether they were suspected or known to contribute significantly to the dietary exposure for the chemical analysed
- whether they were representative of current patterns of food and beverage consumption in Australia
- the resource capabilities of the states and territories to collect samples
- the cost associated with the purchase, shipping and analysis of samples.

Foods were sampled in accordance with a schedule covering both national and regional foods. This ensured more samples were collected where there was potential for regional variation in composition of the food.

Regional foods were defined as those foods that might be expected to show regional variation of chemical concentrations. These foods included milk, tap water, fish, vegetables, red meat and red meat products, chicken, bread and some bakery goods, wine and selected takeaway foods. For each regional food between 8 and 12 composite samples, each consisting of three primary purchases, were collected from seven to eight cities across Australia.

National foods were defined as foods that are distributed nationwide and therefore are not expected to show significant chemical variation. These included breakfast cereals, tea, coffee, sugar and a variety of canned and other shelf-stable packaged foods. For each national food four composite samples, each consisting of three primary purchases, were collected from four capital cities.

Sampling took place in each state and territory over two sampling periods, from 2–13 May 2011 (autumn sampling period) and 20 June – 4 July 2011 (winter sampling period). Due to the large number of samples collected, purchasing took place over several days within the time periods specified above. Samples were sent to the analytical laboratory as soon as practicable after purchase. When the analytical laboratory was located outside of the city/state conducting the sampling, all perishable samples (e.g. fruits, vegetables and meat) were sent overnight in a chilled or frozen state to the laboratory, reflecting how these products arrive in the home.

Food preparation

All analysed foods were prepared to a 'ready to eat' state by the laboratory. For example, chicken breast and lamb chops were grilled before analysis. Further details on food preparation instructions are provided in Appendix 2. A number of the foods surveyed were in a table ready form when purchased and therefore did not require additional cooking or preparation, such as sugar and infant desserts. Perishable foods were all prepared within 48 hours of purchase. Frozen and shelf-stable foods were prepared within a week of purchase.



Estimating dietary exposures



C



Part C – Estimating dietary exposures

What is dietary modelling?

Dietary modelling is a tool used to estimate the dietary exposure to contaminants and other substances from the diet. To estimate dietary exposure to food chemicals, food consumption data are combined with food chemical concentration data (Equation 1).

Equation 1: Dietary exposure calculation

Dietary Exposure = food chemical concentration x food consumption amount

International expert bodies have used dietary modelling techniques for many years to determine if dietary exposures to specific food chemicals pose a potential risk to public health and safety (WHO 2009).

Dietary modelling is an important part of the ATDS as it translates the chemical concentration data for individual foods into dietary exposure estimates that can be compared to relevant HBGVs in order to assess any risks to public health and safety. The HBGVs used in the 24th ATDS are outlined in the relevant sections of the report for the chemicals assessed.

While dietary modelling is a systematic scientific method for estimating the amounts of food chemicals to which a population may be exposed, the accuracy of these estimates depends on the quality of the chemical concentration and food consumption data available for use. For detailed information about the procedures used for dietary modelling in the 24th ATDS, refer to the supplementary information provided in Appendix 3.

Food chemical concentrations

The concentrations of acrylamide found in 24th ATDS foods are shown in Appendix 4, Table A4.1. Mean acrylamide concentrations for each food were used for estimating dietary exposures rather than median concentrations because 13 of the 57 foods with quantified levels of acrylamide had less than 50% positive detections in the individual composite samples making the median value for these foods below the LOR. It is noted that the mean represents a more conservative estimate of concentration than the median (due to the presence of high outlier values in some foods). This method is consistent with the approach used in a number of other studies including the 72nd meeting of JECFA (2011a) and allows the Australian results to be compared to results for other countries.

The concentrations of aluminium found in 24th ATDS foods can be found in Appendix 5, Table A5.1. The median aluminium concentrations for each food were used for the assessment. The median is generally the most appropriate concentration to use as it represents the most likely concentration in a given commodity and avoids the over estimation of exposure. This is because median concentrations are less likely to be affected by a small number of high detections or 'outliers' above the normally expected range. Using the median concentration also removes much uncertainty about dealing with results below the LOR as it typically reflects an actual analysed value. The median is most effective when the majority of samples have 50% or more positive detections (i.e. above the LOR). Median concentrations have been commonly used in estimating dietary exposure to contaminants in previous ATDS (ANZFA 1999), including aluminium in the 23rd ATDS.

There were no detectable quantities of perchlorate measured in any of the eight tap water samples analysed, therefore dietary exposure to perchlorate was not estimated.

Treatment of analytical values below the Limit of Reporting

The LOR refers to the minimum level at which the laboratory will quantitatively report results. The Limit of Quantification (LOQ) refers to the lowest level that a chemical can be detected and quantified using a certain analytical method. The LOR for acrylamide and aluminium was equal to the LOQ. The LOR for perchlorate was equal to four times the LOQ.

Acrylamide is a contaminant which has been reported at varying levels in foods in various international studies. Aluminium can be found in food from various sources including naturally from the environment, aluminium-containing food additives and aluminium food packaging materials. Due to the apparent variable nature of acrylamide formation in food and beverages and the many potential sources of aluminium in food, a conservative approach was taken for treatment of levels reported below the LOR.

For both acrylamide and aluminium two dietary exposure scenarios were assessed. The first scenario was where concentrations reported as less than the LOR were assigned a concentration of zero (not detected (ND=0)). The second scenario was where concentrations reported as less than the LOR were assigned a concentration equal to the LOR (ND=LOR). The dietary exposure estimates represent a range between the lower bound (ND=0) and the upper bound (ND=LOR). The upper bound is a very conservative estimate which is highly protective as it represents the 'worst case' scenario.

Population groups assessed

Dietary exposures to aluminium and acrylamide were estimated for a range of population groups: 9 month old infants, children aged 2–5 years, 6–12 years and 13–16 years, and the population aged 17 years and above. Dietary exposure assessments were conducted for infants and children as separate groups as they generally have higher exposures on a body weight basis because they consume more food per kilogram of body weight compared to adults. For further information about the characteristics of the age groups assessed, refer to the supplementary information in Appendix 3, Table A3.1.

Food consumption data

The dietary exposure assessment used food consumption data from two Australian NNSs: the 2007 Australian National Children's Nutrition and Physical Activity Survey (2007 ANCNPAS) for children aged 2–16 years; and the 1995 NNS for those aged 17 years and above as there has not been a more recent NNS published for Australian adults. Detailed information about these and how they are used in FSANZ's dietary modelling computer program DIAMOND (Dietary Modelling of Nutritional Data) is available on the FSANZ website. There are some differences in survey design between the two surveys that are highlighted in Appendix 3, namely the 2007 survey included two days of food consumption data and the 1995 survey includes one. Estimates of daily dietary exposure using the 2007 survey are therefore averaged over the two days to get a better estimate of long-term dietary exposure.

Food mapping

Mapping is the process of matching the foods analysed in the ATDS to the foods consumed in the nutrition surveys. Given that the ATDS could not survey all foods consumed in the NNSs, mapping is a major step in the dietary modelling process. Mapping can be based on the composition or likely contamination of a food. Due to the different nature of acrylamide and aluminium, two different mapping approaches were used. The mapping process is explained below with more details provided in the relevant sections of the report. Dietary exposure results have been presented in terms of the group of foods that the ATDS food represents, rather than as the individual ATDS food itself (e.g. the ATDS food 'apples' is referred to as 'apples and quinces' in the aluminium dietary exposure assessment results).

There were three types of mapping used for both the acrylamide and aluminium dietary exposure estimates:

1. Direct mapping – where the ATDS foods were directly matched to the same food and to similar foods from the 1995 NNS and 2007 ANCNPAS (e.g. the 1995 NNS foods '*apple, red, raw, unpeeled*' and '*quince, stewed, unsweetened*' were mapped to the ATDS food 'Apples', using the assumption that the food chemicals present in apples are the same in all pome fruits).
2. Mapping using 'factors' – used where the ATDS food was in a different form to that consumed in the 1995 NNS or 2007 ANCNPAS (e.g. the ATDS food 'coffee, instant' was analysed in its hydrated (or ready-to-drink) form but some respondents in the 1995 NNS reported consuming dry instant coffee powder). The NNS food was mapped to the ATDS food after which the food consumption amount reported in the 1995 NNS or 2007 ANCNPAS is multiplied by a 'factor' to convert the food to the same form as analysed in the ATDS (e.g. 2 grams of instant coffee powder was converted to 226 grams of ready-to-drink black instant coffee). The converted consumption amount for the food was then assigned the analysed concentration for the ATDS food in the exposure calculation.
3. Recipes – used where a food consumed in the 1995 NNS or 2007 ANCNPAS was composed of more than one analysed ATDS food (e.g. the 1995 NNS food '*fruit drink, orange, ready-to-drink*' is made up of the ATDS foods 'Sugar, white', 'Water, tap' and 'Juice, fruit'). These mixed foods were not mapped directly but a recipe is used to disaggregate the consumption to the relevant components.

In addition, for acrylamide only, direct mapping was also used based on cooking method due to the influence of cooking conditions on acrylamide formation:

4. Direct mapping based on cooking method for acrylamide only – where the ATDS foods were directly matched to a survey food that most accurately represented the cooking method described for the food from the 1995 NNS and 2007 ANCNPAS (e.g. the 1995 NNS food '*Potato, sebago, unpeeled, baked without oil*' and '*Potato, wedges, homemade – fresh or frozen, peeled, baked without oil*' were mapped to the ATDS food 'Potatoes, baked', based on the assumption that similar amounts of acrylamide formation occurs for all dry-baked potatoes). This method applied to cooked meat, fruit and vegetables where the processing or cooking could be expected to produce acrylamide. A detailed flow chart outlining this approach for fruit and vegetables can be found in Appendix 4, Figure A4.1. Due to a larger number of potatoes and potato products being analysed, a separate flow chart is included to outline the mapping process for potatoes and potato products, also in Appendix 4, Figure A4.2.

Using a 'best fit' approach and the methods listed above, approximately 4,500 1995 NNS foods and 4,000 2007 ANCNPAS foods were matched to the ATDS foods sampled. Details of the ATDS foods and the 1995 NNS and 2007 ANCNPAS foods that they represent are provided for acrylamide in Appendix 4, Table A4.2 and for aluminium in Appendix 5, Table A5.2.

Food contribution calculations

Throughout the report, information about the major food contributors to the dietary exposure to particular chemicals has been presented. To obtain an indication of the contribution each food group made to total estimated exposures, the sum of all individuals' exposures from one food group was divided by the sum of all individuals' exposures from all foods containing the food chemicals assessed, and multiplied by 100. All contributors are calculated using the lower bound ND=0 scenario.

There is no direct association between the analytical concentration of a chemical in an ATDS food and its identification as a major contributor to dietary exposure. Even if a food contains a relatively high concentration of a particular chemical, there are many other factors which may contribute including the amount of the food consumed, the mapping process, the number of individuals that were exposed to the chemical and the level at which they were exposed.

Assumptions and limitations in dietary exposure assessment

The aim of dietary exposure assessments is to make as realistic an estimate of dietary exposure to the food chemicals of interest as possible.

Dietary exposure assessments based on the 1995 NNS and 2007 ANCNPAS provide the best available estimates of actual consumption of all foods and the resulting estimated dietary exposure to a food chemical for the population. FSANZ considers that, despite the age of the 1995 NNS, consumption of staple foods, such as fruit, vegetables, meat, dairy products and cereal products, which make up the majority of most people's diet, is unlikely to have changed markedly since 1995 (Cook et al. 2001a; Cook et al. 2001b).

Nevertheless, limitations still exist in dietary exposure assessment methods as well as in the data. Limitations relating to the food consumption and chemical concentration data include:

- Diets derived from one or two 24-hour food recall surveys are used as the basis for drawing conclusions on lifetime eating patterns (Appendix 3). This normally leads to conservative dietary exposure assessments, particularly where exposure arises from the consumption of non-habitually eaten foods.
- The 1995 NNS data does not include information about food products introduced to the market since the 1995 NNS was conducted.
- Participants in 24-hour food recalls may over- or under-report food consumption, particularly for certain types of foods.
- The dietary exposure to the chemicals of interest from dietary supplements, where relevant, has not been taken into account.
- The model diet used for 9 month old infants is not as accurate as the data derived for other population groups from the 1995 NNS and 2007 ANCNPAS that use reports of food consumption data of individuals.
- The list of analysed foods is only a sample of the foods consumed by the population and may not accurately represent the whole diet.
- Only a small number of each food was sampled and analysed, and these were then used to represent the whole range of that food or similar foods, therefore limiting the potential range of variability in concentrations captured.

Assumptions made in the dietary exposure assessment for the 24th ATDS include:

- The food chemical concentration in the analysed food was a good representation of the concentration of that chemical in all of the other foods to which it was mapped.
- The chemical concentration in a particular analysed food was carried over to all of the mixed foods in which it was used as an ingredient.

Specific assumptions made about the mapping for each contaminant are noted in the mapping sections for acrylamide and aluminium.



Acrylamide



D



Part D – Acrylamide

Acrylamide is a component of polyacrylamide, a flocculant used for a range of industrial purposes including the treatment of drinking water and the production of plastics, grouts and cosmetics (USFDA 2009a).

Acrylamide was first detected in foods in April 2002, although it is likely that people have always been exposed to it in their diet. Acrylamide forms in food when carbohydrate rich foods are heated at high temperatures using cooking methods such as frying, baking, roasting, toasting and grilling. This process is commonly referred to as the Maillard reaction which leads to the browning of foods and development of flavours and aromas commonly associated with high temperature cooking (JECFA 2011a). The Maillard reaction most commonly occurs when the amino acid asparagine and a carbonyl source (typically reducing sugars such as glucose and fructose) are subject to conditions of high temperature in excess of 120°C in a low moisture environment (Codex 2009).

JECFA (2011a) reported several possible ways acrylamide can form other than the Maillard reaction. Formation from the chemical 3-aminopropionamide (3-APA) is thought to occur in some foods. 3-APA is an intermediate in acrylamide formation from the Maillard reaction. It can also form naturally through decarboxylation of asparagine. It has been shown that 3-APA is transformed into acrylamide during heat treatment at a rate 12 times higher than that associated with alteration of asparagine. 3-APA has been found in several foods linked to high acrylamide levels including olives, coffee and cocoa (JECFA 2011a).

Acrylamide hazard summary

Concern about the presence of acrylamide in food has led to a large number of studies to better define its potential toxicological and carcinogenic effects. At the JECFA meeting in 2010, extensive new data from cancer bioassays in rats and mice, physiologically-based pharmacokinetic modelling of internal dosimetry, and a large number of epidemiological studies had become available for consideration (JECFA 2011a). Based on the new information, which supported findings from an earlier meeting (JECFA 2005), JECFA concluded that acrylamide is both genotoxic and carcinogenic and potentially neurotoxic to humans at high doses (non-genotoxic endpoint, No Observed Adverse Effect Level⁵ (NOAEL)=0.2 mg/kg bw/day) which may be achieved at relatively high levels of dietary exposure (JECFA 2011a). Since genotoxic carcinogens are considered not to display a toxicological threshold, the new cancer bioassays in mice and rats enabled the Committee to apply a Benchmark Dosing

5 The highest exposure levels at which there are no biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control.

(BMD) protocol to derive lower confidence limits for development of the most susceptible tumour types in each species. In rats, the BMD level associated with a 10% response (BMDL₁₀) for mammary tumours was calculated to be 0.31 mg/kg bw per day, whereas in mice, the BMDL₁₀ for Harderian gland tumours in males was 0.18 mg/kg bw per day. However, JECFA reported there was a poor correlation between the estimated dietary exposure and internal biological markers of acrylamide exposure (haemoglobin adducts) in humans and that worker cohort epidemiological studies at high levels of exposure did not provide any evidence that exposure to acrylamide resulted in an increase in the incidence of cancer.

Foods included in the study for acrylamide

Acrylamide was analysed in all 94 foods and beverages sampled in the 24th ATDS. The sampling plan was designed to include foods likely to contribute to dietary exposure to acrylamide. FSANZ reviewed recent scientific literature investigating the mechanisms of acrylamide formation, as well as other survey results to refine the sampling list.

Analysis of food and beverage samples

Food samples were analysed for acrylamide by the National Measurement Institute (NMI), a National Association of Testing Authorities (NATA) accredited laboratory. Samples were analysed using tandem Gas Chromatography Mass Spectrometry (GC-MS/MS) in accordance with accredited Quality Assurance (QA) procedures. The LOR was equal to the LOQ at 0.02 mg/kg (20 µg/kg) for all foods.

Acrylamide concentrations in foods

The acrylamide concentrations (mean, median, minimum and maximum) in all sampled foods can be found in Appendix 4, Table A4.1. Acrylamide was detected at a quantifiable level in at least one composite sample in 57 of the 94 foods and beverages analysed. This is expected due to the fact that the food list was developed to include foods and beverages which may be subject to acrylamide formation. The highest mean concentrations of acrylamide were found in starchy foods cooked at high temperature such as various varieties of potato crisps (up to 373 µg/kg), microwaved popcorn (320 µg/kg), various varieties of savoury biscuits (up to 230 µg/kg), sweet biscuits (220 µg/kg), deep-fried potato chips (215 µg/kg) and baked potato (212 µg/kg), assuming all ND=LOR. Fried lean beef mince had the two highest acrylamide concentrations at 950 and 840 µg/kg respectively from individual analyses and a mean concentration of 239 µg/kg. Other foods in this study with notable mean concentrations of acrylamide were pre-packaged olives (328 µg/kg), fresh onions, fried (230 µg/kg), chocolate flavoured energy drink (221 µg/kg), grilled asparagus (212 µg/kg), baked beans (140 µg/kg) and prune juice (128 µg/kg).

Comparison to previous FSANZ survey of chemical contaminants and residues in espresso, instant and ground coffee (2008b)

Two different varieties of coffee were analysed in the 24th ATDS: espresso short black from takeaway outlets and coffee made from instant powder. All results from a total of eight composite samples taken from across Australia were below the LOR. FSANZ previously analysed acrylamide in a survey of chemical contaminants and residues in espresso, instant and ground coffee (FSANZ 2008b). The 2008 survey used Liquid Chromatography Mass Spectrometry (LC/MS) with a Practical Quantitation Limit (PQL) of 0.0001 mg/L (0.1 µg/L). Acrylamide was analysed in ten different varieties of coffee including cappuccino, latte, flat white, long black, short black, mocha, instant black, instant white, ground coffee (plunger) white and ground coffee (plunger) black (FSANZ 2008b). The highest mean concentration reported in 2008 was 0.0097 mg/L (9.7 µg/L) in short black coffee. This value is less than the LOR of 20 µg/kg for acrylamide in the 24th ATDS. Therefore a direct comparison of results cannot be made.

Comparison with other Australian and international studies

FSANZ conducted a review of Australian and international studies of acrylamide levels in food and beverages to compare with 24th ATDS findings (Table 1). Acrylamide levels were generally lower or comparable to the previous studies in traditionally high acrylamide foods such as potato crisps, popcorn, biscuits, hot potato chips, baked potatoes and corn chips (Table 1). The acrylamide levels found in olives in the current study were consistent with other surveys in the United States of America (USA), Canada and the United Kingdom (UK) (USFDA 2009b; Health Canada 2012; UKFSA 2012). Acrylamide was also detected in prune juice, at levels similar to those in the USA and Canada (USFDA 2009b; Health Canada 2012). Grilled asparagus was found to contain acrylamide in 9 out of 10 composite samples. This finding is consistent with the high levels of asparagine in asparagus (JECFA 2011a). Acrylamide was also detected in chocolate flavoured energy drink, which could be attributed to the cocoa content of this product which is known to contain the potential acrylamide precursor 3-APA (JECFA 2011a).

High levels of acrylamide were detected in dry-fried lean beef mince and dry-fried onions. Dry-frying is known to create the ideal high temperature and low moisture conditions associated with the Maillard reaction. Beef mince has a high surface area which would allow acrylamide to form if the appropriate precursor chemicals were present. However, the high levels of acrylamide in lean beef mince were unexpected as the carbohydrate (glycogen) content is low. Moreover, a significant proportion of any asparagine present is likely to be bound up in protein and therefore unavailable for reaction.

Similarly, onions have a relatively low sugar content compared to many other starchy vegetables (FSANZ 2010). The results indicate that the cooking method and surface area of the food may be a contributing factor for acrylamide formation, even for foods which contain relatively low levels of carbohydrate and/or asparagine.

Table 1: Comparison of mean acrylamide ATDS results to other Australian and international studies

ATDS food or beverage	Mean acrylamide concentration (µg/kg)						
	24 th ATDS [#]	Aust ¹	JECFA ²	NZ ³	USA ⁴	Canada ⁵	UK ⁶
Potato crisps	283–373	515	956	258–793	396	225–3203	835
Olives, packaged	328	–	–	–	252	ND–494	884
Popcorn, microwaved	320	332	–	154	161	151–274	328
Beef mince, lean, dry-fried	239	–	–	–	ND	–	–
Biscuits (various savoury and sweet)	44–230	297	288	101–598	294	13–401	380
Chocolate energy drink, from powdered	221	ND	–	–	–	–	–
Hot potato chips	71–215	262	245–410	137–626	419	41–766	194–327
Potatoes, baked	212	189	147	116–1278	42	–	579
Corn chips, taco shells	190	188	–	596	222	287–459	103
Breakfast cereals	35–169	82	149	34–293	112	26–336	149
Baked beans	140	ND*	–	–	–	–	–
Juice, prune	128	93*	–	–	244	68–688	–
Hamburger, takeaway	109	–	–	–	ND	–	–
Chicken, battered or crumbed	62–108	29	42	–	23	27–41	–
Bread, fresh	25–98	34	207	25–56	28	15–79	16
Sweet potato, baked	93	339	–	–	51	–	–

ATDS food or beverage	Mean acrylamide concentration (µg/kg)						
	24 th ATDS [#]	Aust ¹	JECFA ²	NZ ³	USA ⁴	Canada ⁵	UK ⁶
Bread, toasted	35–66	92	–	44–100	–	20–185	–
Coffee, espresso and short black	ND	<1–10 [†]	17–314	–	17	ND–12	501

Results reported as <LOR were assigned a value equal to the LOR for calculation of mean.

ND – Not detected.

1 (Croft et al. 2004) (results were calculated from individual concentrations as specified in the report).

* (Department of Health South Australia 2006).

† (FSANZ 2008b).

2 (JECFA 2011a).

3 (Cressey et al. 2012).

4 (USFDA 2009b) (results were calculated from individual concentrations as reported on the USFDA website).

5 (Health Canada 2012).

6 (UKFSA 2012).

Acrylamide mapping approach

Due to the likely formation of acrylamide resulting from the cooking method applied to the food and the chemical composition of a food, a different approach was used for the mapping acrylamide compared to mapping of foods used in previous ATDSs and for other chemicals in this ATDS. This approach was taken to provide a more realistic exposure estimate to acrylamide, see the 'Food mapping section' for more information.

Assumptions made in acrylamide mapping

The formation of acrylamide in raw fruits and vegetables is unlikely. Therefore no raw fruits and vegetables were mapped, essentially being assigned a zero acrylamide concentration. This assumption was applied to all fruit and vegetable juices except prune juice, which had a direct match to all prune juices only.

The cooking process was the primary focus for possible acrylamide formation for meat, fruit and vegetables, consequently this was considered in the mapping process before the type of meat, fruit and vegetable was considered. Cooking methods such as stewing, boiling and steaming were assumed to produce similar low levels of acrylamide formation. Cooking methods such as baking and stir frying were assumed to produce similar acrylamide formation.

All meat in whole cuts or pieces, regardless of animal origin, was assumed to be cooked according to the food preparation instructions provided for lamb chops (grilled). All minced meat regardless of animal origin, was assumed to be cooked according to the instructions provided for beef, minced (dry-fried).

Acrylamide dietary exposure assessment results

The mean concentrations of acrylamide in foods used in the dietary exposure assessment are presented in Appendix 4, Table A4.1.

The mean and 90th percentile levels of exposure for consumers of acrylamide were estimated in µg/day, and µg/kg bw/day, for all age groups assessed for the lower and upper end of the range of concentrations (i.e. where the lower bound is ND=0 and the upper bound is ND=LOR). For both the 1995 NNS and the 2007 ANCNPAS, all respondents were consumers of acrylamide due to the wide variety of foods found to contain acrylamide. The estimated dietary exposures to acrylamide for each age group assessed are presented in Appendix 4, Table A4.3.

Estimated mean dietary exposures for consumers of acrylamide ranged between 10 and 50 µg/day at the lower bound and between 30 and 110 µg/day at the upper bound, across the age groups assessed. On a body weight basis this equates to 1–2 µg/kg bw/day at the lower bound exposures and 2–4 µg/kg bw/day at the upper bound exposures.

Estimated dietary exposures at the 90th percentile for consumers ranged between 20 and 90 µg/day at the lower bound and 70 and 170 µg/day at the upper bound, across the age groups assessed. On a body weight basis, this equates to 1–3 µg/kg bw/day at the lower bound and 2–8 µg/kg bw/day at the upper bound.

The highest dietary exposures (both mean and 90th percentile) in µg/day were for the population aged 17 years and above, while the highest exposures on a body weight basis were for 9 month old infants. Children tend to have higher dietary exposures on a body weight basis due to their smaller body weights and because they consume more food per kilogram of body weight compared to adults.

Foods contributing to estimated acrylamide dietary exposure

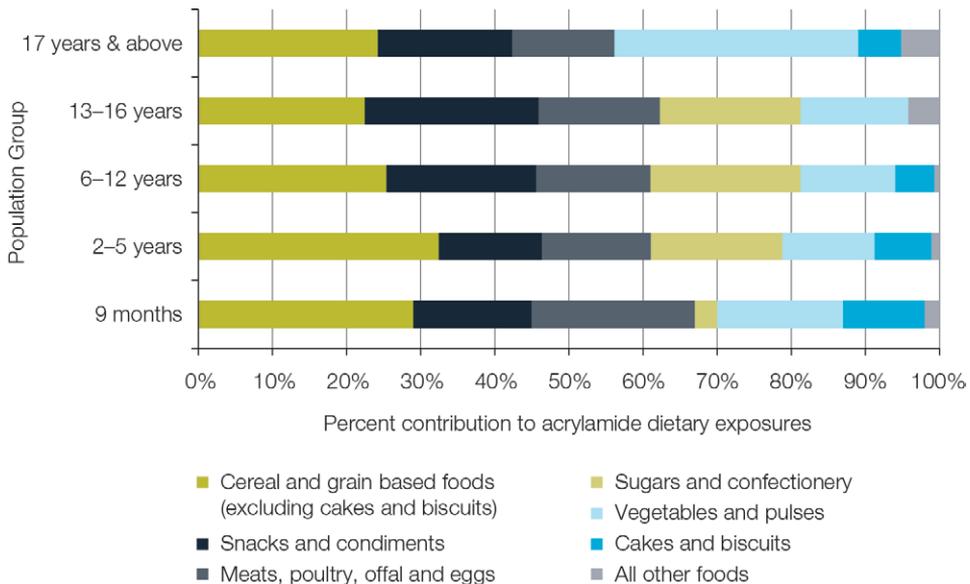
As shown in Figure 1, cereal and grain-based foods (excluding cakes and biscuits), vegetables and pulses, and snacks and condiments were the main sources of acrylamide dietary exposure across the age groups assessed.

Cereal and grain based foods (excluding cakes and biscuits) were the major contributor to estimated acrylamide dietary exposure (24–32%) for all population groups assessed, apart from children aged 13–16 years. Around half of this contribution came from wheat-based cereals and flours. For 13–16 years, snacks and condiments were the major contributor (23%), where around half of this came from fried potato products. For 9-month-old infants the food group ‘meats, poultry, offal and eggs’ was the second highest contributor (22%) to estimated acrylamide dietary exposure, where mince was the main food contributing (16%). Mince had a relatively high concentration of acrylamide, similar to some other foods analysed, but as the infant diet had a higher consumption amount for mince compared to these other foods, it made a higher contribution to

acrylamide dietary exposure for this age group. For children aged 2–5 years and 6–12 years, sugars and confectionery were the second highest contributors (18–22%) to acrylamide dietary exposures. The majority of this contribution came from beverage bases, which had a relatively high acrylamide concentration and consumption volume and were mapped to sugars.

More specific details about the food groups and contributions to estimated acrylamide dietary exposures are presented in Appendix 4, Table A4.4 for major food groups and Table A4.5 for specific food groups.

Figure 1: Major food group contributors (>5%) to estimated acrylamide dietary exposures



Risk characterisation

Frequently, for compounds considered to have no identifiable toxicological threshold, a MOE calculation is undertaken. The MOE is calculated as the ratio between the likely dietary exposure and an effect level (e.g. $BMDL_{10}$). Conceptually, the lower the MOE, the higher is the risk to health. However, it is important to understand that MOEs are not suitable for quantitative risk estimates and therefore deciding what is an acceptable MOE (or not) is a risk management (policy) decision. The acceptability of an MOE is often made on a case-by-case basis that depends on a number of elements including the level of public health protection needed or that is acceptable.

The MOEs calculated for the most sensitive non-carcinogenic end point (a NOAEL of 0.2 mg/kg bw/day for neurotoxicity) ranged between 30 and 310 depending on the scenario assessed (see Table 2). These results are similar to those reported by JECFA (2010) and it is concluded that adverse neurological effects cannot be excluded for individuals with high dietary exposure to acrylamide.

Table 2: Estimated MOEs for consumers of acrylamide at the mean and 90th percentile dietary exposures[#] using a NOAEL of 0.2 mg/kg bw/day for neurotoxicity

Age group	Mean		90 th Percentile	
	ND=0	ND=LOR	ND=0	ND=LOR
9 months [⌘]	220	50	110	30
2–5 years [⌘]	110	60	70	40
6–12 years [⌘]	160	80	90	50
13–16 years [⌘]	240	120	130	80
17 years & above [*]	310	130	150	80

[#] derived using mean analytical concentrations.

[⌘] derived using a model diet.

[⌘] derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

^{*} derived using the 1995 Australian National Nutrition Survey.

An inspection of Table 3 and Table 4 reveals that all the MOE estimates for carcinogenicity are less than 500 irrespective of whether they are compared with the mouse or rat BMDL₁₀ and also whether lower or upper bound dietary exposure scenarios were used. Similar to conclusions reported in other risk assessments, these low MOE estimates suggest a human health concern for a compound that is both genotoxic and carcinogenic (e.g. JECFA 2010). Furthermore, it seems the widespread presence of acrylamide in heated foodstuffs (Table 1) results in a dietary exposure pattern that may make it challenging to reduce overall population exposure. Mitigating acrylamide formation in one or a few food types is unlikely to affect the MOE to such an extent that it increases significantly and therefore reduces the health risk.

Table 3: Estimated MOEs for consumers of acrylamide at the mean and 90th percentile dietary exposures[#] using a BMDL₁₀ of 0.31 mg/kg bw/day

Age group	Mean		90 th Percentile	
	ND=0	ND=LOR	ND=0	ND=LOR
9 months [✕]	330	80	170	40
2–5 years ^φ	180	90	110	60
6–12 years ^φ	240	130	140	80
13–16 years ^φ	370	190	200	120
17 years & above [*]	480	210	240	130

derived using mean analytical concentrations.

✕ derived using a model diet.

φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

Table 4: Estimated MOEs for consumers of acrylamide at the mean and 90th percentile dietary exposures[#] using a BMDL₁₀ of 0.18 mg/kg bw/day

Age group	Mean		90 th Percentile	
	ND=0	ND=LOR	ND=0	ND=LOR
9 months [✕]	190	50	100	20
2–5 years ^φ	100	50	60	30
6–12 years ^φ	140	70	80	50
13–16 years ^φ	210	110	120	70
17 years & above [*]	280	120	140	80

derived using mean analytical concentrations.

✕ derived using a model diet.

φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

Since humans have been cooking their food for millennia, dietary exposure to acrylamide is not new although it was only accidentally identified in starchy foods in 2002. As a consequence, our inability to identify a population with no acrylamide exposure may be a key reason why all large scale epidemiological studies have failed to identify any increased cancer risk. Typically these epidemiological studies have compared low levels of dietary

acrylamide exposure with high intake consumers. It is noteworthy that, unlike the data from rodents, there was a poor correlation between the estimated dietary exposure and biomarkers of acrylamide exposure (i.e. haemoglobin adducts) in humans. More reassuring though, was that a number of worker cohort epidemiological studies did not provide any evidence that exposure to high levels of acrylamide from multiple sources (i.e. dietary and occupational) resulted in an increase in the incidence of cancer (JECFA 2011a).

It should be noted that lower bound (ND=0) MOE estimates at mean dietary exposure were over 100 for all population groups assessed using all three toxicological and carcinogenic endpoints. The upper bound (ND=LOR) scenarios are conservative and significant contributions to estimated dietary exposure were from foods and beverages which had no detections of acrylamide reported above the LOR.

To obtain a better understanding of the risk posed by acrylamide in the diet, JECFA has recommended that longitudinal epidemiological studies be undertaken to compare intra-individual levels of haemoglobin adducts over time in relation to concurrent dietary exposure (JECFA 2011a).

Risk management

The current MOEs indicate that acrylamide exposure of Australian consumers is consistent with those MOEs considered to be of possible concern to human health by JECFA. Therefore, measures to reduce exposure to acrylamide should be ongoing.

Although it is reassuring that the concentrations of acrylamide detected in various foods is generally lower than those analysed in other countries (Table 1), with approximately 40% of surveyed foods containing no detectable acrylamide, the formation of acrylamide is unpredictable. The same food type may show high levels of acrylamide in one analysis and no detectable levels in the next. This is exemplified in the 24th ATDS where some foods that would be expected to have detectable levels of acrylamide did not, e.g. coffee and pizza, and others that were not expected to contain acrylamide showed unexpectedly high levels, such as fried beef mince.

The detection of acrylamide at up to 950 µg/kg in fried beef mince was unusual. This explains why the food group 'meats, poultry, offal and eggs' was a consistently high contributor to estimated dietary exposure across all age groups. As far as FSANZ is aware, this is the first time that such a level of acrylamide has been reported in meat. The JECFA (2011a) safety assessment reported a mean acrylamide concentration of 42 µg/kg in meats and offal. The USFDA (2009b) survey did not detect any acrylamide in fried beef mince. Therefore, this result warrants further investigation to check if it is reproducible, and to determine the exact conditions under which beef and other meats could form such high levels of acrylamide in the absence of an obvious carbonyl source. It is known that in

certain instances intermediates in the Maillard reaction do not proceed to form acrylamide, but if extraction is conducted at a high pH then these intermediates would proceed to form acrylamide (Vikstrom et al. 2008). Therefore, the level of acrylamide obtained under such conditions could be an analytical artefact and not a true reflection of exposure via food.

Acrylamide can be expected to form in prune juice owing to the presence of intermediates in the prunes and the manufacturing process employed. However, further investigation is necessary to gain a better understanding of how acrylamide formation in this food type might be minimised. It may also be beneficial to investigate the potential for acrylamide formation in other dried fruits. FSANZ notes that prunes and prune juice do not ordinarily form a significant portion of the Australian diet, and therefore their contribution to overall acrylamide intake is likely to be minimal.

The results of further investigations will form the basis for any future measures to minimise the formation of acrylamide in various foods. FSANZ recognises that to achieve sustained reduction in dietary exposure to acrylamide, cooperation is necessary among regulatory authorities, industry and consumers. A key component of any such cooperation will be the sharing of information on the various pathways for acrylamide formation, and the measures that are likely to result in significant reduction in acrylamide levels. Consumer awareness is also critical, because domestic cooking practices can have a huge influence on acrylamide exposure.

Risk management strategies used domestically and internationally include industry codes of practice, food reformulation in the food industry, research on enzymes that inhibit/minimise acrylamide formation and consumer education strategies etc.

As a result of this report FSANZ will:

- continue to investigate the results of this survey for minced beef and prunes
- monitor risk management strategies employed domestically and internationally, including new processing measures designed to reduce acrylamide formation, particularly in baked or roasted food
- continue to liaise with the Australian and New Zealand food industry to encourage and support them to examine ways in which manufacturing practices might be changed to reduce acrylamide formation in foods
- continue to encourage adoption of the 'Acrylamide toolbox' produced by the Confederation of the Food and Drink Industries of the EU (the CIAA). This toolbox aims to assist food manufacturers to use the most current research appropriate for their products and manufacturing processes to reduce the formation of acrylamide.



Aluminium



E



Part E – Aluminium

Aluminium is the most abundant metallic element found in the Earth's crust. It is highly reactive and found naturally in mineral compounds such as aluminium silicates, hydroxides, phosphates and sulphates. Aluminium is distributed in the natural environment through geological processes such as weathering and erosion and also human activities such as mining and industrial aluminium production. Levels in soil are highly variable, generally ranging from 7 to over 100 g/kg. Aluminium can be absorbed into the food chain through agricultural processes. Aluminium metal has a range of industrial uses and is used in an array of food packaging and cooking materials such as cans and cookware. Aluminium minerals are commonly used in water purification, as detergents and in the sugar refining, brewing and wine making industries (EFSA 2011).

Aluminium is also used in a variety of permitted food additives. Aluminium-containing food additives are commonly used in baked products as leavening agents and also as emulsifiers and anti-caking agents. They are used to improve the functional properties of various food colours permitted for use in Australia. The Code lists the additives and levels permitted for use in Australia and New Zealand (FSANZ 2013).

Aluminium hazard summary

When soluble forms of aluminium salts are ingested, aluminium distributes to all tissues in animals and humans and accumulates in some, in particular bone. Aluminium may persist for a very long time in various organs and tissues before it is excreted in the urine. It is considered unlikely that aluminium is a human carcinogen at dietary relevant doses.

Although aluminium has been implicated in the aetiology of Alzheimer's disease, a substantial body of scientific evidence suggests that it is unlikely that exposure to aluminium via food would constitute a risk for developing Alzheimer's disease. Some compounds containing aluminium have been shown at comparatively high doses to produce neurotoxicity (mice, rats) and to affect the male reproductive system (dogs). Similarly, following maternal exposure, aluminium has also been shown to cause embryotoxicity (mice) and affect the developing nervous system in the offspring (mice, rats).

In its most recent consideration of aluminium, JECFA reviewed several new studies which reconsidered key toxicological endpoints related to the developing embryo and nervous system (JECFA 2011b). The recent evidence was unable to confirm any effects of aluminium on reproductive outcomes. However, the new studies did support previous observations of neurodevelopmental effects in experimental animals, but there continues to be a lack of consistency regarding the reported effects, and there are some limitations in all the studies. As a result of these data, JECFA withdrew the PTWI of 1 mg/kg bw it had previously established (JECFA 2007). It established a new PTWI of 2 mg/kg bw based on a NOAEL of 30 mg/kg bw per day and applying a safety factor of 100 for interspecies and intraspecies differences in sensitivity (JECFA 2011b).

Foods included in the study for aluminium

Aluminium was analysed in 31 foods and beverages in this study. The results from these analyses were combined with recent results from the 23rd ATDS for a further 88 foods and beverages. For this study, additional foods and beverages were selected to supplement data from the 23rd ATDS based on where aluminium-containing food additives were likely to be used. Several foods were re-sampled in the 24th ATDS where high concentrations were found in the 23rd ATDS, including several types of cakes. Foods analysed included bread, cereal, sweet bakery products, battered/crumbed chicken products, confectionery, dried fruit, herbal tea, frozen mixed vegetables, infant biscuits, infant formula, prune juice and milk.

Analysis of food and beverage samples

Food samples were analysed for aluminium by the NATA certified NMI laboratory in Melbourne using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Foods were analysed in accordance with accepted QA procedures. The LOR for the analysis was equal to the LOQ at 0.5 mg/kg. Samples below the LOR were re-analysed using Inductively Coupled Optical Emission Spectrometry (ICP-OES), which has a LOR/LOQ of 0.1 mg/kg. ICP-MS and ICP-OES results are considered to be directly comparable to each other and are subject to the same acceptance and QA criteria.

Aluminium concentrations in foods

The mean, median, minimum and maximum concentrations of aluminium in foods are presented in Appendix 5, Table A5.1. The highest aluminium concentrations from individual analyses were found in cakes (sponge and chocolate), pikelets and English style muffins. The highest median concentrations from the 24th ATDS were in sponge cake (415 mg/kg), pikelets and pancakes (225 mg/kg), chocolate cake (113 mg/kg), battered or crumbed takeaway chicken products (15 mg/kg) and dried fruit cake (9 mg/kg). This is expected as aluminium-containing food additives are permitted in the Code, Standard 1.3.1 – Food Additives, as leavening agents in baked goods in accordance with Good Manufacturing Practice (GMP).

The 23rd ATDS reported the highest concentrations from individual analyses in bread and cakes. The highest median concentrations were found in chocolate cake (88 mg/kg), frozen fish portions (24 mg/kg) and beef sausages (10 mg/kg). All other foods had median aluminium concentrations below 10 mg/kg.

Aluminium concentrations derived in the 24th ATDS were generally higher than the 23rd ATDS due to the narrowed focus on foods likely to contain aluminium-containing food additives.

Most foods in this study contained quantifiable concentrations of aluminium. White sugar, bananas, mango, orange, and peaches in natural juice were the only foods that did not contain quantifiable concentrations of aluminium in any of the analysed composites.

Aluminium mapping

The 23rd ATDS and the 24th ATDS aluminium results were merged to form a unique list of 119 analysed foods. The 23rd ATDS food list focused on naturally occurring aluminium and consisted primarily of unprocessed foods. The 24th ATDS included a larger number of processed foods where aluminium may be present from food additive use. This enables a more complete estimate of aluminium exposure from the total diet. The 24th ATDS food list was also used to better refine the estimated dietary exposures by including more foods within a specific food group where necessary. Where a food was sampled in both the 23rd and 24th ATDS, the most recent data from the 24th ATDS was used. As the 23rd ATDS food list had a restricted number of processed foods, a large number of processed foods were unable to be mapped in the 23rd ATDS. These foods were instead broken down into their ingredients and each ingredient was assigned a concentration where possible from the sampled food list. Some of these foods were analysed in the 24th ATDS and therefore were not broken down using a recipe but were instead directly assigned a concentration in their own right. Due to the larger food list in the 24th ATDS there were a number of changes in the mapping that had a significant effect on the dietary exposure assessment results.

Aluminium dietary exposure results

The median concentrations of aluminium in foods used in the dietary exposure assessment are presented in Appendix 5, Table A5.1. If the median concentration fell on a ND result, two concentrations were used, one where ND results were equal to zero (ND=0) and one where ND results were equal to the LOR (ND=LOR).

The mean and 90th percentile levels of exposure for consumers of aluminium were estimated in mg/day and mg/kg bw/day for all age groups assessed, for the lower and upper end of the range (i.e. where the lower bound is ND=0 and the upper bound is ND=LOR). For both the 1995 NNS and the 2007 ANCNPAS, all respondents were consumers of aluminium because aluminium was found in most foods. The estimated dietary exposures to aluminium for each age group assessed are presented in Appendix 5, Table A5.3.

Estimated mean dietary exposures for all population groups assessed ranged between 0.6 and 3.7 mg/day at the lower bound and between 0.6 and 3.8 mg/day at the upper bound, across the age groups assessed. On a body weight basis this equates to 0.05–0.12 mg/kg bw/day at the lower bound exposures and 0.05–0.13 mg/kg bw/day at the upper bound exposures.

Estimated dietary exposures at the 90th percentile ranged between 1.2 and 8.4 mg/day at the lower bound and 1.3 and 8.5 mg/day at the upper bound, across the age groups assessed. On a body weight basis, this equates to 0.09–0.31 mg/kg bw/day at the lower bound and 0.09–0.32 mg/kg bw/day at the upper bound.

The highest mean dietary exposures in mg/day were for the population aged 17 years and above and the highest 90th percentile dietary exposures were for children aged 13–16 years. The highest exposures on a body weight basis (both mean and 90th percentile) were for children aged 2–5 years.

Foods contributing to aluminium dietary exposure

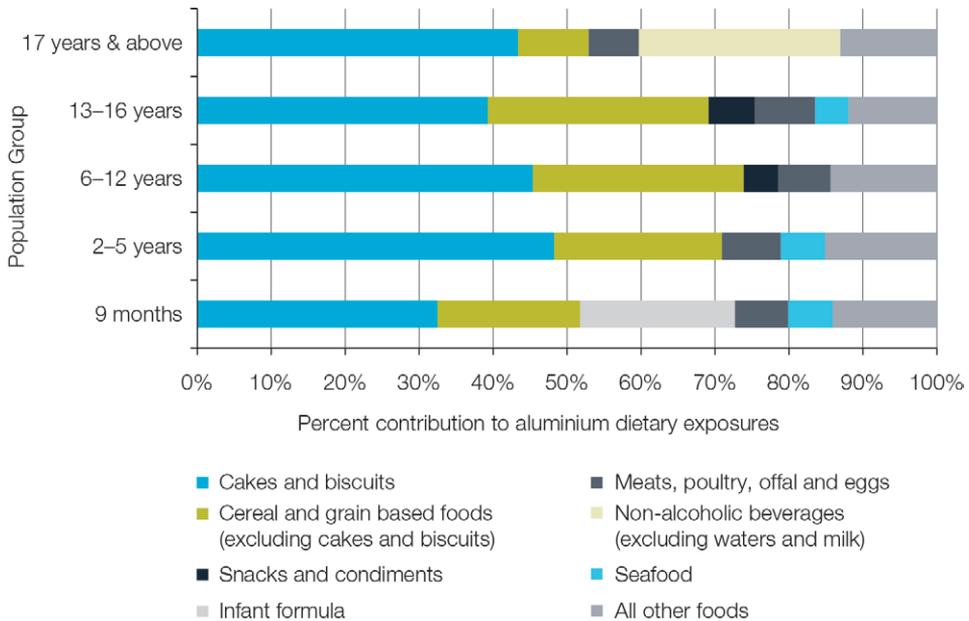
The major food group with the highest contribution to estimated aluminium dietary exposures was cakes and biscuits for all age groups assessed (32–48%) (Figure 2). The specific food group 'Cakes and muffins (excluding fruit cakes and sponges)' (categorised under cakes and biscuits) was the major source of aluminium exposure for all age groups assessed.

These results may be partially explained by the presence of aluminium-containing additives such as sodium aluminium phosphate (food additive number 541), which are commonly used as leavening agents in a number of products in this food group.

The second highest major food group contributing to estimated aluminium dietary exposures for all children aged 2–16 years was cereal and grain based foods (excluding cakes and biscuits) (23–30%). Around half of this contribution was from pikelets/pancakes, assumed to be made from a package purchased with dry ingredients with liquid added by the user and shaken before use. For 9 month old infants, infant formula was the second highest contributor (21%) to estimated aluminium dietary exposures. While the concentration of aluminium in infant formula is relatively low, this food makes up a large part of the infants diet resulting in a high contribution. For Australians aged 17 years and above, non-alcoholic beverages (excluding waters and milk) was the second highest contributor (27%) to estimated aluminium dietary exposures, with the majority of that coming from tea (except herbal) (24%).

More specific details on the food groups and their contribution to estimated aluminium dietary exposures are presented in Appendix 5, Table A5.5 for major food groups and Table A5.6 for specific food groups.

Figure 2: Major food group contributors (>5%) to estimated aluminium dietary exposures



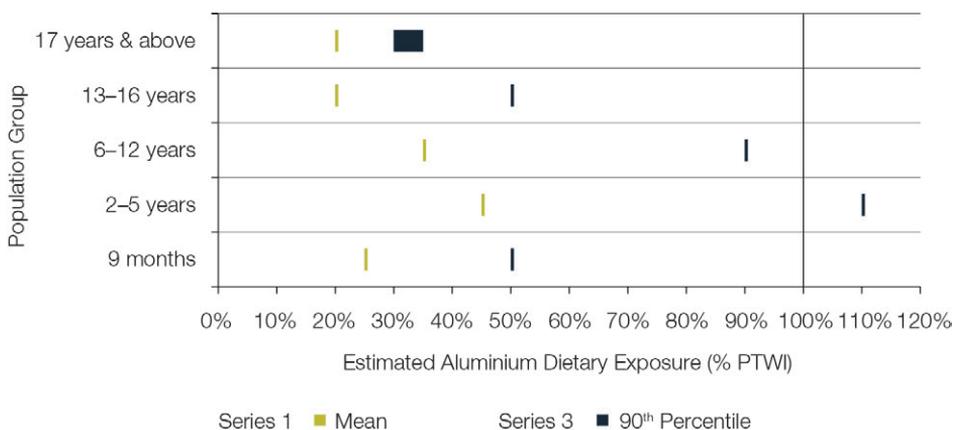
Risk characterisation

The risk characterisation of aluminium was performed by comparing mean and 90th percentile estimated dietary exposures to the JECFA PTWI of 2 mg/kg bw.

The estimated dietary exposures were then calculated as a percentage of the PTWI, with dietary exposures estimated on a 'per day' basis multiplied by 7 to obtain a weekly dietary exposure estimate to make it directly comparable to the PTWI. Estimated exposures as a percentage of the PTWI are shown in Figure 3 and are provided in Appendix 5, Table A5.4.

Estimated mean dietary exposures for consumers of aluminium for all population groups were below the PTWI. In addition, high level exposure (i.e. 90th percentile for consumers) was also below the PTWI in all population groups, with the exception of 2–5 year olds, which exceeded the PTWI by approximately 10%. JECFA had previously estimated that dietary exposure of children to aluminium-containing food additives may exceed the PTWI by up to 2-fold (JECFA 2011b). Therefore, the slight exceedance of the PTWI in the current study in children would suggest that children's current exposure to aluminium food additives is comparable to international estimates.

Figure 3: Range of mean and 90th percentile estimated dietary exposure for consumers of aluminium[∅] as a percentage of the PTWI[×]



∅ Lower end of the range represents where all ND analytical results have been assigned a concentration of zero; the upper end of the range represents where all ND analytical results have been assigned a concentration equal to the LOR.

× PTWI 2 mg/kg bw (JECFA 2011b).

For the general population the major route of exposure to aluminium is through the diet. The design of human dietary studies and analytical methods used only determine the total aluminium content in food, and not the individual aluminium compounds or species present. For this reason, it is not possible to be conclusive about the sources contributing to the aluminium content of a particular food i.e. the amount that is naturally present versus contributions from food additives or from food processing materials or storage containers.

As expected, the estimates of dietary exposure to aluminium were higher in the 24th ATDS compared to the 23rd ATDS, as a more comprehensive and representative set of foods were included in the assessment. Because a wider range of foods were available for mapping in the 24th ATDS, changes to the food list and food mapping approach from the 23rd to 24th ATDS were made. Some examples of this are below:

- In the 23rd ATDS, many cereal-based foods were included in the dietary exposure calculations indirectly by breaking them down via recipes into their core ingredients as there were no other appropriate foods to map them to, or by mapping to another food. However the 24th ATDS delivered analytical data for many of these foods that contain aluminium-containing food additives, such as pancake and pikelet products and sponge cakes. In some cases, the analysed aluminium levels found in the 24th ATDS were higher than had been estimated using the food mapping and recipes of the 23rd ATDS. For example, the 24th ATDS food 'Cake, sponge, plain' had the highest median concentration of aluminium of all foods analysed (approximately 5 times higher than the aluminium concentration assigned to the food it had been mapped to in the 23rd ATDS).
- Prunes and prune juice were mapped to 'juice, fruit' in the 23rd ATDS but were analysed separately in the 24th ATDS, yielding aluminium concentrations 5 times higher than that assigned to them in the 23rd ATDS.
- All foods translated to 'noodles, egg, fresh' in the 24th ATDS were translated to 'pasta' in the 23rd ATDS but 'noodles, egg, fresh' had more than three times the concentration of aluminium compared to 'pasta'.

The estimated dietary exposure for aluminium reported in the 24th ATDS is considerably higher than that reported in the 23rd ATDS, but is considered to be a more accurate estimate of exposure.

Risk management

In view of the conservative nature of the current PTWI, the small exceedance of the PTWI by high consumers in the 2–5 year age group is unlikely to represent a public health and safety issue. However, FSANZ will consider appropriate risk management options and their effects. As part of these considerations, FSANZ will discuss with industry whether current permissions for aluminium-containing food additives in the Code are still appropriate for the established technological need; or if they could be decreased to lower estimated dietary exposures, particularly for young children. In addition, alternative food additives that may be available for industry will be explored.



Perchlorate



F



Part F – Perchlorate

Perchlorate (ClO_4^-) is a salt of chloric acid. Perchlorate salts are highly soluble in water, but the perchlorate ion itself is very stable. It has been identified as a potential contaminant in drinking water. Water, soil and fertilizers are considered to be the main sources of perchlorate contamination in the diet (JECFA 2011a). Perchlorate occurs naturally in the environment and can precipitate into soil and groundwater from the atmosphere or through leaching of mineral deposits. Perchlorate containing compounds are widely used for industrial purposes such as nitrate fertilisers and chlorine dioxide-based disinfectants and bleaching agents. Ammonium perchlorate is used in rocket propellants, explosives, fireworks, flares and airbag inflators (JECFA 2010).

In other countries such as the USA, there is some concern over potential contamination of drinking water with perchlorate salts. The US Environmental Protection Agency (EPA) has announced that they are developing a proposed national primary drinking water regulation for perchlorate (USEPA 2012).

Perchlorate was included in this study to give an indication of possible perchlorate levels in the Australian water supply.

Perchlorate hazard summary

Perchlorate is rapidly absorbed following ingestion and rapidly excreted unchanged, mostly in the urine. Potassium perchlorate can be used as a human therapeutic medicine to treat thyroid disease. The key pharmacological activity of perchlorate is its ability to competitively inhibit uptake of iodide by the thyroid gland, potentially causing hypothyroidism. However, since it is well known that common laboratory animals are not good surrogates for substances that are known to affect the thyroid, such as inhibiting the uptake of iodide, they should not be used to establish the hazard relevant for humans. A human clinical study in which perchlorate was given daily in drinking water for 14 days was the basis of the HBGV. The uptake of radiolabelled iodide into the thyroid was measured. A critical effect size of 50% inhibition of iodide uptake was chosen as the benchmark response (BMDL_{50}). This choice was made because human clinical data from healthy adults following both short-term and chronic exposure have shown that this level of inhibition is not associated with any changes in thyroid stimulating hormone or thyroid hormone levels. Applying a 10-fold factor to the BMDL_{50} and rounding to one significant figure, a Provisional Maximum Tolerable Daily Intake (PMTDI)⁶ of 0.01 mg/kg bw was established for perchlorate (JECFA 2010).

6 A PMTDI is a reference value established to indicate a safe level of intake of a contaminant in food which is not known to accumulate in the body.

Foods included in the study for perchlorate

Perchlorate was analysed in tap water from each of Australia's eight states and territories.

Analysis of food samples

NMI conducted the analysis using the NATA accredited method, ion chromatography. The LOR was 0.02 mg/kg which is four times the LOQ of 0.005 mg/kg.

Perchlorates were only analysed in tap water samples and no detectable levels were found. For this reason no dietary exposure assessment was conducted for perchlorates.

Risk characterisation

As there was no detectable perchlorate in Australian tap water there is unlikely to be any appreciable human health and safety risk from perchlorate.

References

ACT Community Care (2000) From Milk to More...Introducing foods to your baby., Publishing Services, Canberra.

ANZFA (1999) Contaminants in foods – metals, full assessment report, Proposal P157. ANZFA, Canberra.

Codex (2009) Code of practice for the reduction of acrylamide in foods. Codex Alimentarius. http://www.codexalimentarius.net/download/standards/11258/CXP_067e.pdf

Cook T, Rutishauser I, Seelig M (2001a) Comparable data on food and nutrient intake and physical measurements from the 1983, 1985 and 1995 national nutrition surveys. Australian Food and Nutrition Monitoring Unit, Commonwealth Department of Health and Aged Care, Commonwealth of Australia, Canberra.

Cook T, Rutishauser I, Allsopp R (2001b) The Bridging Study: comparing results from the 1983, 1985 and 1995 Australian national nutrition surveys. Australian Food and Nutrition Monitoring Unit, Commonwealth Department of Health and Aged Care, Commonwealth of Australia, Canberra.

Cressey P, Thomson B, Ashworth M, Grounds P, McGill E (2012) Acrylamide in New Zealand food and updated exposure assessment. 2011/19. New Zealand Ministry of Agriculture and Forestry. <http://www.foodsafety.govt.nz/elibrary/industry/acrylamide-in-nz-food-updated-exposure-assessment.pdf>

Croft M, Tong P, Fuentes D, Hambridge T (2004) Australian survey of acrylamide in carbohydrate-based foods. *Food Additives and Contaminants* 21(8):721–736.

Department of Health South Australia (2006) Acrylamide, A survey of acrylamide in non-carbohydrate based foods. South Australia, Australia. www.health.sa.gov.au/pehs/Food/survey-acrylamide-jan07.pdf

EFSA (2011) Statement of EFSA on the evaluation of a new study related to the bioavailability of aluminium in food. *EFSA Journal* 9(5):1–16.

FAO (2004) Human Energy Requirements: Report of a Joint FAO/WHO/UNU Expert Consultation, Rome, 17–24 October 2001. FAO, Rome. <ftp://ftp.fao.org/docrep/fao/007/y5686e/y5686e00.pdf>. Accessed 1 March 2011.

FSANZ (2005) The 21st Australian Total Diet Study. Food Standards Australia New Zealand, Canberra. <http://www.foodstandards.gov.au/scienceandeducation/publications/21staustriantotald2963.cfm>

FSANZ (2008a) 22nd Australian Total Diet Study. Food Standards Australia New Zealand, Canberra. <http://www.foodstandards.gov.au/scienceandeducation/publications/22ndaustriantotaldietstudy/>.

FSANZ (2008b) Survey of chemical contaminants and residues in espresso, instant and ground coffee. Food Standards Australia New Zealand. http://www.foodstandards.gov.au/_srcfiles/Survey%20of%20chemical%20contaminants%20and%20residues%20in%20coffee1.pdf

FSANZ (2010) NUTTAB 2010 online searchable database. Food Standards Australia New Zealand. <http://www.foodstandards.gov.au/consumerinformation/nutttab2010/>. Accessed 8 November 2012.

- FSANZ (2011) The 23rd Australian Total Diet Study. Food Standards Australia New Zealand, Canberra.
- FSANZ (2012) The 2007 Australian National Children's Nutrition and Physical Activity Survey. Volume Eight: Dietary exposure to food sourced chemicals. Department of Health and Ageing, Canberra. <http://www.health.gov.au/internet/main/publishing.nsf/Content/add-anal>
- FSANZ (2013) *Australia New Zealand Food Standards Code*. <http://www.foodstandards.gov.au/foodstandards/foodstandardscode.cfm>. Accessed 11 January 2013.
- H.J Heinz (2010a) Developmental Milestones and Behaviour: 7 to 9 months. <http://www.forbaby.com.au/modules/readingroom/article.php?id=50>. Accessed 4 November 2010a.
- H.J Heinz (2010b) What parents need to know about cow's milk. http://www.forbaby.com.au/modules/feeding_baby/article.php?id=29. Accessed 4 November 2010b.
- Health Canada (2012) Health Canada's revised exposure assessment of acrylamide in food. Bureau of Chemical Safety Food Directorate Health Products and Food Branch, Canada. http://www.hc-sc.gc.ca/fn-an/alt_formats/pdf/securit/chem-chim/food-aliment/acrylamide/rev-eval-exposure-exposition-eng.pdf
- Hitchcock NE, Gracey M, Gilmour AI, Oowler EN (1986) Nutrition and growth in infancy and early childhood: a longitudinal study from birth to five years. *Monographs in Paediatrics* 19:1–92.
- JECFA (2005) Evaluation of certain food contaminants (Sixty-fourth report of the Joint FAO/WHO Expert Committee on Food Additives).
- JECFA (2007) Safety evaluation of certain food additives and contaminants. WHO Food Additive Series, no. 58.
- JECFA (2010) Summary report of the seventy-second meeting of JECFA. http://www.who.int/entity/foodsafety/chem/summary72_rev.pdf
- JECFA (2011a) Safety evaluation of certain contaminants in food. WHO Food Additive Series 63. Joint FAO/WHO Expert Committee on Food Additives, Geneva.
- JECFA (2011b) Summary and conclusions of the seventy-fourth JECFA meeting.
- NHMRC (2001) Dietary Guidelines for Children and Adolescents In Australia Incorporating Infant Feeding Guidelines For Health Workers (Draft). Unpublished.
- NHMRC (2003) Dietary Guidelines for Children and Adolescents in Australia incorporating the Infant Feeding Guidelines for Health Workers. National Health and Medical Research Council. http://www.nhmrc.gov.au/publications/synopses/_files/n34.pdf. Accessed 1 April 2008.
- NHMRC, NRMCMC (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.
- The Children's Hospital at Westmead (2008) Constipation. <http://www.chw.edu.au/parents/factsheets/constipj.htm>. Accessed 4 November 2010.

UKFSA (2012) Survey of acrylamide and furan in UK retail products 2010–11. 02/12. United Kingdom Food Standards Agency, United Kingdom. http://www.foodbase.org.uk//admintools/reportdocuments/752-1-1328_acrylamide-furan-survey_FINAL.pdf

USEPA (2012) Perchlorate. United States Environmental Protection Agency. <http://water.epa.gov/drink/contaminants/unregulated/perchlorate.cfm>. Accessed 3 September 2012.

USFDA (2009a) Acrylamide Questions and Answers. US Food and Drug Administration. <http://www.fda.gov/food/foodsafety/foodcontaminantsadulteration/chemicalcontaminants/acrylamide/ucm053569.htm>. Accessed 6 March 2012a.

USFDA (2009b) Survey Data on Acrylamide in Food: Total Diet Study Results. US Food and Drug Administration. <http://www.fda.gov/Food/FoodSafety/FoodContaminantsAdulteration/ChemicalContaminants/Acrylamide/ucm053566.htm>. Accessed 5 September 2012b.

Vikstrom AC, Eriksson S, Paulsson B, Karlsson P, Athanassiadis I, Tornqvist M (2008) Internal doses of acrylamide and glycidamide in mice fed diets with low acrylamide contents. *Molecular Nutrition and Food Research* 52:974–980.

WHO (1985) Guidelines For The Study of Dietary Intakes of Chemical Contaminants. 87. World Health Organisation, Geneva.

WHO (2007a) The WHO Child Growth Standards. http://www.who.int/childgrowth/standards/WFA_boys_0_5_percentiles.pdf. Accessed 14 June 7 A.D.a.

WHO (2007b) WHO Technical Report Series 940-Evaluation of certain Food Additives and Contaminants: sixty-Seventh report of the Joint FAO/WHO Expert Committee on Food Additives. World Health Organization. <http://www.who.int/ipcs/publications/jecfa/reports/trs940.pdf>

WHO (2009) Environmental Health Criteria 240 Principles and Methods for the Risk Assessment of Chemicals in Food – Chapter 6 Dietary Exposure Assessment of Chemicals In Food. World Health Organization, Geneva, Geneva. http://whqlibdoc.who.int/ehc/WHO_EHC_240_9_eng_Chapter6.pdf

Appendices



Appendix 1: Foods sampled in the 24th ATDS**Table A1.1: Foods sampled for acrylamide in phase 1 of the 24th ATDS**

Food	Food
Asparagus (R)	Infant formula (non-soy) (N)
Bacon (N)	Infant formula, soy-based (N)
Baked beans in tomato sauce (N)	Infant rusks/biscuits (N)
Beef, minced, lean (R)	Jams (e.g. marmalade) – excluding fruit spreads and diet varieties (N)
Beer, full strength (N)	Juice, prune (N)
Biscuits, savoury, corn based (N)	Lamb chops, loin (R)
Biscuits, savoury, rice based (N)	Milk, fresh (full fat) (R)
Biscuits, savoury, wheat based (N)	Milk, UHT (full fat) (R)
Biscuits, sweet, plain (N)	Muesli bars, with dried fruit (N)
Bread, fancy, fresh (savoury) (R)	Noodles, egg fresh (N)
Bread, fancy, fresh (sweet) (R)	Noodles, instant (N)
Bread, fancy, toasted (sweet) (R)	Nuts, mixed, roasted and salted (N)
Bread, flat (pita, burrito etc.) (R)	Olives (N)
Bread, multigrain, fresh (R)	Onions – frozen packaged (N)
Bread, multigrain, toasted (R)	Onions, fresh (R)
Bread, white, fresh (R)	Pasta (cooked) (N)
Bread, white, toasted (R)	Peanut butter (N)
Bread, wholemeal, fresh (R)	Pie, fruit (N)
Bread, wholemeal, toasted (R)	Pie, meat, individual size (N)
Breakfast bars, baked style (N)	Pikelets/pancakes from shaker (N)
Breakfast cereals, mixed grains (N)	Pikelets/pancakes ready-to-eat (N)
Breakfast cereals, muesli toasted (N)	Pizza, meat and vegetable topped (N)
Breakfast cereals, single grain, corn based (N)	Popcorn, microwave (N)
Breakfast cereals, single grain, rice based (N)	Potato chips, frozen (N)

Food	Food
Breakfast cereals, single grain, wheat based (N)	Potato crisps (mixed varieties excluding salt and vinegar) (N)
Cake, chocolate, iced (N)	Potato crisps (salt and vinegar only) (N)
Cake, dried fruit (N)	Potato, chips, deep-fried, from takeaway (R)
Cake, sponge, plain (N)	Potatoes, baked (R)
Chicken breast (R)	Potatoes, boiled (R)
Chicken products, battered or crumbed (N)	Pumpkin, roasted (R)
Chicken products, battered or crumbed (deep-fried from takeaway) (N)	Sauce, tomato (N)
Chocolate energy drink, powdered (N)	Sausages, beef (R)
Chocolate, plain, milk (N)	Snack foods, corn based chips and taco shells (N)
Coffee, espresso short black, from takeaway (N)	Snack foods, extruded (excluding potato crisps) (N)
Coffee, instant (N)	Soup, base (include liquid and dry packet mix) (N)
Confectionery, soft candy e.g. jelly beans, jelly babies and snakes (N)	Spring rolls, fried, takeaway (R)
Crumpet, English style muffins (R)	Sugar, white (N)
Doughnuts, plain (no icing and no filling) (R)	Sweet potato, baked (R)
Fish fillets – white fish, fresh (R)	Tea, herbal (N)
Fish fillets, battered from takeaway (R)	Tea, regular, (non-herbal) (N)
Fish portions, frozen from supermarket (crumbed only) (N)	Tomatoes, canned (N)
Fruit, dried or processed (sultanas) (N)	Vegetables, char-grilled in oil (N)
Hamburger, from takeaway (R)	Vegetables, mixed, frozen (N)
Infant cereal, mixed (N)	Water, tap (R)
Infant dessert, fruit based (N)	Wine, red (R)
Infant dessert, milk based (N)	Wine, white (R)
Infant dinner (N)	Yeast extract (N)

N = National Food. Three retail samples make up each composite sample, 4 composite samples of each food.

R = Regional Food. Three retail samples make up each composite sample, 8–12 composite samples of each food.

Table A1.2: Foods sampled for aluminium in the 23rd and 24th ATDS

Food	ATDS	Food	ATDS
Almonds (N)	23 rd	Infant dinner (N)	23 rd
Apples (R)	23 rd	Infant formula (N)	23 rd
Avocados (R)	23 rd	Infant formula, soy-based (N)	24 th
Bacon (N)	23 rd	Infant rusks/biscuits (N)	24 th
Baked beans in tomato sauce (N)	23 rd	Juice, fruit (N)	23 rd
Bananas (R)	23 rd	Juice, prune (N)	24 th
Beans, green, raw (R)	23 rd	Kiwifruit (R)	23 rd
Beef, minced, lean (R)	23 rd	Lamb chops, loin (R)	23 rd
Beer, full strength (N)	23 rd	Lettuce (R)	23 rd
Beetroot, canned (N)	23 rd	Liver pate (chicken) (N)	23 rd
Biscuits, savoury (N)	23 rd	Mango (N)	23 rd
Biscuits, sweet, plain (N)	23 rd	Margarine, monounsaturated (N)	23 rd
Bread, fancy (R)	23 rd	Milk, fresh (full fat) (R)	24 th
Bread, fancy, fresh (savoury) (R)	24 th	Milk, UHT (full fat) (R)	24 th
Bread, flat (pita, burrito etc.) (R)	24 th	Muesli bars, with dried fruit (N)	24 th
Bread, multigrain (R)	23 rd	Mushrooms (R)	23 rd
Bread, white (R)	23 rd	Nectarine (R)	23 rd
Bread, wholemeal, fresh (R)	24 th	Noodles, egg fresh (N)	24 th
Breakfast bars, baked style (N)	24 th	Oats, rolled (N)	23 rd
Breakfast cereals, mixed grains (N)	23 rd	Oil, canola and olive (N)	23 rd
Breakfast cereals, muesli toasted (N)	24 th	Onions (R)	23 rd
Breakfast cereals, single grain, corn based (N)	24 th	Orange (R)	23 rd
Breakfast cereals, single grain, rice based (N)	24 th	Pasta (N)	23 rd

Food	ATDS	Food	ATDS
Breakfast cereals, single grain, wheat based (N)	24 th	Peach, natural juice (N)	23 rd
Broccoli (R)	23 rd	Peanut butter (N)	23 rd
Butter (N)	23 rd	Pear, natural juice (N)	23 rd
Cabbage (R)	23 rd	Peas, frozen (N)	23 rd
Cake, chocolate, iced (N)	24 th	Pie, fruit (N)	24 th
Cake, dried fruit (N)	24 th	Pie, meat, individual size (N)	23 rd
Cake, sponge, plain (N)	24 th	Pikelets/pancakes from shaker (N)	24 th
Capsicum (R)	23 rd	Pikelets/pancakes ready-to-eat (N)	24 th
Carrots (R)	23 rd	Pineapple, canned in natural juice (N)	23 rd
Cauliflower (R)	23 rd	Pizza, meat and vege topping (N)	23 rd
Celery (R)	23 rd	Potato (R)	23 rd
Cheese, cheddar, full fat (R)	23 rd	Potato crisps (N)	23 rd
Chicken breast (R)	23 rd	Prawns, cooked (R)	23 rd
Chicken mince (R)	23 rd	Pumpkin (R)	23 rd
Chicken products, battered or crumbed (N)	24 th	Rice, white, long grain (N)	23 rd
Chicken products, battered or crumbed (deep-fried from takeaway) (N)	24 th	Sauce, tomato (N)	23 rd
Chocolate energy drink, powdered (N)	24 th	Sausages, beef (R)	23 rd
Chocolate, milk (N)	23 rd	Savoury sauce, non tomato (N)	23 rd
Coconut, desiccated (N)	23 rd	Soft drink (N)	23 rd
Coffee, espresso (N)	23 rd	Soy beverage, full fat (N)	23 rd
Coffee, instant (N)	23 rd	Spring rolls, fried, takeaway (R)	24 th
Confectionary, soft candy e.g. jelly beans, jelly babies and snakes (N)	24 th	Strawberries (R)	23 rd
Crumpet, English style muffins (R)	24 th	Sugar, white (N)	23 rd

Food	ATDS	Food	ATDS
Cucumber (R)	23 rd	Sweetcorn, kernels, frozen (N)	23 rd
Doughnuts, plain (no icing and no filling) (R)	24 th	Tea (N)	23 rd
Dried apricots (N)	23 rd	Tea, herbal (N)	24 th
Eggs (R)	23 rd	Tomatoes, canned (N)	23 rd
Fish fillets, battered from takeaway (R)	23 rd	Tomatoes, raw (R)	23 rd
Fish portions, frozen from supermarket (N)	23 rd	Tuna, canned in brine (N)	23 rd
Fruit, dried or processed (sultanas) (N)	24 th	Vegetables, mixed, frozen (N)	24 th
Grapes (R)	23 rd	Water, bottled, still (N)	23 rd
Ham, sliced delicatessen style (N)	23 rd	Water, tap (R)	23 rd
Hamburger (R)	23 rd	Watermelon (R)	23 rd
Honey (N)	23 rd	Wine, red (R)	23 rd
Ice cream, full fat, vanilla (N)	23 rd	Wine, white (R)	23 rd
Infant cereal, mixed (N)	23 rd	Yoghurt, fruit, full fat (R)	23 rd
Infant dessert, milk based (N)	23 rd		

N = National Food. Three retail samples make up each composite sample, 4 composite samples of each food.

R = Regional Food. Three retail samples make up each composite sample, 8–12 composite samples of each food.

Appendix 2: Food preparation instructions

These instructions were included in a procedures manual provided to the laboratory to specify sample preparation instructions.

General instructions

Avoiding cross contamination

Care must be taken to ensure no mixing of any kind between the three primary samples ('purchases') when preparing composite samples. This means careful cleaning and drying of utensils in between removing portions of each primary sample for compositing.

Gloves

Gloves are to be worn whenever the food being prepared could come into contact with hands. Food preparation gloves such as Ansell latex gloves (subject to allergy concerns) or nitrile not containing lubricant should be used.

Equipment

- Stainless steel knives
- Wooden cutting board (good quality, smooth, crack free)
- Stainless steel utensils (i.e. fry pans, spatulas, etc.)
- Glass/Pyrex equipment can also be used
- For the purposes of mixing liquids, a large stainless steel or Pyrex receptacle such as a jug or bowl is to be used
- Laboratory mixer with stainless steel or glass vessel
- Laboratory grade storage containers suitable for long term freezing without leaching
- Plastic bags for enclosing sample containers.

Washing of Equipment

The analytical laboratory or preparation facility is to determine the detergent to be used in the washing of food preparation equipment. The detergent chosen should not interfere with the analyses for the analytes of interest.

Handling purchases for food preparation

Each purchase as provided by the purchasing officer should arrive in separate packaging. Purchases from each jurisdiction will be in lots of three. Each purchase will represent a primary sample. Unprocessed, raw foods such as chicken breast and fish fillets will be in separate packages clearly labelled with the name of the food and primary sample identification (A, B or C) which will correspond with the detailed information on the sample spreadsheet completed by the purchasing officer. The sample spreadsheet should be checked by the laboratory for completeness and to ensure that recorded information corresponds to sample labels.

Preparing and storing samples

1. Primary samples (purchases) are to first be prepared in their 'ready to eat state' as indicated e.g. if cooking is required cook first (Refer to table under Food Preparation Instructions below). In preparing foods for ATDS analysis it is imperative that preparation instructions are followed and that all of the food that would be consumed forms the analytical sample in the proportions that would typically be eaten. For example any juices from canned tomatoes must be regarded as an integral part of the food being prepared for analysis. A proportional amount of juice and seeds (must therefore be included in the sample containers).
2. Once prepared as indicated, mix the amount of primary sample specified until homogenous. If the sample is a liquid do not allow to sit and separate out.
3. Fill and label a suitable sized and type of storage container to retain sufficient amounts of the prepared primary sample for two further analyses (this step will need to be repeated for each of the three primary samples). The label should be given a unique identifier that will enable it to be definitively linked to the primary sample information recorded by the purchasing officer.
4. Accurately measure (solids and semi solids can be weighed, liquids measured by volume) out the minimum amount required for the composite sample (e.g. one third of the total amount required for the composite sample allowing for some wastage) and place this into a vessel for further mixing or blending of the composite sample. For example, for prune juice, if 300mls is required for triplicate analysis for each screen/analyte then at least 100mls of each primary sample ('purchase') of prune juice needs to be used to prepare the composite sample. Unused composite samples are to be stored for 12 months after completion of the study.
5. Once the primary samples are all added to the vessel mix until homogenous. If the sample is a liquid do not allow to sit and separate out.

6. Fill and label a suitable sized and type of storage container to retain a sufficient amount of the composite sample for at least all of the analytical test specified as well two repeat analysis of each specified test (for repeat analyses of the original tests and possibly one inter-lab check test if required). The label for the composite sample needs to enable it to be definitively linked to its three constituent primary samples and the analytical results.
7. Note all samples are to be stored for 12 months after final report has been received.

Glossary

Boiling water

Except where other instructions are provided, 'boiling water' means that the food is to be boiled in 'unsalted' tap water.

Washing

Foods are to be washed in accordance with local practice and the food concerned.

Mix

When the preparation instruction states 'mix' or 'mix thoroughly', then the sample should be pureed in a laboratory grade mixer or ground finely by hand until the sample is homogenous and comprises only very fine particles. Liquids such as beer or tea can simply be stirred in a glass or stainless steel vessel. Do not allow mixed samples to sit and potentially separate out before decanting into the sample container.

Frying and grilling

In the case of samples of meat, it is imperative that typical cooking behaviour be followed. For example, meat that is fried will exude fat. As the fried food is removed from the fry pan some fat will remain in the fry pan and some will remain on the cooked meat product. The fat remaining in the fry pan is to be discarded and only the fat on the cooked food is to be included for analysis. No oil is to be used in the fry pan or grill prior to cooking.

Baking

This cooking method is applicable for potatoes, sweet potatoes and pumpkin. The following procedure is proposed:

1. Wash, peel and evenly cut the required amount of potatoes.
2. Place in boiling water and then cook until they start to soften. Remove before fully cooked.
3. Place on non-stick tray and bake for 1 hour in preheated oven at 200°C.
4. Remove from oven and ALLOW TO COOL before handling.
5. The fat remaining in the tray is to be discarded and only the fat on the cooked food is to be included for analysis.

Microwaving

The time required for microwaving will depend upon the power of the microwave. For packaged food products e.g. popcorn, follow the instructions on the label. For fresh foods e.g. asparagus, the following procedure is proposed:

1. Place the required amount of asparagus into a glass/pyrex cooking dish that has a fitted lid and add one third of a cup of water.
2. Place in 650-Watt microwave on high power setting for 7 minutes. Higher power microwaves should have the setting adjusted to medium or the time of cooking reduced as necessary. It may also be necessary to stir during cooking to ensure even heat distribution.
3. Remove from microwave and ALLOW TO COOL before handling.

Food preparation instructions

The preparations required for foods which are not purchased in a ready-to-eat state are given in Table A2.1.

Table A2.1: Food preparation instructions

Food	Preparation Instructions
Asparagus	Wash and grill until just cooked.
Bacon	Remove rind and dry fry.
Baked beans in tomato sauce	Include sauce.
Beef, minced, lean	Dry fry until thoroughly browned, do not scrape pan.
Bread, fancy	Toast until golden brown.
Bread (excluding flat bread)	Toast until golden brown. Include a proportional quantity of crust.
Cake, chocolate, iced	Include a proportional quantity of icing.
Cake, dried fruit	Include a proportional quantity of fruit.
Chicken breast	Grill and discard fat in grill tray.
Chicken products, battered or crumbed	Bake according to the instructions on the packaging or as advised by shop assistant at poultry store (purchasing officer to record).
Chocolate energy drink, powdered	Prepare in accordance with the instructions on the label. Use full fat milk.
Coffee, instant	Make up as directed on label using tap water.
Confectionery, soft candy	Lightly toast the marshmallows only.

Food	Preparation Instructions
Crumpets, English style muffins	Toast until golden brown.
Fish portions, frozen from supermarket (crumbed only)	Bake according to the instructions on the packaging.
Fish fillets, white fish, fresh	Grill and discard fat in grill tray.
Infant cereal, mixed	Prepare in accordance with the instructions on the packaging.
Infant formula	Make up using tap water according to manufacturer's directions.
Lamb chops, loin	Grill. When cooked, cut all the meat away from the bone and trim off excess fat. Discard the fat in the grill tray.
Noodles, egg, fresh	Prepare in accordance with the instructions on the label.
Noodles, instant	Prepare in accordance with the instructions on the label. Use flavour sachet.
Onion, plain	Dry fry until translucent/light browned.
Pasta	Boil in tap water according to the instructions on the packaging. Do not add salt.
Pie, containing fruit	If uncooked, cook according to instructions on the label and cool.
Pie, meat, individual size	If uncooked, cook according to instructions on the label and cool.
Pikelets/pancakes	If from shaker, prepare in accordance with the instructions on the label.
Pizza, meat and vegetable topped	If uncooked, cook according to instructions on the label and cool.
Popcorn, microwave	Prepare in accordance with the instructions on the label.
Potato chips, frozen	Bake according to the instructions on the packaging.
Potatoes, baked	Wash, peel, evenly cut, and then oven cook for 1hr at 200°C.
Potatoes, boiled	Wash, peel, evenly cut and cook in boiling unsalted water. When cooked, drain potatoes, chop finely and mix.
Pumpkin, baked	Wash, peel, evenly cut, and then oven cook for 1hr at 200°C.
Sausages, beef	Dry fry, discard fat in pan.
Soup, base (liquid and dry packet mix)	Prepare in accordance with the instructions on the label.
Sweet potato	Wash, peel, evenly cut and oven bake for 1 hr at 180°C.
Tea	Brew using one teabag per 250mls of tap water. Wait 5 minutes for the tea to infuse. Do not add milk.
Tomatoes, canned	Include a representative proportion of juice.

Appendix 3: Estimating dietary exposures

How the dietary modelling was conducted

For the 24th ATDS, dietary modelling was conducted using the computer program DIAMOND, which was designed to automate dietary exposure calculations. DIAMOND multiplied the chemical concentration for each food consumed in national nutrition surveys with the amount of that food that each survey respondent consumed to estimate each individual's exposure to that chemical from each food. Once this had been completed for all foods determined as containing a particular chemical, the total amount of the chemical consumed from all foods was summed for each individual. Population statistics (e.g. mean and 90th percentile exposures) for each age group were derived from the individual ranked exposures. Where the results are expressed on a body weight basis, each individual's exposure from all foods was divided by their own body weight before population summary statistics were derived.

The use of DIAMOND for dietary modelling brings many benefits. DIAMOND enables the dietary exposure assessments to be conducted using actual diets, as recorded in national nutrition surveys, in place of the 'average' diets which were used prior to the 19th ATDS. This means that dietary exposure is calculated for each individual in the survey before mean and high percentile dietary exposure results are derived for each age group. The use of specific food consumption data greatly improves the reliability and accuracy of the dietary exposure estimates and takes account of the different eating patterns of consumers.

Once dietary exposure to the chemical from the total diet had been estimated, this is compared to relevant HBGVs to assess the potential risk to human health. The comparison of the estimated dietary exposures with HBGVs is discussed in further detail in the risk characterisation sections of the report.

Number of respondents in each of the population groups assessed

A range of population groups were assessed including infants, children and adults. Table A3.1 shows the number of individuals in each age group assessed.

Table A3.1: Number of respondents and average body weight for each age group assessed

Age	Number of Respondents	Average body weight (kg)
9 months [⌘]		8.9
2–5 years ^φ	1,178	18
6–12 years ^φ	2,090	36
13–16 years ^φ	1,219	61
17 years & above [*]	11,129	74

⌘ based on a model diet.

φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey.

* derived using the 1995 Australian National Nutrition Survey.

Food consumption data

The dietary exposure assessment uses food consumption data from two Australian National Nutrition Surveys: the 2007 ANCNPAS for children aged 2–16 years, and the 1995 NNS for those aged 17 years and above.

In the 1995 NNS, most respondents completed only one 24-hour recall. In contrast, in the 2007 ANCNPAS, all respondents completed two 24-hour recalls. The different survey design has some implications for interpreting the dietary exposure assessments reported in this ATDS. Where a chemical is present in only a small number of foods, using two 24-hour recalls will give a more realistic estimate of long-term dietary exposure, particularly long-term high exposure. Using two 24-hour recalls leads to an increased number of consumers of a food.

The 2007 ANCNPAS was conducted over a seven month time period, from February to August 2007, which means that foods largely available only in summer will not be fully represented. This has the potential to have a minor effect on estimations of dietary exposure to chemicals found in spring and summer fruits and vegetables. However, other research on the effect of the sampling time frame on estimates of dietary exposure for a range of food chemicals shows this effect is minimal (FSANZ 2012).

Sampling weights are only applied in DIAMOND to the data from the 2007 ANCNPAS as this survey used survey techniques that over-sampled some sectors of the population. Data from the 1995 NNS are used unweighted. The lack of use of sampling weights with the 1995 NNS is not expected to have a significant effect on the dietary exposure estimates from this survey as the survey sample was broadly reflective of the overall Australian population at that time.

Neither the 1995 NNS nor the 2007 ANCNPAS examined children aged below two years of age. Therefore a model diet was constructed to allow the dietary exposure assessments to be conducted for infants aged nine months.

Construction of the model diet for 9 month old infants

By the age of 9 months, most infants will be consuming a mixed diet and will be exposed to food chemicals from a range of foods in addition to human breast milk and/or infant formula. To enable food chemical exposures for 9 month old infants to be estimated, a model diet was constructed. The model diet was based on recommended energy intakes, mean body weight, the proportion of milk and solid foods in the diet for a 9 month old infant, and 2007 ANCNPAS data on foods consumed by a two year old child. The recommended energy intake for a 9 month old boy (FAO 2004) at the 50th percentile weight (WHO 2007a) was used as the basis for the model diet. Boys' weights were used as boys tend to be heavier than girls at the same age and therefore have higher energy and food requirements. The body weight of a 50th percentile 9 month old boy was 8.9 kg.

It was assumed that 50% of energy intake was derived from infant formula and 50% from solids and other fluids (Hitchcock et al. 1986). The patterns of consumption of a two year old child from the 2007 NNS survey were scaled down and used to determine the 50% solid and other fluids portion of the 9 month old infant's diet. Certain foods such as nuts, tea, coffee and alcohol, were removed from the diet since nuts are not recommended for infants because of choking risk (NHMRC 2001) and coffee and alcohol are unsuitable for infant consumption (ACT Community Care 2000). Consumption of breakfast cereals was assumed to be in the form of either infant cereal or single grain breakfast cereals. The mixed grain breakfast cereals that were sampled in this survey included light muesli products and bran based cereals. Bran is not recommended in the diet of infants due to the potential interference with the absorption of minerals (The Children's Hospital at Westmead 2008) and to the immaturity of the infant gut (H.J Heinz 2010a). Consequently, mixed grain breakfast cereals were excluded from the model infant diet. Since cow's milk is not recommended as the main milk source for children aged less than 12 months of age (NHMRC 2003; H.J Heinz 2010b), all milk consumption was assumed to be in the form of infant formula.

Two model diets were constructed, one based on the mapping for aluminium, and one based on the mapping for acrylamide (see Appendix 7: Food consumption data for the foods included in the diets and amounts consumed). As there are a large number of foods that have not been mapped to an ATDS food for the acrylamide exposure estimates (see acrylamide mapping) a ratio was applied to the ATDS foods to allow a consumption amount for these foods. The ratio was based on 2 year old consumption data of the unmapped foods using the 2007 ANCNPAS data. This adjustment allowed for a more realistic exposure estimate to acrylamide.

As the model diet is based on mean food consumption amounts only, a distribution of food consumption was not available and hence, a distribution of food chemical exposures was not able to be produced. Therefore, the 90th percentile dietary exposures were estimated using the calculation shown in Equation 2. Exposures were then compared to the HBGVs where relevant.

Equation 2: 90th percentile dietary exposure calculation for the 9 month old infant model diet

$$90^{\text{th}} \text{ percentile exposure} = \text{mean exposure} \times 2^*$$

* (WHO 1985).

Dietary modelling approach for this study

For population groups aged 17 years and above, the estimated dietary exposures were derived from a single day 24-hour recall of food consumption from the 1995 NNS.

For children aged 2–16 years, estimated dietary exposures were derived using the average of the food consumption data from the two 24-hour recalls in the 2007 ANCNPAS survey.

Due to the different methodologies used to derive the data from the two nutrition surveys, caution should be applied when comparing exposure estimates for children and adults, particularly at the high percentiles. Despite the different approaches used, all age groups are presented in a combined format.

Respondents versus consumers

Estimates of dietary exposure can be calculated for all survey respondents or only for those who reported consuming a food containing the chemical on the day of the survey ('consumers'). This study reports exposure estimates for 'consumers'.

The contaminants investigated in this study are distributed across a wide range of foods and are frequently consumed by all members of the population. In the two surveys considered, all respondents were consumers of acrylamide and aluminium.

The number of respondents in each age group is provided in Table A3.1.

Appendix 4: Detailed information on acrylamide risk assessment and risk characterisation

Table A4.1: Concentrations of acrylamide in foods (µg/kg)

Notes on Table:

Results are derived from composite samples.

'ND' means result less than the limit of reporting (LOR).

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Asparagus	10	1	210	212	215	215	<LOR	490
Bacon	4	3	58	73	0	20	<LOR	230
Baked beans in tomato sauce	4	2	130	140	80	90	<LOR	360
Beef, minced, lean	10	4	231	239	69	69	<LOR	950
Beer, full strength	4	4	0	20	0	20	<LOR	<LOR
Biscuits, savoury, corn based	4	0	107	107	105	105	28	190
Biscuits, savoury, rice based	4	1	39	44	43	43	<LOR	68
Biscuits, savoury, wheat based	4	0	230	230	210	210	160	340
Biscuits, sweet, plain	4	0	220	220	215	215	180	270
Bread, fancy, fresh (savoury)	8	3	37	44	32	32	<LOR	100
Bread, fancy, fresh (sweet)	8	2	29	34	34	34	<LOR	60
Bread, fancy, toasted (sweet)	8	2	30	35	36	36	<LOR	49

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Bread, flat (pita, burrito etc.)	8	6	8	23	0	20	<LOR	34
Bread, multigrain, fresh	12	3	41	46	27	32	<LOR	190
Bread, multigrain, toasted	12	2	58	61	48	48	<LOR	150
Bread, white, fresh	12	7	13	25	0	20	<LOR	50
Bread, white, toasted	12	4	33	39	42	42	<LOR	71
Bread, wholemeal, fresh	12	2	94	98	43	43	<LOR	750
Bread, wholemeal, toasted	12	3	61	66	74	74	<LOR	140
Breakfast bars, baked style	4	1	26	31	28	28	<LOR	50
Breakfast cereals, mixed grains	4	0	135	135	120	120	61	240
Breakfast cereals, muesli toasted	4	2	26	36	21	31	<LOR	64
Breakfast cereals, single grain, corn based	4	0	94	94	96	96	56	130
Breakfast cereals, single grain, rice based	4	1	30	35	30	30	<LOR	61
Breakfast cereals, single grain, wheat based	4	0	169	169	180	180	87	230

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Cake, chocolate, iced	4	4	0	20	0	20	<LOR	<LOR
Cake, dried fruit	4	3	23	38	0	20	<LOR	90
Cake, sponge, plain	4	4	0	20	0	20	<LOR	<LOR
Chicken breast	10	9	6	24	0	20	<LOR	61
Chicken products, battered or crumbed	4	2	98	108	50	60	<LOR	290
Chicken products, battered or crumbed (deep-fried from takeaway)	4	2	52	62	40	50	<LOR	130
Chocolate energy drink, powdered	4	1	216	221	202	202	<LOR	460
Chocolate, plain, milk	4	2	32	42	25	35	<LOR	76
Coffee, espresso short black, from takeaway	4	4	0	20	0	20	<LOR	<LOR
Coffee, instant	4	4	0	20	0	20	<LOR	<LOR
Confectionery, soft candy e.g. jelly beans, jelly babies and snakes	4	4	0	20	0	20	<LOR	<LOR
Crumpet, English style muffins	8	4	25	35	21	31	<LOR	58
Doughnuts, plain (no icing and no filling)	8	6	8	23	0	20	<LOR	38

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Fish fillets – white fish, fresh	12	12	0	20	0	20	<LOR	<LOR
Fish fillets, battered from takeaway	10	10	0	20	0	20	<LOR	<LOR
Fish portions, frozen from supermarket (crumbed only)	4	4	0	20	0	20	<LOR	<LOR
Fruit, dried or processed (sultanas)	4	4	0	20	0	20	<LOR	<LOR
Hamburger, from takeaway	8	0	109	109	114	114	39	190
Infant cereal, mixed	4	4	0	20	0	20	<LOR	<LOR
Infant dessert, fruit based	4	4	0	20	0	20	<LOR	<LOR
Infant dessert, milk based	4	3	35	50	0	20	<LOR	140
Infant dinner	4	4	0	20	0	20	<LOR	<LOR
Infant formula (non-soy)	4	4	0	20	0	20	<LOR	<LOR
Infant formula, soy-based	4	4	0	20	0	20	<LOR	<LOR
Infant rusks/ biscuits	4	4	0	20	0	20	<LOR	<LOR
Jams (e.g. marmalade) – excluding fruit spreads and diet varieties	4	4	0	20	0	20	<LOR	<LOR
Juice, prune	4	0	128	128	135	135	81	160
Lamb chops, loin	10	9	7	25	0	20	<LOR	73

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Milk, fresh (full fat)	12	12	0	20	0	20	<LOR	<LOR
Milk, UHT (full fat)	12	12	0	20	0	20	<LOR	<LOR
Muesli bars, with dried fruit	4	4	0	20	0	20	<LOR	<LOR
Noodles, egg fresh	4	4	0	20	0	20	<LOR	<LOR
Noodles, instant	4	2	44	54	33	43	<LOR	110
Nuts, mixed, roasted and salted	4	2	28	38	18	28	<LOR	78
Olives	4	0	328	328	315	315	230	450
Onions – frozen packaged	4	3	30	45	0	20	<LOR	120
Onions fresh	10	1	228	230	200	200	<LOR	570
Pasta (cooked)	4	4	0	20	0	20	<LOR	<LOR
Peanut butter	4	0	69	69	71	71	56	79
Pie, fruit	4	4	0	20	0	20	<LOR	<LOR
Pie, meat, individual size	4	4	0	20	0	20	<LOR	<LOR
Pikelets/ pancakes from shaker	4	4	0	20	0	20	<LOR	<LOR
Pikelets/ pancakes ready-to-eat	4	4	0	20	0	20	<LOR	<LOR
Pizza, meat and vegetable topped	4	4	0	20	0	20	<LOR	<LOR
Popcorn, microwave	4	1	315	320	290	290	<LOR	680

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Potato chips, frozen	4	1	66	71	63	63	<LOR	140
Potato crisps (mixed varieties excluding salt and vinegar)	4	0	283	283	250	250	52	580
Potato crisps (salt and vinegar only)	4	0	373	373	375	375	290	450
Potato, chips, deep-fried, from takeaway	8	0	215	215	210	210	100	320
Potatoes (baked)	10	0	212	212	90	90	33	620
Potatoes (boiled)	10	9	5	23	0	20	<LOR	54
Pumpkin, roasted	10	2	63	67	45	45	<LOR	180
Sauce, tomato	4	4	0	20	0	20	<LOR	<LOR
Sausages, beef	10	7	41	55	0	20	<LOR	190
Snack foods, corn based chips and taco shells	4	0	190	190	170	170	140	280
Snack foods, extruded. (excluding potato crisps)	4	3	17	32	0	20	<LOR	66
Soup, base (include liquid and dry packet mix)	4	3	55	70	0	20	<LOR	220
Spring rolls, fried, takeaway	8	4	37	47	14	24	<LOR	150
Sugar, white	4	4	0	20	0	20	<LOR	<LOR

Food	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
			ND=0	ND=LOR	ND=0	ND=LOR		
Sweet potato, baked	10	0	93	93	43	43	22	470
Tea, herbal	4	4	0	20	0	20	<LOR	<LOR
Tea, regular, (non-herbal)	4	4	0	20	0	20	<LOR	<LOR
Tomatoes, canned	4	4	0	20	0	20	<LOR	<LOR
Vegetables, char-grilled in oil	4	0	48	48	46	46	35	64
Vegetables, mixed, frozen	4	4	0	20	0	20	<LOR	<LOR
Water, tap	8	8	0	20	0	20	<LOR	<LOR
Wine, red	8	8	0	20	0	20	<LOR	<LOR
Wine, white	8	8	0	20	0	20	<LOR	<LOR
Yeast extract	4	4	0	20	0	20	<LOR	<LOR

Table A4.2: Mapping of ATDS foods to national nutrition survey foods analysed for acrylamide

ATDS food	Foods translated to the ATDS food	Food group name
Asparagus	Stalk and stem vegetables (artichoke, asparagus, celery) and leafy vegetables (spinach, silverbeet, endive, lettuce); baked, stir-fried or cooked unspecified	Stalk and stem vegetables; baked, stir-fried or cooked unspecified
Bacon	Bacon; ham and pork deli meats grilled, fried, baked, and cooked unspecified. Excluding chicken, turkey and salami raw or cooked	Bacon
Baked beans in tomato sauce	All pulses excluding soy beans	Pulses (except soy beans)
Beef, minced, lean	All minced meat types excluding poultry	Mince
Beer, full strength	Beer; spirits; non-cream and non-coffee liqueurs; non-fruit based spirits	Beer, liqueurs and spirits
Biscuits, savoury, corn based	Savoury biscuits (excluding rice and wheat based); excluding extruded snacks	Corn based savoury biscuits
Biscuits, savoury, rice based	Savoury biscuits (excluding corn and wheat based); rice crackers; rice cakes	Rice based savoury biscuits
Biscuits, savoury, wheat based	Savoury biscuits (excluding corn and rice based); crackers; crispbread; excluding extruded snacks	Wheat based savoury biscuits
Biscuits, sweet, plain	Commercial and homemade plain sweet biscuits (excluding filled); cones for ice cream	Sweet plain biscuits
Bread, fancy, fresh (savoury)	Vegetable-, herb-, cheese-, or bacon-containing breads, buns and rolls; focaccias, savoury muffins	Savoury breads
Bread, fancy, fresh (sweet)	Fruit containing breads, buns and rolls, bagels	Fruit breads
Bread, fancy, toasted (sweet)	Fruit containing breads, buns and rolls (toasted)	Toasted fruit breads
Bread, flat (pita, burrito etc.)	Flat breads; tortilla, lavash, pita, burrito, naans	Flat breads
Bread, multigrain, fresh	Multigrain breads, rolls; pumpnickel	Breads containing grains and seeds
Bread, multigrain, toasted	Multigrain breads (toasted)	Breads containing grains and seeds, toasted

ATDS food	Foods translated to the ATDS food	Food group name
Bread, white, fresh	White and high-fibre white breads, rolls, focaccia; sourdough	White breads (including high-fibre white)
Bread, white, toasted	White and high-fibre white breads (toasted); croutons; pizza bases	White breads (including high-fibre white), toasted
Bread, wholemeal, fresh	Wholemeal breads including spelt and rye breads	Wholemeal, rye and spelt breads
Bread, wholemeal, toasted	Wholemeal breads including spelt and rye breads (toasted)	Wholemeal, rye and spelt breads, toasted
Breakfast bars, baked style	Bars containing mixed grains, including fruit and nut	Breakfast bars
Breakfast cereals, mixed grains	Mixed grain breakfast cereals and brans; breakfast cereals containing fruits and/or nuts; untoasted muesli; unspecified cereals	Breakfast cereals with mixed grains/ fruits/nuts
Breakfast cereals, muesli toasted	Muesli; baked, toasted, untoasted; unspecified muesli	Muesli
Breakfast cereals, single grain, corn based	Corn based single grain breakfast cereals and brans including types containing fruit and/or nuts; cornmeal; flours and starches	Corn based cereals and flours
Breakfast cereals, single grain, rice based	Rice based single grain breakfast cereals and brans including types containing fruit and/or nuts; flours	Rice based cereals and flours
Breakfast cereals, single grain, wheat based	Wheat based single grain breakfast cereals and brans including types containing fruit or nuts; barley; buckwheat; millet; oats; quinoa; tapioca; semolina; bulghur; flours	Wheat based cereals and flours
Cake, chocolate, iced	Commercial and homemade iced and un-iced chocolate flavoured cakes without fruit, excluding light and rich fruit cakes and plain sponge cake; cake-style puddings; muffins; dumplings	Cakes, muffins and plain puddings
Cake, dried fruit	Light and rich fruit cakes, muffins; puddings	Fruit cakes and fruit puddings
Cake, sponge, plain	Plain or flavoured sponge-style cakes; muffins	Sponge cakes
Chicken breast	Poultry fillets and pieces with and without skin; poultry mince; poultry deli meats; including duck, turkey and quail; fried, braised, baked, roasted, grilled, stewed and cooked unspecified	Uncoated poultry

ATDS food	Foods translated to the ATDS food	Food group name
Chicken products, battered or crumbed	Crumbed poultry fillets and pieces with and without skin; poultry mince; including duck, turkey and quail	Battered and crumbed poultry (excluding takeaway)
Chicken products, battered or crumbed, deep-fried from takeaway	Commercial poultry fillets and pieces with and without skin; poultry mince; including duck, turkey and quail	Takeaway battered and crumbed poultry
Chocolate energy drink, powdered	All flavoured beverage bases; cocoa powder	Beverage bases
Chocolate, plain, milk	Milk-, white-, dark-, chocolate; carob	Chocolate and carob
Coffee, espresso short black, from takeaway	Coffee from ground including decaffeinated	Coffee (from ground)
Coffee, instant	Instant coffee including decaffeinated, cereal beverages	Coffee (from instant) and cereal-based beverages
Confectionery, soft candy e.g. jelly beans, jelly babies and snakes	Hard and soft confectionery	Confectionery
Crumpets, English style muffins	English muffins and crumpets	Crumpets and English style muffins
Doughnuts, plain (no icing no filling)	Plain doughnuts (e.g. cinnamon)	Plain doughnuts
Fish fillets, battered from takeaway	Battered fish and seafood excluding canned; fried/deep-fried, steamed, poached or baked	Seafood (battered)
Fish fillets, white fish, fresh	Fresh fish and seafood (not specified as to coating); raw, fried, baked, grilled, steamed/poached; canned fish and seafood	Seafood (no coating)
Fish portions, frozen from supermarket (crumbed only)	Crumbed or floured fish and seafood; fried, baked, grilled	Seafood (crumbed)
Fruit, dried or processed (sultanas)	Dried and processed fruit, dried vegetables	Dried fruit and vegetables
Hamburger, from takeaway	Hamburgers; chicken burgers; fish burgers	Hamburgers (all meat types)
Infant cereal, mixed	Infant cereal	Infant cereals

ATDS food	Foods translated to the ATDS food	Food group name
Infant dessert, fruit based	Infant dessert containing fruit	Infant stewed fruits
Infant dessert, milk based	Yoghurt and custard based infant desserts	Infant custards and yoghurts
Infant dinner	Infant dinners	Infant dinners
Infant formula (non-soy)	Non-soy based infant formula	Non soy-based infant formula
Infant formula, soy based	Soy based infant formula; soy bean and flour; soy yoghurt; soy ice-confection; soy beverages	Soy based infant formula and foods
Infant rusks/biscuits	Infant biscuits	Infant biscuits
Jams (e.g. marmalade) – not fruit spreads, not diet varieties	Jams; fruit spread; marmalade	Jams
Juice, prune	Prune juice	Prune juice
Lamb chops, loin	Lamb; beef; veal; pork; mutton; venison; kangaroo; rabbit and unspecified meat; fried, braised, baked, roasted, grilled, stewed and cooked unspecified	Whole cuts of meat
Milk, fresh (full fat)	All dairy milks (cow and goat); flavoured milks; buttermilk; creams; cheeses; yoghurt; ice cream	Fresh dairy products
Milk, UHT (full fat)	All dried, evaporated, condensed; dairy milks (cow and goat), cream	Processed milk and creams
Muesli bars, with dried fruit	Muesli bars; plain, fruit, nut, chocolate	Muesli bars
Noodles, egg, fresh	All egg containing pastas and noodles	Egg noodles
Noodles, instant	Instant noodles, rice noodles	Instant noodles
Nuts, mixed, roasted and salted	All nuts (excluding peanuts) and seeds	Mixed nuts and seeds
Olives	Olives; capers	Olives and capers
Onions, fresh	Bulb vegetables; (onions; garlic; shallots; spring onions; leeks) and brassica vegetables (broccoli, cauliflower, Brussels sprouts, cabbage) baked, stir-fried or cooked unspecified	Bulb vegetables; baked, stir-fried or cooked unspecified

ATDS food	Foods translated to the ATDS food	Food group name
Pasta (cooked)	Pasta; couscous; all types of rice; wheat noodles	Rice, pasta and couscous
Peanut butter	Peanut butter; peanuts; satay sauce	Peanuts and peanut butter
Pie, fruit	Pastry; pies and pastries, fruit and custard filled	Sweet pastries/pies/danishes
Pie, meat, individual size	All savoury pies and pastries	Savoury pastries/pies/pasties
Pikelets/pancakes from shaker	Homemade pikelets/pancakes/waffles/hotcakes	Homemade pancakes/pikelets/crepes/waffles
Pikelets/pancakes ready-to-eat	Commercial pikelets/pancakes/waffles/hotcakes	Commercial pancakes/pikelets/crepes/waffles
Pizza, meat and vegetable topping	Meat and poultry containing savoury pizzas, seafood pizzas, vegetarian pizzas	Pizzas
Popcorn, microwave	Plain popcorn; flavoured popcorn	Popcorn
Potato chips, frozen	All frozen potato products including wedges, not including sweet potato products	Potato chips and wedges from frozen
Potato crisps (mixed varieties excluding salt and vinegar)	All potato crisps unflavoured, excluding salt and vinegar, including not further specified	Plain potato crisps
Potato crisps (salt and vinegar only)	Flavoured potato crisps	Flavoured potato crisps
Potato, chips, deep-fried, takeaway style	Fried/deep-fried potato products, including wedges, hash browns, scallops	Fried potato products
Potatoes, baked	Baked potato products; potato starch/flour	Baked potato products
Potatoes, boiled	Boiled potato; mashed potato; tapioca; arrowroot	Boiled potato
Pumpkin, baked/roasted	Cucurbits (pumpkin, squash, zucchini, marrow), other fruiting vegetables (eggplant, okra, capsicum, chilli, corn, mushrooms, tomato) and legume vegetables (peas, snow peas, beans, excluding all dried and canned beans); baked, stir-fried or cooked unspecified	Cucurbits; baked, stir-fried or cooked unspecified
Sauce, tomato	All sauces; marinades; chutney, excluding satay	Sauces, marinades and chutneys

ATDS food	Foods translated to the ATDS food	Food group name
Sausages, beef	All sausages (beef, chicken, pork, lamb, not further specified); frankfurts, salami	Sausages, frankfurts and salami
Snack foods, corn based chips and taco shells	Corn chips, taco shells	Corn crisps
Snack foods, extruded (excluding potato crisps)	All extruded savoury snacks, excluding potato crisps and corn based snack foods	Extruded snacks
Soup, base (liquid and dry packet mix)	All soups	Soup
Spring rolls, fried, takeaway	Spring rolls, dim sim, wonton	Spring rolls, dim sims and wontons
Sugar, white	All sugars, sugar syrups/powders/liquids, jelly crystals	Sugars, syrups and icings
Sweet potato, baked	Root and tuber vegetables (beetroot, carrot, cassava, parsnip, swede, sweet potato, taro, turnip) baked, stir-fried or cooked unspecified	Root and tuber vegetables; baked, stir-fried or cooked unspecified
Tea, herbal	Herbal tea	Herbal tea
Tea, regular, (non-herbal)	Black tea including from instant, decaffeinated and iced	Black tea
Tomatoes, canned	Canned tomatoes; all other canned fruit and vegetables consumed without heating (e.g. pears, peaches, beetroot, asparagus)	Canned fruits and vegetables
Vegetables, char-grilled in oil	All fruit and vegetables cooked in fat	Fruit and vegetables cooked unspecified in fat
Vegetables, mixed, frozen	All boiled and stewed fruit and vegetables except potatoes	Boiled fruit and vegetables (except potatoes)
Water, tap	Mineral, carbonated, bore, tap and bottled water	Water (non-bottled)
Wine, red	Red and rose wines; sherry; port; brandy	Red/rose wines, sherry and port
Wine, white	White wines; sparkling wine; wine coolers; rice wine; ginger wine	White wines, wine coolers, rice and ginger wines
Yeast extract	Compressed yeast; vegemite/marmite	Yeast and yeast spreads

Figure A4.1: Mapping logic for acrylamide, for fruit and vegetables (except potatoes)

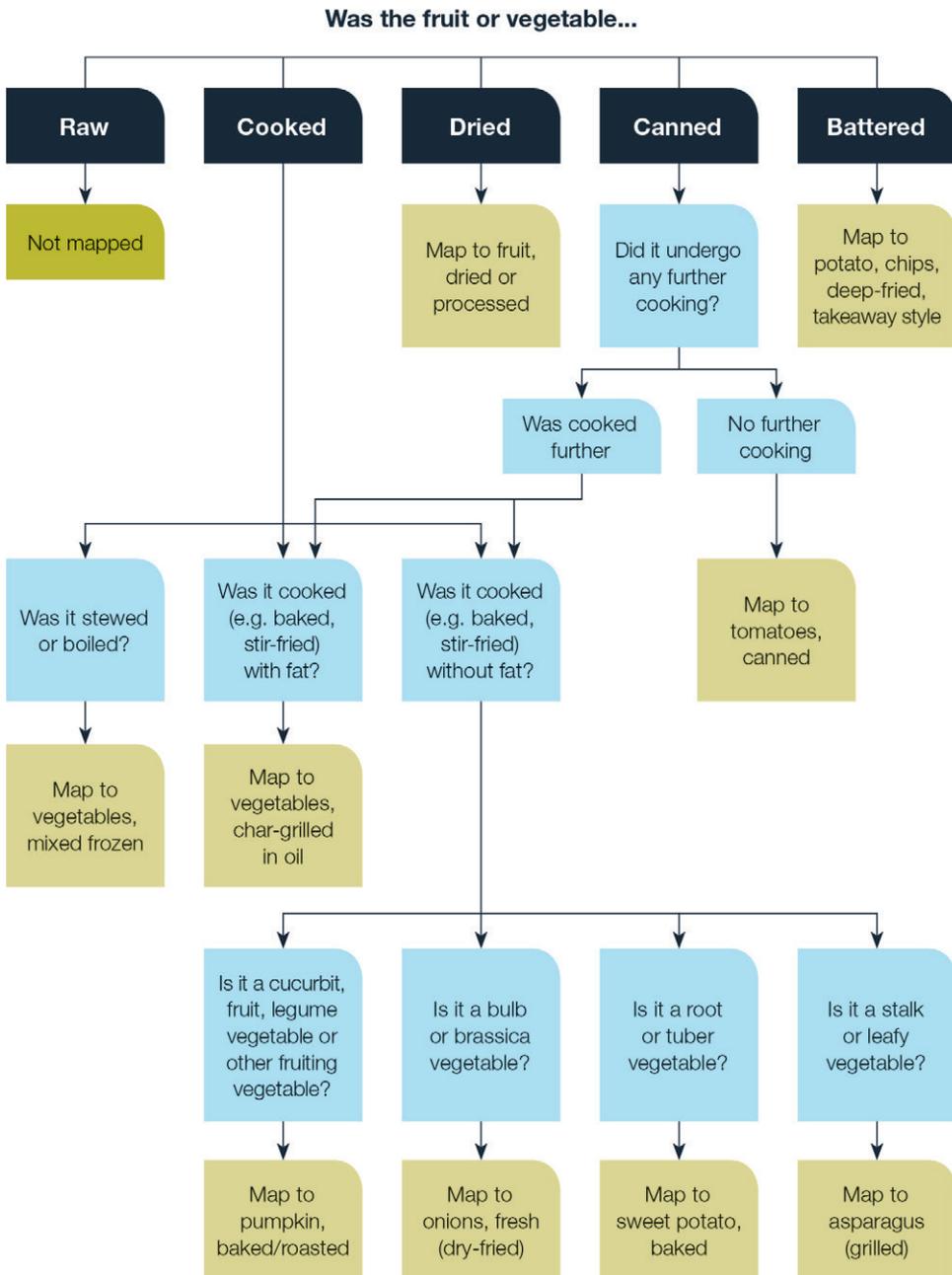


Figure A4.2: Mapping logic for acrylamide, for potatoes

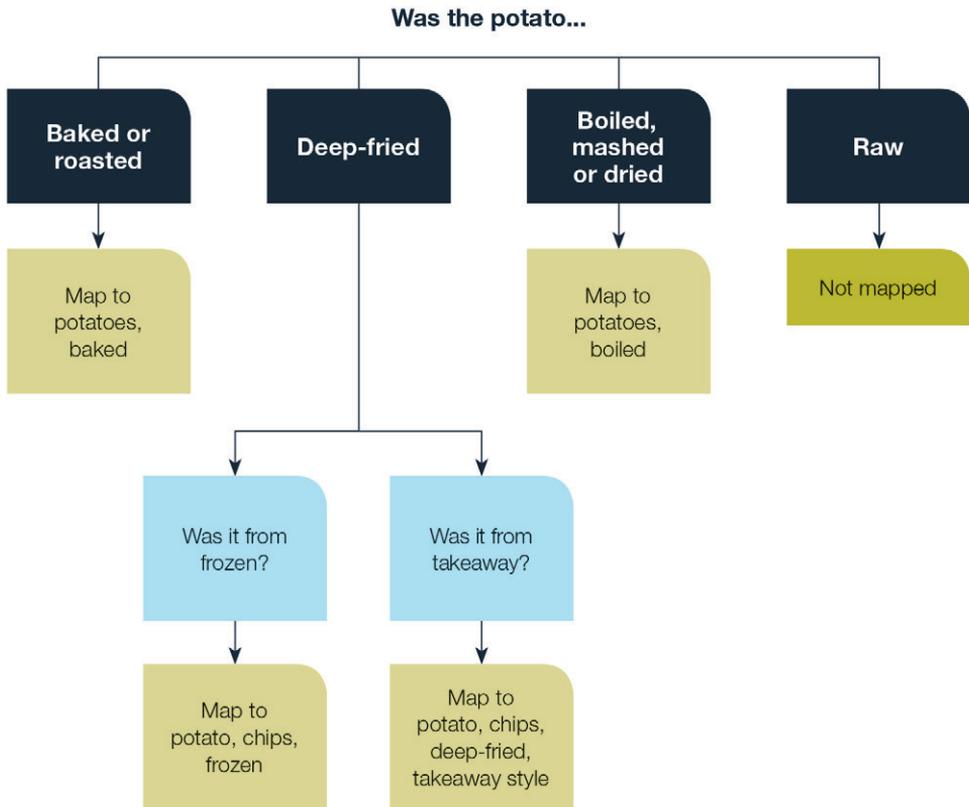


Table A4.3: Estimated dietary exposures for consumers of acrylamide, derived using mean analytical concentrations

Age group	No. Respondents	% consumers to respondents	Estimated consumer dietary exposure							
			µg/day			µg/kg bw/day				
			Mean	90 th percentile	90 th percentile	Mean	90 th percentile	90 th percentile		
	ND=0	ND=LOR	ND=0	ND=LOR	ND=0	ND=LOR	ND=0	ND=LOR		
9 months*			10	30	20	70	1	4	2	8
2–5 years [†]	1,178	100	30	60	50	90	2	3	3	5
6–12 years [†]	2,090	100	40	80	70	120	1	2	2	4
13–16 years [†]	1,219	100	50	100	90	150	1	2	2	3
17 years & above*	11,129	100	50	110	90	170	1	2	1	2

* derived using a model diet.

[†] derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

Table A4.4: Contribution of major food groups to estimated acrylamide dietary exposures, derived using mean analytical concentrations

Major food group	Contribution (%) [*]				
	9 months [⌘]	2–5 years ^ϕ	6–12 years ^ϕ	13–16 years ^ϕ	17 years & above [*]
Alcoholic beverages	0	0	0	0	0
Cakes and biscuits	11	8	5	3	6
Cereal and grain based foods (excluding cakes and biscuits)	29	32	25	22	24
Snacks and condiments	16	14	20	23	18
Dairy products	0	0	0	0	0
Fats and oils	0	0	0	0	0
Fruits and nuts	1	1	1	1	1
Infant foods	1	0	0	0	0
Infant formula	0	0	0	0	0
Meats, poultry, offal and eggs	22	15	15	16	14
Non-alcoholic beverages (excluding waters and milk)	0	0	0	0	0
Seafood	0	0	0	0	0
Sugars and confectionery	3	18	20	19	4
Vegetables and pulses	17	12	13	15	33
Waters	0	0	0	0	0

⌘ derived using a model diet.

ϕ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

⌘ percentage contributions were calculated using the ND=0 scenario.

Table A4.5: Major contributors (>5%) of individual food groups to estimated acrylamide dietary exposures, derived using mean analytical concentrations

Food group	% Contribution*					Major food group to which this food is included
	9 months [✕]	2–5 years ^φ	6–12 years ^φ	13–16 years ^φ	17 years and above*	
Mince	16	9	10	11	9	Meats, poultry, offal and eggs
Wheat based savoury biscuits	5	<5	<5	<5	<5	Cakes and biscuits
Wheat based cereals and flours	15	19	14	11	12	Cereal and grain based foods (excluding cakes and biscuits)
Beverage bases	<5	17	20	19	<5	Sugars and confectionery
Bulb vegetables; baked, stir-fried or cooked unspecified	<5	<5	<5	<5	12	Vegetables and pulses
Fried potato products	8	6	8	11	8	Snacks and condiments
Baked potato products	6	6	6	7	8	Vegetables and pulses
Soup	<5	<5	<5	<5	7	Snacks and condiments

✕ derived using a model diet.

φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

✕ percentage contributions were calculated using the ND=0 scenario.

Note: grey shading indicates that the food is not a major contributor for the age group.

Appendix 5: Detailed information on aluminium risk assessment and risk characterisation

Table A5.1: Concentrations of aluminium in foods (mg/kg)

Notes on Table:

Results are derived from composite samples.

'ND' means result less than the limit of reporting (LOR).

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

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Almonds	23 rd	4	0	3.5	3.5	3.4	3.4	3.1	4.2
Apples	23 rd	8	2	0.25	0.28	0.26	0.26	<LOR	0.54
Avocados	23 rd	8	7	0.024	0.90	0	1.0	<LOR	0.19
Bacon	23 rd	4	0	0.73	0.73	0.56	0.56	0.41	1.4
Baked beans in tomato sauce	23 rd	4	0	0.46	0.46	0.46	0.46	0.21	0.71
Bananas	23 rd	8	8	0	0.10	0	0.10	<LOR	<LOR
Beans, green, raw	23 rd	8	0	0.83	0.83	0.87	0.87	0.39	1.2
Beef, minced, lean	23 rd	8	0	1.4	1.4	0.67	0.67	0.29	4.1
Beer, full strength	23 rd	4	1	0.080	0.093	0.082	0.082	<LOR	0.16
Beetroot, canned	23 rd	4	1	0.39	0.42	0.26	0.26	<LOR	1.1
Biscuits, savoury	23 rd	4	0	4.1	4.1	4.2	4.2	2.5	5.5
Biscuits, sweet, plain	23 rd	4	0	1.9	1.9	1.6	1.6	1.2	3.3
Bread, fancy	23 rd	8	0	41.2	41.2	2.8	2.8	1.5	309.0

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Bread, fancy, fresh (savoury)	24 th	8	0	1.7	1.7	1.6	1.6	0.80	4.0
Bread, flat (pita, burrito etc.)	24 th	8	0	1.3	1.3	1.2	1.2	0.83	1.9
Bread, multigrain	23 rd	12	0	2.8	2.8	2.7	2.7	1.4	4.1
Bread, white	23 rd	12	0	2.3	2.3	2.2	2.2	1.2	4.5
Bread, wholemeal, fresh	24 th	12	0	2.6	2.6	2.4	2.4	1.3	6.1
Breakfast bars, baked style	24 th	4	0	1.8	1.8	1.7	1.7	0.85	2.9
Breakfast cereals, mixed grains	23 rd	4	0	3.2	3.2	2.9	2.9	2.7	4.2
Breakfast cereals, muesli toasted	24 th	4	0	2.3	2.3	2.3	2.3	1.3	3.2
Breakfast cereals, single grain, corn based	24 th	4	0	0.43	0.43	0.43	0.43	0.33	0.53
Breakfast cereals, single grain, rice based	24 th	4	0	2.6	2.6	2.7	2.7	1.9	3.2
Breakfast cereals, single grain, wheat based	24 th	4	0	1.5	1.5	1.4	1.4	1.0	2.0
Broccoli	23 rd	8	0	0.84	0.84	0.78	0.78	0.33	1.7

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Butter	23 rd	4	3	0.027	0.78	0	1.0	<LOR	0.11
Cabbage	23 rd	8	7	0.076	0.16	0	0.10	<LOR	0.61
Cake, chocolate, iced	24 th	4	0	109.8	109.8	112.5	112.5	34.0	180.0
Cake, dried fruit	24 th	4	0	22.5	22.5	9.4	9.4	5.1	66.0
Cake, sponge, plain	24 th	4	0	395.0	395.0	415.0	415.0	140.0	610.0
Capsicum	23 rd	8	5	0.17	0.23	0	0.10	<LOR	0.71
Carrots	23 rd	10	6	0.14	0.20	0	0.10	<LOR	0.69
Cauliflower	23 rd	8	5	0.17	0.23	0	0.10	<LOR	1.0
Celery	23 rd	8	0	1.4	1.4	0.71	0.71	0.32	6.6
Cheese, cheddar, full fat	23 rd	10	0	0.65	0.65	0.52	0.52	0.21	1.4
Chicken breast	23 rd	10	7	0.15	0.22	0	0.10	<LOR	1.1
Chicken mince	23 rd	10	1	1.4	1.4	0.92	0.92	<LOR	4.0
Chicken products, battered or crumbed	24 th	4	0	9.2	9.2	2.6	2.6	0.70	31.0
Chicken products, battered or crumbed (deep-fried from takeaway)	24 th	4	0	16.7	16.7	14.8	14.8	1.3	36.0
Chocolate energy drink, powdered	24 th	4	0	0.53	0.53	0.52	0.52	0.38	0.70

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Chocolate, milk	23 rd	4	0	5.5	5.5	4.1	4.1	2.7	11.2
Coconut, desiccated	23 rd	4	2	0.32	0.82	0.087	1.0	<LOR	1.1
Coffee, espresso	23 rd	4	3	0.012	0.050	0	0.050	<LOR	0.050
Coffee, instant	23 rd	4	0	0.26	0.26	0.21	0.21	0.15	0.46
Confectionery, soft candy e.g. jelly beans, jelly babies and snakes	24 th	4	0	0.28	0.28	0.26	0.26	0.19	0.39
Crumpet, English style muffins	24 th	8	0	57.9	57.9	2.5	2.5	0.70	260.0
Cucumber	23 rd	8	5	0.064	0.13	0	0.10	<LOR	0.27
Doughnuts, plain (no icing and no filling)	24 th	8	0	2.3	2.3	2.3	2.3	1.3	3.3
Dried apricots	23 rd	4	0	5.9	5.9	5.1	5.1	3.9	9.6
Eggs	23 rd	10	9	0.027	0.12	0	0.10	<LOR	0.27
Fish fillets, battered from takeaway	23 rd	10	0	18.9	18.9	1.4	1.4	0.25	84.5
Fish portions, frozen from supermarket	23 rd	4	0	24.9	24.9	23.6	23.6	14.6	37.9
Fruit, dried or processed (sultanas)	24 th	4	0	8.9	8.9	6.6	6.6	5.6	17.0
Grapes	23 rd	8	0	0.53	0.53	0.51	0.51	0.24	0.88

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Ham, sliced delicatessen style	23 rd	4	0	2.9	2.9	3.2	3.2	1.6	3.7
Hamburger	23 rd	8	0	2.8	2.8	3.0	3.0	1.5	3.7
Honey	23 rd	4	0	0.88	0.88	0.86	0.86	0.42	1.4
Ice cream, full fat, vanilla	23 rd	4	3	0.14	0.22	0	0.10	<LOR	0.58
Infant cereal, mixed	23 rd	4	2	0.25	0.30	0.12	0.17	<LOR	0.75
Infant dessert, milk based	23 rd	4	1	0.16	0.19	0.20	0.20	<LOR	0.25
Infant dinner	23 rd	4	0	0.52	0.52	0.46	0.46	0.12	1.0
Infant formula	23 rd	4	0	0.29	0.29	0.24	0.24	0.18	0.53
Infant formula, soy-based	24 th	4	0	0.30	0.30	0.29	0.29	0.26	0.36
Infant rusks/ biscuits	24 th	4	0	1.7	1.7	1.7	1.7	1.0	2.2
Juice, fruit	23 rd	4	0	0.13	0.13	0.11	0.11	0.090	0.21
Juice, prune	24 th	4	0	4.7	4.7	5.0	5.0	2.8	6.0
Kiwifruit	23 rd	8	0	2.2	2.2	1.8	1.8	1.2	5.0
Lamb chops, loin	23 rd	10	1	0.90	0.91	0.56	0.56	<LOR	2.8
Lettuce	23 rd	8	2	1.0	1.1	0.70	0.70	<LOR	2.4
Liver pate (chicken)	23 rd	4	0	1.3	1.3	1.4	1.4	0.67	1.7
Mango	23 rd	4	4	0	0.10	0	0.10	<LOR	<LOR

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Margarine, mono-unsaturated	23 rd	4	2	0.15	0.65	0.12	0.68	<LOR	0.37
Milk, fresh (full fat)	24 th	12	8	0.083	0.15	0	0.10	0	0.41
Milk, UHT (full fat)	24 th	12	10	0.026	0.11	0	0.10	0	0.18
Muesli bars, with dried fruit	24 th	4	0	1.5	1.5	0.93	0.93	0.70	3.3
Mushrooms	23 rd	8	3	0.20	0.24	0.21	0.21	<LOR	0.45
Nectarine	23 rd	8	0	0.29	0.29	0.29	0.29	0.15	0.40
Noodles, egg fresh	24 th	4	0	1.8	1.8	1.2	1.2	0.49	4.5
Oats, rolled	23 rd	4	2	0.15	0.20	0.11	0.16	<LOR	0.36
Oil, canola and olive	23 rd	4	1	0.077	0.33	0.073	0.13	0.057	0.16
Onions	23 rd	8	5	0.10	0.16	0	0.10	<LOR	0.42
Orange	23 rd	8	8	0	0.10	0	0.10	<LOR	<LOR
Pasta	23 rd	4	0	0.41	0.41	0.32	0.32	0.24	0.76
Peach, natural juice	23 rd	4	4	0	0.10	0	0.10	<LOR	<LOR
Peanut butter	23 rd	4	0	3.1	3.1	2.5	2.5	0.20	7.1
Pear, natural juice	23 rd	4	3	0.016	0.091	0	0.10	<LOR	0.070
Peas, frozen	23 rd	4	0	1.7	1.7	1.7	1.7	0.84	2.4
Pie, fruit	24 th	4	0	1.7	1.7	1.2	1.2	0.58	4.0
Pie, meat, individual size	23 rd	4	0	1.9	1.9	1.9	1.9	1.6	2.1

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Pikelets/ pancakes from shaker	24 th	4	0	247.5	247.5	225.0	225.0	150.0	390.0
Pikelets/ pancakes ready-to-eat	24 th	4	0	6.2	6.2	1.1	1.1	0.48	22.0
Pineapple, canned in natural juice	23 rd	4	2	0.13	0.18	0.12	0.17	<LOR	0.27
Pizza, meat and vegetable topping	23 rd	4	0	2.1	2.1	1.9	1.9	1.6	3.0
Potato	23 rd	12	7	0.14	0.20	0	0.10	<LOR	0.87
Potato crisps	23 rd	4	0	2.4	2.4	2.6	2.6	1.7	2.9
Prawns, cooked	23 rd	8	0	3.2	3.2	1.9	1.9	0.76	7.6
Pumpkin	23 rd	8	7	0.036	0.12	0	0.10	<LOR	0.29
Rice, white, long grain	23 rd	4	2	0.18	0.23	0.063	0.11	<LOR	0.59
Sauce, tomato	23 rd	4	0	3.9	3.9	4.4	4.4	1.7	4.9
Sausages, beef	23 rd	10	0	15.7	15.7	10.0	10.0	2.1	36.2
Savoury sauce, non-tomato	23 rd	4	0	1.9	1.9	1.7	1.7	0.33	4.1
Soft drink	23 rd	4	2	0.075	0.10	0.046	0.071	<LOR	0.21
Soy beverage, full fat	23 rd	4	0	0.40	0.40	0.38	0.38	0.25	0.58
Spring rolls, fried, takeaway	24 th	8	0	2.5	2.5	1.9	1.9	0.41	5.6

Food	ATDS	No. of analyses	No. of ND samples	Mean		Median		Minimum	Maximum
				ND=0	ND=LOR	ND=0	ND=LOR		
Strawberries	23 rd	8	0	0.61	0.61	0.54	0.54	0.39	1.1
Sugar, white	23 rd	4	4	0	1.0	0	1.0	<LOR	<LOR
Sweetcorn, kernels, frozen	23 rd	4	3	0.043	0.12	0	0.10	<LOR	0.17
Tea	23 rd	4	0	2.4	2.4	2.3	2.3	1.7	3.3
Tea, herbal	24 th	4	1	0.14	0.17	0.16	0.16	0	0.26
Tomatoes, canned	23 rd	4	0	1.3	1.3	0.59	0.59	0.32	3.7
Tomatoes, raw	23 rd	8	7	0.036	0.12	0	0.10	<LOR	0.29
Tuna, canned in brine	23 rd	4	0	0.67	0.67	0.64	0.64	0.15	1.2
Vegetables, mixed, frozen	24 th	4	0	0.46	0.46	0.35	0.35	0.27	0.86
Water, bottled, still	23 rd	4	3	0.074	0.082	0	0.010	<LOR	0.30
Water, tap	23 rd	8	0	0.093	0.093	0.069	0.069	0.020	0.21
Watermelon	23 rd	8	5	0.061	0.12	0	0.10	<LOR	0.30
Wine, red	23 rd	8	0	0.46	0.46	0.44	0.44	0.22	0.84
Wine, white	23 rd	8	0	0.55	0.55	0.54	0.54	0.40	0.80
Yoghurt, fruit, full fat	23 rd	8	1	0.25	0.26	0.27	0.27	<LOR	0.39

Table A5.2: Mapping of ATDS foods to nutrition survey foods, for aluminium

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Almonds	23 rd ATDS	All tree nuts except coconut, seeds	Seeds and tree nuts (excluding coconut)
Apples	23 rd ATDS	Apples (fresh, canned, dried and stewed); quinces	Apples and quinces
Avocados	23 rd ATDS	Avocado; olives	Avocados and olives
Bacon	23 rd ATDS	Bacon	Bacon
Baked beans in tomato sauce	23 rd ATDS	All pulses (dried beans and lentils) except soy beans	Dried pulses (except soy beans)
Bananas	23 rd ATDS	Bananas; plantains	Bananas and plantains
Beans, green, raw	23 rd ATDS	Pulses (fresh beans); bean sprouts	Fresh beans and bean sprouts
Beef, minced, lean	23 rd ATDS	Beef; veal; venison and unspecified meat; minced and cuts	Beef, veal and venison
Beer, full strength	23 rd ATDS	Beer; non-cream and non-coffee liqueurs; non-fruit based spirits	Beer, liqueurs and spirits
Beetroot, canned	23 rd ATDS	Beetroot	Beetroot
Biscuits, savoury	23 rd ATDS	Savoury biscuits (excluding rice crackers); pretzels	Savoury biscuits and crackers
Biscuits, sweet, plain	23 rd ATDS	Commercial plain sweet biscuits; cones for ice cream (2007 KEKP) Commercial plain and filled sweet biscuits; meal replacement biscuits; cones for ice cream, plain slices (for 1995 NNS)	Sweet/plain/filled biscuits
Bread, fancy	23 rd ATDS	Fresh and toasted plain, dried fruit-, chocolate- or nut-containing sweet breads	Sweet fancy breads

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Bread, fancy, fresh (savoury)	24 th ATDS	Fresh and toasted Focaccia; Turkish bread; cheese-, or vegetable-, or meat-topped breads and rolls	Savoury fancy breads
Bread, flat (pita, burrito etc.)	24 th ATDS	Chapatti, naan, lavash, pita or Lebanese bread, souvlaki bread, tortilla, matzo	Flat breads
Bread, multigrain	23 rd ATDS	Fresh and toasted homemade and commercial mixed grain breads and rolls (including gluten free); rye breads with grains	Breads containing grains and seeds
Bread, white	23 rd ATDS	Fresh and toasted homemade and commercial white and high fibre white breads and rolls (including gluten free); pizza bases; breadcrumbs; croutons; croissants	White breads (including high-fibre white)
Bread, wholemeal, fresh	24 th ATDS	Fresh and toasted homemade and commercial wholemeal breads and rolls (including gluten free); rye breads without whole grains; wheat germ	Wholemeal breads
Breakfast bars, baked style	24 th ATDS	Breakfast bars (all types)	Breakfast bars
Breakfast cereals, mixed grains	23 rd ATDS	Mixed grain breakfast cereals and brans; breakfast cereals containing fruits and/or nuts (excluding muesli)	Breakfast cereals with mixed grains/fruits/nuts (excluding muesli)
Breakfast cereals, muesli toasted	24 th ATDS	Homemade and commercial toasted and untoasted mueslis	Muesli
Breakfast cereals, single grain, corn based	24 th ATDS	Single grain breakfast cereals from maize that do not contain fruit or nuts; cornmeal; flours and starches from maize; popcorn	Corn based cereals and flours
Breakfast cereals, single grain, rice based	24 th ATDS	Single grain breakfast cereals from rice that do not contain fruit or nuts; rice bran; gluten free flour; rice flour	Rice based cereals and flours

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Breakfast cereals, single grain, wheat based	24 th ATDS	Single grain breakfast cereals and brans that do not contain fruit or nuts; wheat flours; bulghur; barley; millet; buckwheat; quinoa; rye; spelt; sorghum; triticale	Grain based (not rice and corn) cereals and flours
Broccoli	23 rd ATDS	Broccoli and broccoflower	Broccoli and broccoflower
Butter	23 rd ATDS	Butter; ghee; animal fats	Butter and animal fats
Cabbage	23 rd ATDS	All green, red and Chinese (e.g. bok choy, Chinese flowering) cabbages; sauerkraut; kohlrabi; Brussels sprouts	Cabbages, Brussels sprouts and kohlrabi
Cake, chocolate, iced	24 th ATDS	Commercial plain cakes and cake-style muffins (includes iced and un-iced); cake-style puddings; brownies; scones. Excludes light and rich fruit cakes and sponges.	Cakes and muffins (excluding fruit cakes and sponges)
Cake, fruit	24 th ATDS	Commercial light and rich fruit cakes (dried fruit); plum and fruit puddings	Fruit cakes and fruit puddings
Cake, sponge, plain	24 th ATDS	Commercial plain sponge cakes	Sponge cakes
Capsicum	23 rd ATDS	Capsicum; chillies; capers; spices; curry pastes and powders	Capsicums, chillies and spices
Carrots	23 rd ATDS	Carrots and all other non-starchy root vegetables, excluding beetroot (radishes, horseradish, water chestnut, ginger)	Root vegetables (non-starchy)
Cauliflower	23 rd ATDS	Cauliflower	Cauliflower
Celery	23 rd ATDS	All stalk and stem vegetables (celery, celeriac, artichoke, rhubarb, bamboo shoot, fennel, artichoke)	Stalk and stem vegetables
Cheese, cheddar, full fat	23 rd ATDS	Cheeses; dried cheese (recipe mixes)	Cheeses

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Chicken breast	23 rd ATDS	Skinless poultry fillets and pieces	Poultry (skinless)
Chicken mince	23 rd ATDS	Poultry fillets and pieces with the skin; poultry mince; poultry deli-meats	Poultry (excluding skinless)
Chicken products, battered or crumbed	24 th ATDS	Crumbed or battered poultry patties, meatballs, pieces; commercial vegetable fingers	Battered and crumbed poultry (not takeaway)
Chicken products, battered or crumbed, deep-fried from takeaway	24 th ATDS	Deep-fried coated chicken	Takeaway battered and crumbed poultry
Chocolate energy drink, powdered	24 th ATDS	Drinking chocolate and other chocolate-flavoured beverage bases; chocolate-flavoured sports supplements and meal replacements	Chocolate flavoured beverage bases
Chocolate, milk	23 rd ATDS	Cocoa; chocolate; chocolate bars; carob	Chocolates and cocoa
Coconut, desiccated	23 rd ATDS	Coconut	Coconut
Coffee, espresso	23 rd ATDS	Caffeinated and decaffeinated coffees made from coffee grounds (long black, espresso, Turkish)	Coffee (from ground)
Coffee, instant	24 th ATDS	Caffeinated and decaffeinated instant coffee; cereal beverages (coffee substitutes)	Coffee (from instant) and cereal-based beverages
Confectionery, soft candy e.g. jelly beans, jelly babies and snakes	24 th ATDS	Sugar confectionery	Confectionery
Crumpets, English style muffins	24 th ATDS	Crumpets and English muffins	Crumpets and English style muffins
Cucumber	23 rd ATDS	Cucumbers; cucumber pickles; gherkins; chokos	Cucumbers and chokos
Doughnuts, plain (no icing no filling)	24 th ATDS	Un-iced and unfilled doughnuts (e.g. cinnamon)	Doughnuts

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Dried apricots	23 rd ATDS	Dried and glace apricots; fruit peel; glace cherries; glace ginger; fruit leathers	Dried apricots, peel, cherries, ginger and fruit leathers
Eggs	23 rd ATDS	Poultry eggs	Eggs
Fish fillets, battered from takeaway	23 rd ATDS	Battered fish and other seafood	Seafood (battered)
Fish portions, frozen from supermarket (crumbed only)	23 rd ATDS	Crumbed fish and other seafood; fish cakes	Seafood (crumbed)
Fruit, dried or processed (sultanas)	24 th ATDS	Dried vine fruits; dried figs; dried dates	Dried grapes/figs/dates
Grapes	23 rd ATDS	All raw grapes	Grapes
Ham, sliced delicatessen style	23 rd ATDS	All plain pork except bacon; deli meats (except bacon, frankfurters, sausages and poultry-based)	Pork (except bacon) and deli meats (except frankfurts and poultry-based)
Hamburger, from takeaway	23 rd ATDS	Hamburgers; chicken burgers; fish burgers (homemade and commercial)	Hamburgers (all meat types)
Honey	23 rd ATDS	Honey	Honey
Ice cream, full fat, vanilla	23 rd ATDS	Ice creams; frozen yoghurt; milk-based ice-confections	Frozen dairy based desserts
Infant cereal, mixed	23 rd ATDS	Infant cereal	Infant cereals
Infant dessert, milk based	23 rd ATDS	Infant custards and yoghurts	Infant custards and yoghurts
Infant dinner	23 rd ATDS	Infant dinners	Infant dinners
Infant formula	23 rd ATDS	Cow's milk formula, toddler milk	Infant formulas and toddler milk (dairy based)
Infant formula, soy-based	24 th ATDS	Soy infant formula and toddler milk	Infant formulas and toddler milk (soy based)
Infant rusks/biscuits	24 th ATDS	Infant rusks/biscuits	Infant biscuits

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Juice, fruit	23 rd ATDS	Fruit juices (excluding prune), including infant juices; cider; fruit based ice-confection	Fruit juices (except prune) and ciders
Juice, prune	24 th ATDS	Prune juice and prunes	Prunes and prune juice
Kiwifruit	23 rd ATDS	Kiwifruit; rambutan; lychees; custard apples	Tropical fruits (rough or furry skin, except pineapples and jackfruit)
Lamb chops, loin	24 th ATDS	Lamb; mutton; kangaroo; rabbit	Lamb, mutton, kangaroo and rabbit
Lettuce	23 rd ATDS	Leafy vegetables; herbs	Leafy vegetables and herbs
Liver pate (chicken)	23 rd ATDS	Beef, sheep, pig and poultry offal, including pate and liverwurst	Offal (including pate and liverwurst)
Mango	23 rd ATDS	Mango; pawpaw; guavas; tamarillo; feijoa; dates; persimmons; passionfruit; pomegranate	Tropical fruits (smooth-skinned, except bananas, plantains, avocados and olives)
Margarine, monounsaturated	23 rd ATDS	Margarines and margarine spreads, NFS spreads/fats, vegetable based hard fats	Margarines and margarine spreads
Milk, fresh (full fat)	24 th ATDS	Fresh dairy milks (cow and goat), including dried; flavoured milks; cream	Fresh milks and cream
Milk, UHT (full fat)	24 th ATDS	Aerosol, canned, evaporated, condensed, UHT and dried milks and creams	Processed milks and cream
Muesli bars, with dried fruit	24 th ATDS	All types of muesli bars	Muesli bars
Mushrooms	23 rd ATDS	Mushrooms	Mushrooms
Nectarine	23 rd ATDS	'Smooth skinned' stone fruits (cherries, nectarines, plums); figs	Stone fruits (smooth skinned) and figs

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Noodles, egg, fresh	24 th ATDS	All egg containing pastas and noodles	Egg pastas and noodles
Oats, rolled	23 rd ATDS	Oats	Oats
Oil, canola and olive	23 rd ATDS	Oils	Oils
Onions	23 rd ATDS	Onions; garlic; shallots; spring onions; leeks	Onions, garlic, shallots, spring onions and leeks
Orange	23 rd ATDS	Citrus fruits; kumquats	Citrus fruits and kumquats
Pasta	23 rd ATDS	All non-egg containing pasta and noodles (except rice noodles); couscous	Pasta (non-egg), noodles (except rice) and couscous
Peach, natural juice	23 rd ATDS	'Furry skinned' stone fruits (peaches, apricots)	Stone fruits (furry skinned)
Peanut butter	23 rd ATDS	Peanuts; peanut butter	Peanuts and peanut butter
Pear, natural juice	23 rd ATDS	Pears (fresh, canned and dried); loquats	Pears and loquats
Peas, frozen	23 rd ATDS	Peas (fresh, frozen, canned, dried and sprouts); broad beans; snow peas	Peas (fresh, dried and sprouts) and broad beans
Pie, fruit	24 th ATDS	Pies and Danishes that contain fruits, custard or jam	Sweet pies and pastries
Pie, meat, individual size	23 rd ATDS	Meat-, chicken-, seafood- or vegetable-containing pies; pasties; sausage rolls; meat/chicken containing pastries (excluding dim sims, spring rolls and Chiko rolls)	Savoury pastries (excluding spring rolls and dim sims)
Pikelets/pancakes from shaker	24 th ATDS	Pikelets/pancakes made from shaker or dry mix	Pikelets/pancakes from shaker
Pikelets/pancakes ready-to-eat	24 th ATDS	Commercial pikelets/pancakes/hot cakes; waffles	Pikelets/pancakes ready-to-eat
Pineapple, canned in natural juice	23 rd ATDS	Pineapple (including dried); jackfruit	Pineapple and jackfruit

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Pizza, meat and vegetable topped	23 rd ATDS	All commercial pizzas; excludes homemade	Pizzas (commercial)
Potato	23 rd ATDS	Potatoes (excluding chips and crisps), sweet potatoes cassava, taro, swedes, yams and turnips; potato starches and flours; tapioca; inulin; arrowroot	Root vegetables (starchy)
Potato crisps	23 rd ATDS	Potato crisps, corn chips and extruded savoury snacks	Savoury snacks
Prawns, cooked	23 rd ATDS	Molluscs; crustacea; not battered or crumbed	Molluscs and crustacea
Pumpkin	23 rd ATDS	Pumpkin; squash; marrow; zucchini	Pumpkins, squash, marrows and zucchini
Rice, white, long grain	23 rd ATDS	Cooked and raw rice and rice noodles; rice crackers; rice cakes	Rice and rice products
Sauce, tomato	23 rd ATDS	Tomato sauces and salsas (excluding simmer and pasta sauces)	Savoury sauces (tomato)
Sausages, beef	23 rd ATDS	All meat- and vegetable-containing sausages; frankfurts	Sausages and frankfurts
Savoury sauce, non-tomato	23 rd ATDS	e.g. Soy sauce; oyster sauce; BBQ sauce; Worcestershire sauce; chilli sauce	Savoury sauces (excluding tomato)
Soft Drink	23 rd ATDS	Soft drinks; flavoured mineral waters; tonic water; fruit-flavoured drinks; sports drinks; water ice-confections; sorbet	Non-alcoholic beverages (except milk, waters and juices)
Soy Beverage, full fat	23 rd ATDS	Soy beverages, soy beans, tofu, soy flour and soy-based cheese (with raw equivalence factors); soy yoghurt	Soy beverages, soy beans and tofu
Spring rolls, fried, takeaway	24 th ATDS	Spring rolls; Chiko rolls; wontons; dim sims; filled dumplings	Spring rolls, dim sims, wontons and dumplings

ATDS food	ATDS Sampling	Foods translated to the ATDS food	Food group name
Strawberries	23 rd ATDS	Berries (fresh, canned, frozen and dried)	Berries
Sugar, white	23 rd ATDS	Sugars, syrups and sugared jelly crystals. Icings (1995 NNS only)	Sugars and syrups
Sweetcorn, kernels, frozen	23 rd ATDS	Sweetcorn	Sweetcorn
Tea, herbal	24 th ATDS	All barley and herbal teas	Herbal teas
Tea, regular, (non-herbal)	23 rd ATDS	All teas, except herbal	Tea (except herbal)
Tomatoes, canned	23 rd ATDS	Canned or cooked tomatoes; tomato paste; tomato juice; cooked eggplant; cooked okra	Tomatoes/eggplant/okra (cooked or processed)
Tomatoes, raw	23 rd ATDS	Raw tomatoes and sun-dried tomatoes; pepino; raw eggplant; goji berries	Tomatoes/eggplant/pepino (raw or sun-dried)
Tuna, canned in brine	23 rd ATDS	All un-crumbed or un-battered fish, including canned; roe	Plain fish
Vegetables, mixed, frozen	24 th ATDS	Mixed frozen and dried vegetables	Mixed vegetables (frozen and dried)
Water, bottled, still	23 rd ATDS	Bottled water, plain mineral and soda waters	Water (bottled/plain mineral/soda)
Water, tap	23 rd ATDS	Tap water; rain water	Water (non-bottled)
Watermelon	23 rd ATDS	Sweet and bitter melons (e.g. watermelon, bitter melon, rockmelon, honeydew melon)	Melons
Wine, red	23 rd ATDS	Red and rose wines; sherry; port; brandy	Red/rose wines, sherry, port and brandy
Wine, white	23 rd ATDS	White wines; wine coolers; rice wine; ginger wine, sake	White wines, wine coolers, rice and ginger wines
Yogurt, fruit, full fat	23 rd ATDS	All yoghurts (excluding frozen) and fromage frais	Yoghurt (except frozen)

Table A5.3: Estimated dietary exposures for consumers of aluminium (mg/day and mg/kg bw/day), using median analytical concentrations

Age group	No. Respondents	% consumers to respondents	Estimated consumer dietary exposure							
			mg/day			mg/kg bw/day				
			Mean	90 th percentile	90 th percentile	Mean	90 th percentile	90 th percentile		
9 months*			0.62	0.64	1.2	1.3	0.07	0.07	0.14	0.14
2–5 years [†]	1,178	100	2.1	2.2	5.3	5.4	0.12	0.13	0.31	0.32
6–12 years [†]	2,090	100	3.1	3.2	8.2	8.3	0.09	0.10	0.26	0.26
13–16 years [†]	1,219	100	3.3	3.4	8.4	8.5	0.06	0.06	0.15	0.15
17 years & above*	11,129	100	3.7	3.8	6.4	6.5	0.05	0.05	0.09	0.09

* derived using a model diet.

[†] derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

Table A5.4: Estimated dietary exposures for consumers of aluminium as a percent of the PTWI[×], derived using median analytical concentrations

Age group	No. Respondents	% consumers to respondents	Estimated consumer dietary exposure			
			%PTWI [×]			
			Mean		90 th percentile	
			ND=0	ND=LOR	ND=0	ND=LOR
9 months [⌘]			25	25	50	50
2–5 years ^ϕ	1,178	100	45	45	110	110
6–12 years ^ϕ	2,090	100	35	35	90	90
13–16 years ^ϕ	1,219	100	20	20	50	50
17 years & above [*]	11,129	100	20	20	30	35

⌘ derived using a model diet.

ϕ derived using the 2007 Australian National Children’s Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

× PTWI 2 mg/kg bw (JECFA 2011b).

Table A5.5: Contributions of major food groups to estimated aluminium dietary exposures, derived using median analytical concentrations

Major food group	Contribution (%) ^x				
	9 months [⌘]	2–5 years ^ϕ	6–12 years ^ϕ	13–16 years ^ϕ	17 years & above [*]
Alcoholic beverages	0	<1	<1	<1	1
Cakes and biscuits	32	48	45	39	43
Cereal and grain based foods (excluding cakes and biscuits)	19	23	29	30	10
Snacks and condiments	3	4	5	6	3
Dairy products	1	1	<1	<1	<1
Fats and oils	0	<1	<1	<1	<1
Fruits and nuts	4	3	2	1	2
Infant foods	<1	<1	<1	<1	<1
Infant formula	21	<1	0	0	<1
Meats, poultry, offal and eggs	7	8	7	8	7
Non-alcoholic beverages (excluding waters and milk)	<1	2	2	4	27
Seafood	6	6	4	5	2
Sugars and confectionery	<1	2	2	2	<1
Vegetables and pulses	1	2	1	2	2
Waters	4	2	2	2	2

⌘ derived using a model diet.

ϕ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

x percentage contributions were calculated using the ND=0 scenario.

Table A5.6: Major contributors (>5%) of individual food groups to estimated aluminium dietary exposures, derived using median analytical concentrations

Food group	% Contribution*					Major food group to which this food is included
	9 months [✕]	2-5 years ^φ	6-12 years ^φ	13-16 years ^φ	17 years & above [*]	
Cakes (excluding fruit cakes and sponges)	18	30	27	21	19	Cakes and biscuits
Cake, sponge	12	17	17	17	23	Cakes and biscuits
Seafood (crumbed)	6	6	<5	<5	<5	Seafood
Infant formulas and toddler milk (dairy based)	21	<5	0	0	0	Infant formula
Pikelets/ pancakes from shaker	10	11	19	20	<5	Cereal and grain based foods (excluding cakes and biscuits)
Tea (except herbal)	0	<5	<5	<5	24	Non-alcoholic beverages (excluding waters and milk)

✕ derived using a model diet.

φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey (Day 1 and 2 average).

* derived using the 1995 Australian National Nutrition Survey.

✕ percentage contributions were calculated using the ND=0 scenario.

Note: grey shading indicates that the food is not a major contributor for the age group.

Appendix 6: Definitions and glossary of terms

Benchmark Dose (BMD) – The BMD is the dose of a substance which corresponds with a particular level or rate of physiological response. It is derived by modelling the dose-response curve in a range of relevant observable data, and then using that model to estimate a dose that corresponds to a particular level of response. The Benchmark Dose Lower Confidence Level ($BMDL_{10}$) refers to the dose that corresponds with a 10% response rate for a particular physiological response.

Consumer – A respondent in a NNS who reports consuming a particular food containing the food chemical of interest within the previous 24 hours.

Good Manufacturing Practice (GMP), with respect to the addition of additives and processing aids to food, means –

- the quantity of additive or processing aid added to food shall be limited to the lowest possible level necessary to accomplish its desired effect; and
- the quantity of the additive or processing aid that becomes a component of food as a result of its use in the manufacture, processing or packaging of a food, and which is not intended to accomplish any physical or other technical effect in the finished food itself, is reduced to the extent reasonably possible; and
- the additive or processing aid is prepared and handled in the same way as a food ingredient.

Exposure – The amount of a specified chemical that is ingested by a person as part of the diet (via food, beverages and drinking water).

Limit of Detection (LOD) – The LOD is the lowest concentration of a specific chemical that can be qualitatively detected using a specified laboratory method and/or item of laboratory equipment (i.e. its presence can be detected but not necessarily quantified).

Limit of Quantification (LOQ) – The LOQ is the lowest concentration of a specific chemical that can be detected and quantified, with an acceptable degree of certainty, using a specified analytical method and/or item of laboratory equipment.

Limit of Reporting (LOR) – The LOR is the lowest concentration level that the laboratory reports analytical results.

Margin of Exposure (MOE) – Ratio of the no observed adverse effect level (NOAEL) or BMDL for the critical effect to the theoretical, predicted or estimated exposure. The calculation usually involves a reference point value (also called a point of departure) derived from the hazard assessment that is then divided by an estimate of human dietary exposure to give a dimensionless ratio that is the MOE.

Mean – Arithmetic mean.

National foods – Those foods that are distributed nationwide and therefore not expected to show regional variation, such as breakfast cereals, tea, coffee, soft drink and canned fruit.

No observed adverse effect level (NOAEL) – The highest exposure level at which there are no biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered adverse or precursors of adverse effects.

Practical Quantitation Limit (PQL) – The PQL is equivalent to the LOQ and is used by some laboratories instead of the LOQ.

Provisional Maximum Tolerable Daily Intake (PMTDI) – A PMTDI is a reference value established to indicate a safe level of intake of a contaminant in food which is not known to accumulate in the body.

Provisional Tolerable Weekly Intake (PTWI) – The PTWI is a permissible human daily/weekly exposures to those contaminants unavoidable associated with the consumption of otherwise wholesome and nutritious food (WHO 2001c).

The tolerable intake is referred to as ‘provisional’ as there is often a lack of data on the consequences of human exposure at low levels and new data may result in changes to the tolerable intake.

The method for calculating a PTDI/PTWI for a contaminant is similar to that used for calculating an ADI for a pesticide. A No Observable Effect Level (NOEL) is set and the PTDI/PTWI is derived from the NOEL using a safety factor. In many cases, there is human epidemiological information, usually occupational exposure data, on which NOELs can be based. Because NOELs are generally based on human data, a lower safety factor than commonly used for food additives is therefore normally applied.

Tolerable levels are recommended by JECFA.

Regional foods – Those foods that may be expected to show regional variation of aluminium, acrylamide or packaging material chemical levels. These foods included fresh fruit and vegetables, red meat, chicken, eggs, bread and other bakery goods, wine and some dairy foods.

Respondent – Any person included in a NNS, irrespective of whether they are reported consuming a particular food containing the chemical of interest or not.

Appendix 7: Food consumption data

Acrylamide

Table A7.1: Mean consumption amounts used in model diet for 9 month old infants for acrylamide, grams per person per day

Food group	Grams/person/day
Bacon	2.8
Baked potato products	2.5
Battered and crumbed poultry (excluding takeaway)	1.0
Beer, liqueurs and spirits	0
Beverage bases	1.1
Black tea	0
Boiled fruit and vegetables (except potatoes)	16.0
Boiled potato	6.2
Breads containing grains and seeds	3.3
Breads containing grains and seeds, toasted	1.3
Breakfast bars	0.5
Breakfast cereals with mixed grains/fruits/nuts	0
Bulb vegetables; baked, stir-fried or cooked unspecified	1.0
Cakes, muffins and plain puddings	0.8
Canned fruits and vegetables	6.6
Chocolate and carob	1.1
Coffee (from ground)	0
Coffee (from instant) and cereal-based beverages	0
Commercial pancakes/pikelets/crepes/waffles	0.2
Confectionery	1.1
Corn based cereals and flours	0.5
Corn based savoury biscuits	0.1
Corn crisps	0.2

Food group	Grams/person/day
Crumpets and English style muffins	0.7
Cucurbits; baked, stir-fried or cooked unspecified	1.8
Dried fruit and vegetables	2.8
Egg noodles	0.2
Extruded snacks	0.3
Flat breads	1.1
Flavoured potato crisps	0.1
Fresh dairy products	0
Fried potato products	3.0
Fruit and vegetables cooked unspecified in fat	0.4
Fruit breads	0.3
Fruit cakes and fruit puddings	0.2
Hamburgers (all meat types)	0.3
Herbal tea	0
Homemade pancakes/pikelets/crepes/waffles	0.4
Infant biscuits	0.6
Infant cereals	23.7
Infant custards and yoghurts	2.0
Infant dinners	3.3
Infant stewed fruits	0.4
Instant noodles	2.9
Jams	0.7
Mince	5.6
Mixed nuts and seeds	0.4
Muesli	0
Muesli bars	0.6
Non-soy based infant formula	544.0

Food group	Grams/person/day
Olives and capers	0.2
Peanuts and peanut butter	0.5
Pizzas	1.1
Plain doughnuts	0.3
Plain potato crisps	0.7
Popcorn	0.2
Potato chips and wedges from frozen	0.4
Processed milks and creams	0
Prune juice	0.1
Pulses (except soy beans)	2.3
Red/rose wines, sherry and port	0
Rice based cereals and flours	1.1
Rice based savoury biscuits	0.8
Rice, pasta and couscous	19.0
Root and tuber vegetables; baked, stir-fried or cooked unspecified	0.7
Sauces, marinades and chutneys	1.8
Sausages, frankfurts and salami	3.0
Savoury breads	0.9
Savoury pastries/pies/pasties	1.9
Seafood (battered)	0.2
Seafood (crumbed)	1.7
Seafood (no coating)	2.0
Soup	5.9
Soy based infant formula and foods	0
Sponge cakes	0.7
Spring rolls, dim sims and wontons	0.2
Stalk and stem vegetables; baked, stir-fried or cooked unspecified	0.2

Food group	Grams/person/day
Sugars, syrups and icings	4.9
Sweet pastries/pies/danishes	0.3
Sweet plain biscuits	1.7
Takeaway battered and crumbed poultry	1.0
Toasted fruit breads	0.5
Uncoated poultry	5.9
Water (non-bottled)	657.1
Wheat based cereals and flours	7.3
Wheat based savoury biscuits	1.9
White breads (including high-fibre white)	7.8
White breads (including high-fibre white), toasted	2.7
White wines, wine coolers, rice and ginger wines	0
Whole cuts of meat	5.5
Wholemeal, rye and spelt breads	4.1
Wholemeal, rye and spelt breads, toasted	1.5
Yeast and yeast spreads	0.8

Table A7.2: Mean food consumption amounts derived from the 2007 ANCNPAS and the 1995 NNS for all respondents, from the acrylamide dietary exposure assessment

Food group	Mean consumption (grams/person/day)			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above*
Bacon	8.0	9.7	11.6	10.3
Baked potato products	7.7	11.0	16.0	16.5
Battered and crumbed poultry (excluding takeaway)	3.8	6.5	10.2	2.0
Beer, liqueurs and spirits	0.003	0.1	1.1	196.4
Beverage bases	4.5	7.2	8.8	2.5
Black tea	3.9	14.4	31.7	389.7
Boiled fruit and vegetables(except potatoes)	38.4	40.2	43.0	37.7
Boiled potato	15.8	21.1	24.2	49.9
Breads containing grains and seeds	8.7	6.7	9.0	7.7
Breads containing grains and seeds, toasted	3.0	2.7	4.3	5.6
Breakfast bars	1.7	2.2	2.1	0.1
Breakfast cereals with mixed grains/fruits/nuts	5.1	7.4	10.1	8.5
Bulb vegetables; baked, stir-fried or cooked unspecified	2.3	4.3	6.2	23.3
Cakes, muffins and plain puddings	2.9	5.0	5.3	3.9
Canned fruits and vegetables	15.7	17.6	20.7	19.0
Chocolate and carob	3.5	5.4	3.6	5.7
Coffee (from ground)	0.03	0.1	3.5	48.6
Coffee (from instant) and cereal-based beverages	0.001	0.01	0.1	373.4
Commercial pancakes/ pikelets/crepes/waffles	1.2	1.0	0.4	0.7
Confectionery	3.5	5.7	7.1	2.6

Food group	Mean consumption (grams/person/day)			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Corn based cereals and flours	1.9	2.8	3.1	2.7
Corn based savoury biscuits	0.2	0.1	0.1	0.01
Corn crisps	0.7	2.2	2.2	0.8
Crumpets and English style muffins	2.0	2.8	3.1	2.6
Cucurbits; baked, stir-fried or cooked unspecified	4.8	6.0	8.0	20.2
Dried fruit and vegetables	5.4	2.6	2.8	13.1
Egg noodles	0.3	0.1	0.3	0.7
Extruded snacks	1.0	1.3	1.1	0.7
Flat breads	2.2	4.2	4.6	2.2
Flavoured potato crisps	0.5	1.2	0.7	1.1
Fresh dairy products	404.6	358.7	367.6	313.2
Fried potato products	8.9	15.6	24.2	16.4
Fruit and vegetables cooked unspecified in fat	1.2	1.8	2.3	17.7
Fruit breads	0.8	0.8	0.9	0.7
Fruit cakes and fruit puddings	0.4	1.2	1.4	4.2
Hamburgers (all meat types)	1.8	7.1	11.2	8.1
Herbal tea	0.4	2.5	3.5	19.1
Homemade pancakes/pikelets/crepes/waffles	1.4	3.1	3.2	1.0
Infant biscuits	0.002	NC	NC	NC
Infant cereals	0.03	NC	NC	0.01
Infant custards and yoghurts	0.1	NC	NC	0.02
Infant dinners	0.6	NC	NC	0.003
Infant stewed fruits	0.5	0.2	0.1	0.1
Instant noodles	5.5	14.1	15.6	4.4

Food group	Mean consumption (grams/person/day)			
	2–5 years [†]	6–12 years [†]	13–16 years [†]	17 years & above [*]
Jams	1.4	1.3	1.6	3.5
Mince	12.3	18.7	22.5	18.2
Mixed nuts and seeds	1.2	1.3	1.6	3.0
Muesli	0.2	0.2	0.3	1.3
Muesli bars	1.9	2.4	3.2	0.8
Non-soy based infant formula	2.2	NC	NC	NC
Olives and capers	0.5	0.3	0.5	0.5
Peanuts and peanut butter	1.3	2.1	2.4	2.7
Pizzas	3.9	12.8	21.7	9.5
Plain doughnuts	1.0	1.2	1.1	1.4
Plain potato crisps	2.8	5.5	7.2	0.9
Popcorn	0.8	2.2	1.2	0.3
Potato chips and wedges from frozen	2.0	4.0	3.8	4.5
Processed milks and creams	5.1	6.3	5.6	8.4
Prune juice	0.3	0.2	NC	0.2
Pulses (except soy beans)	5.4	6.6	5.7	9.2
Red/rose wines, sherry and port	0.1	0.1	0.2	19.5
Rice based cereals and flours	3.2	4.0	3.2	0.8
Rice based savoury biscuits	2.3	1.6	1.0	0.3
Rice, pasta and couscous	46.3	57.5	74.1	75.3
Root and tuber vegetables; baked, stir-fried or cooked unspecified	1.8	2.4	3.0	14.6
Sauces, marinades and chutneys	6.1	8.5	12.5	7.1
Sausages, frankfurts and salami	9.6	10.4	11.4	13.7

Food group	Mean consumption (grams/person/day)			
	2–5 years [†]	6–12 years [†]	13–16 years [†]	17 years & above [*]
Savoury breads	2.1	3.0	4.3	2.9
Savoury pastries/pies/pasties	7.4	14.5	20.4	19
Seafood (battered)	0.5	1.9	2.6	3.2
Seafood (crumbed)	4.6	3.3	3.5	6.2
Seafood (no coating)	6.5	8.2	8.8	14.0
Soup	13.1	22.3	33.7	54.9
Soy based infant formula and foods	14.8	3.9	6.0	5.0
Sponge cakes	3.3	3.6	3.6	6.5
Spring rolls, dim sims and wontons	0.7	2.2	2.7	1.5
Stalk and stem vegetables; baked, stir-fried or cooked unspecified	0.4	0.5	0.9	3.5
Sugars, syrups and icings	15.5	30.5	42.8	38.5
Sweet pastries/pies/danishes	0.7	2.3	4.8	10.7
Sweet plain biscuits	4.0	3.1	2.4	7.4
Takeaway battered and crumbed poultry	3.7	5.5	4.7	3.5
Toasted fruit breads	1.1	1.2	1.0	0.9
Uncoated poultry	17.5	28.3	39.0	33.1
Water (non-bottled)	699.9	1012.5	1254.2	1095.3
Wheat based cereals and flours	17.1	17.6	18.8	17.0
Wheat based savoury biscuits	5.0	5.7	4.3	4.0
White breads (including high-fibre white)	27.4	35.8	39.1	39.3
White breads (including high-fibre white), toasted	7.1	12.6	15.4	18.4

Food group	Mean consumption (grams/person/day)			
	2–5 years ^φ	6–12 years ^φ	13–16 years ^φ	17 years & above [*]
White wines, wine coolers, rice and ginger wines	0.03	0.02	0.1	34.6
Whole cuts of meat	13.9	21.7	32.7	57.2
Wholemeal, rye and spelt breads	12.3	9.6	7.1	13.4
Wholemeal, rye and spelt breads, toasted	3.5	3.7	3.1	8.1
Yeast and yeast spreads	2.0	1.6	1.6	0.9

^φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey.

^{*} derived using the 1995 Australian National Nutrition Survey.

NC = not consumed.

Table A7.3: Mean food consumption amounts derived from the 2007 ANCNPAS and the 1995 NNS for consumers only, from the acrylamide dietary exposure assessment

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [§]	6–12 years [§]	13–16 years [§]	17 years & above [*]
Bacon	21.1	25.9	29.3	42.3
Baked potato products	30.0	45.5	70.0	147.0
Battered and crumbed poultry	52.4	78.4	88.9	129.5
Beer, liqueurs and spirits	0.5	10.5	59.5	896.7
Beverage bases	8.9	12.2	18.7	18.7
Black tea	76.5	160.0	209.9	753.8
Boiled fruit and vegetables (except potatoes)	51.0	58.3	63.3	82.5
Boiled potato	36.2	52.0	60.9	161.2
Breads containing grains and seeds	38.6	44.2	54.9	89.5
Breads containing grains and seeds, toasted	28.9	33.9	39.7	61.6
Breakfast bars	17.1	17.7	18.8	46.8
Breakfast cereals with mixed grains/fruits/nuts	22.8	32.5	46.7	65.5
Bulb vegetables; baked, stir-fried or cooked unspecified	7.3	11.6	14.7	86.3
Cakes, muffins and plain puddings	32.5	44.7	51.7	94.5
Canned fruits and vegetables	36.6	42.1	48.6	79.8
Chocolate and carob	15.0	21.1	22.8	26.1
Coffee (from ground)	90.0	41.5	120.0	377.6
Coffee (from instant) and cereal-based beverages	0.5	1.5	3.5	699.4
Commercial pancakes/pikelets/crepes/waffles	41.0	34.5	49.0	90.9
Confectionery	11.1	16.4	24.0	29.1

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [§]	6–12 years [§]	13–16 years [§]	17 years & above [*]
Corn based cereals and flours	5.7	7.3	9.5	21.8
Corn based savoury biscuits	8.6	10.1	11.8	36.7
Corn crisps	13.9	26.3	34.9	46.1
Crumpets and English style muffins	30.1	45.8	43.2	77.9
Cucurbits; baked, stir-fried or cooked unspecified	22.1	30.6	33.1	70.2
Dried fruit and vegetables	14.1	9.8	13.2	47.0
Egg noodles	34.4	26.8	54.4	225.3
Extruded snacks	13.4	17.2	22.0	37.1
Flat breads	26.2	36.8	47.7	94.7
Flavoured potato crisps	14.8	16.6	14.8	47.0
Fresh dairy products	407.6	362.2	371.5	331
Fried potato products	44.9	63.2	82.1	140.7
Fruit and vegetables cooked unspecified in fat	12.9	15.8	20.1	99.0
Fruit breads	24.7	34.9	38.3	72.3
Fruit cakes and fruit puddings	28.1	46.2	57.4	78.3
Hamburgers (all meat types)	54.9	91.4	109.8	227.6
Herbal tea	97.8	236.5	215.7	499.2
Homemade pancakes/pikelets/crepes/waffles	28.1	47.9	51.9	89.8
Infant biscuits	3.5	NC	NC	NC
Infant cereals	11.6	NC	NC	54.0
Infant custards and yoghurts	69.5	NC	NC	57.6
Infant dinners	138.1	NC	NC	33.0
Infant stewed fruits	45.2	33.0	60.9	34.9
Instant noodles	60.2	93.9	116.7	161.0

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [§]	6–12 years [§]	13–16 years [§]	17 years & above [*]
Jams	7.7	10.3	12.2	15.6
Mince	38.1	54.2	66.4	131.6
Mixed nuts and seeds	5.5	4.6	6.2	16.8
Muesli	34.2	39.2	88.4	95.7
Muesli bars	17.9	19.0	23.1	40.0
Non-soy based infant formula	126.7	NC	NC	NC
Olives and capers	10.0	6.1	9.0	17.9
Peanuts and peanut butter	7.2	9.5	11.9	23.3
Pizzas	66.4	100.8	140.5	208
Plain doughnuts	32.9	43.4	40.5	91.5
Plain potato crisps	16.5	21.3	26.1	39.9
Popcorn	11.7	20.9	21.2	41.6
Potato chips and wedges from frozen	42.1	57.5	62.9	138.3
Processed milks and creams	6.0	7.3	6.9	12.5
Prune juice	59.5	128.9	NC	292.5
Pulses (except soy beans)	48.9	66.0	62.8	124.6
Red/rose wines, sherry and port	9.2	13.6	18.5	257.5
Rice based cereals and flours	18.3	26.3	34.6	16.2
Rice based savoury biscuits	10.2	12.3	16.2	22.5
Rice, pasta and couscous	79.6	108.4	136.3	237.5
Root and tuber vegetables; baked, stir-fried or cooked unspecified	14.9	20.5	20.6	53.5
Sauces, marinades and chutneys	12.3	16.2	22.4	21.0
Sausages, frankfurts and salami	33.2	38.6	49.6	95.0

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Savoury breads	29.9	38.1	47.6	83.2
Savoury pastries/pies/pasties	57.7	85.1	103.6	195.8
Seafood (battered)	41.1	66.6	104.5	141.7
Seafood (crumbed)	44.6	52.6	71.9	125.4
Seafood (no coating)	40.8	49.3	57.3	112.5
Soup	51.0	84.1	114.2	168.6
Soy based infant formulas and foods	218.0	138.2	155.1	211.5
Sponge cakes	30.4	34.0	42.8	68.1
Spring rolls, dim sims and wontons	40.4	51.5	72.7	113.2
Stalk and stem vegetables; baked, stir-fried or cooked unspecified	10.5	9.8	14.0	51.5
Sugars, syrups and icings	16.2	31.3	43.9	47.0
Sweet pastries/pies/danishes	31.5	58.9	92.0	131.4
Sweet plain biscuits	12.5	14.3	19.2	27.4
Takeaway battered and crumbed poultry	37.2	50.8	74.1	133.1
Toasted fruit breads	25.3	32.3	43.2	55.0
Uncoated poultry	45.4	68.1	84.6	131.9
Water (non-bottled)	700.2	1012.4	1255.4	1120.9
Wheat based cereals and flours	22.9	27.0	31.0	32.5
Wheat based savoury biscuits	13.5	18.4	20.7	26.1
White breads (including high-fibre white)	46.8	54.3	64.5	100.6
White breads (including high-fibre white), toasted	26.6	38.5	47.3	61.9

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years ^φ	6–12 years ^φ	13–16 years ^φ	17 years & above [*]
White wines, wine coolers, rice and ginger wines	5.8	8.46	11.0	341.7
Whole cuts of meat	35.1	52.1	72.1	131.9
Wholemeal, rye and spelt breads	41.7	44.8	46.7	86.1
Wholemeal, rye and spelt breads, toasted	25.1	34.3	36.4	60.4
Yeast and yeast spreads	4.5	5.0	5.8	4.5

^φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey.

^{*} derived using the 1995 Australian National Nutrition Survey.

[#] Different food groups have different numbers of consumers.

NC = not consumed.

Aluminium

Table A7.4: Mean consumption amounts used in model diet for 9 month old infants for aluminium, grams per person per day

Food group	Grams/person/day
Apples and quinces	17.5
Avocados and olives	1.4
Bacon	0.5
Bananas and plantains	13.9
Battered and crumbed poultry (not takeaway)	1.6
Beef, veal and venison	7.0
Beer, liqueurs and spirits	0
Beetroot	0.2
Berries	2.6
Breads containing grains and seeds	3.7
Breakfast bars	0.4
Breakfast cereals with mixed grains/fruits/nuts (excluding muesli)	0
Broccoli and broccoflower	1.4
Butter and animal fats	0.9
Cabbages, Brussels sprouts and kohlrabi	0.4
Cakes and muffins (excluding fruit cakes and sponges)	1.3
Plain fish	1.5
Capsicums, chillies and spices	0.6
Cauliflower	0.8
Cheeses	5.1
Chocolate flavoured beverage bases	2.1
Chocolates and cocoa	0
Citrus fruits and kumquats	7.1
Coconut	0.1
Coffee (from ground)	0

Food group	Grams/person/day
Coffee (from instant) and cereal-based beverages	0
Confectionery	0.9
Corn based cereals and flours	0.6
Crumpets and English style muffins	0
Cucumbers and chokos	1.0
Doughnuts	0.5
Dried apricots, peel, cherries, ginger and fruit leathers	0.4
Dried grapes/figs/dates	1.7
Dried pulses (except soy beans)	1.9
Egg pastas and noodles	0.2
Eggs	2.1
Flat breads	0.9
Fresh beans and bean sprouts	0.7
Fresh milks and cream	0
Frozen dairy based desserts	2.7
Fruit cakes and fruit puddings	0.1
Fruit juices (except prune) and ciders	28.9
Grain based (not rice and corn) cereals and flours	4.1
Grapes	3.4
Hamburgers (all meat types)	0.3
Herbal teas	0.3
Honey	0.4
Infant biscuits	0.5
Infant cereals	16.5
Infant custards and yoghurts	2.9
Infant dinners	3.9
Infant formulas and toddler milk (dairy based)	544.0

Food group	Grams/person/day
Infant formulas and toddler milk (soy based)	0
Lamb, mutton, kangaroo and rabbit	1.1
Leafy vegetables and herbs	0.7
Margarines and margarine spreads	1.7
Melons	5.0
Mixed vegetables (frozen and dried)	1.1
Molluscs and crustacea	0.1
Muesli	0
Muesli bars	0
Mushrooms	0.5
Non-alcoholic beverages (except milk, waters and juices)	6.9
Oats	2.8
Offal (including pate and liverwurst)	0
Oils	0.7
Onions, garlic, shallots, spring onions and leeks	1.7
Pasta (non-egg), noodles (except rice) and couscous	12.3
Peanuts and peanut butter	0.4
Pears and loquats	3.2
Peas (fresh, dried and sprouts) and broad beans	1.4
Pikelets/pancakes from shaker	0.3
Pikelets/pancakes ready-to-eat	0.1
Pineapple and jackfruit	1.2
Pizzas (commercial)	0.8
Pork (except bacon) and deli meats (except frankfurts and poultry-based)	3.1
Poultry (excluding skinless)	1.1
Poultry (skinless)	3.8
Processed milks and creams	0

Food group	Grams/person/day
Prunes and prune juice	0.1
Pumpkins, squash, marrows and zucchini	2.9
Red/rose wines, sherry, port and brandy	0
Rice and rice products	7.3
Rice based cereals and flours	0.9
Root vegetables (non-starchy)	3.2
Root vegetables (starchy)	11.8
Sausages and frankfurts	2.3
Savoury biscuits and crackers	1.7
Savoury fancy breads	0.4
Savoury pastries (excluding spring rolls and dim sims)	1.7
Savoury sauces (excluding tomato)	0.6
Savoury sauces (tomato)	2.0
Savoury snacks	1.0
Seafood (battered)	0
Seafood (crumbed)	1.5
Seeds and tree nuts (excluding coconut)	0
Soy beverages, soy beans and tofu	0
Sponge cakes	0.2
Spring rolls, dim sims, wontons and dumplings	0.2
Stalk and stem vegetables	0.5
Stone fruits (furry skinned)	1.6
Stone fruits (smooth skinned) and figs	0.3
Sugars and syrups	2.6
Sweet fancy breads	0.9
Sweet pies and pastries	0.2
Sweet/plain/filled biscuits	2.3

Food group	Grams/person/day
Sweetcorn	1.9
Takeaway battered and crumbed poultry	0
Tea (except herbal)	0
Tomatoes/eggplant/okra (cooked or processed)	3.8
Tomatoes/eggplant/pepino (raw or sun-dried)	2.6
Tropical fruits (rough or furry skin, except pineapples and jackfruit)	0.4
Tropical fruits (smooth-skinned, except bananas, plantains, avocados and olives)	0.3
Water (bottled/plain mineral/soda)	310.8
Water (non-bottled)	310.8
White breads (including high-fibre white)	8.8
White wines, wine coolers, rice and ginger wines	0
Wholemeal breads	4.5
Yoghurt (except frozen)	18.1

Table A7.5: Mean food consumption amounts derived from the 2007 ANCNPAS and the 1995 NNS for all respondents, from the aluminium dietary exposure assessment

Food group	Mean consumption (grams/person/day)			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above*
Apples and quinces	62.0	65.6	54.8	36.0
Avocados and olives	3.5	2.6	4.0	2.9
Bacon	1.4	2.6	4.1	3.6
Bananas and plantains	42.9	27.0	19.3	25.7
Battered and crumbed poultry (not takeaway)	7.8	11.5	13.7	3.0
Beef, veal and venison	20.5	32.1	45.8	54.7
Beer, liqueurs and spirits	0.003	0.1	1.1	192.0
Beetroot	0.7	0.7	0.8	2.4
Berries	8.9	5.4	4.2	4.1
Breads containing grains and seeds	11.7	9.3	13.4	13.2
Breakfast bars	1.7	2.2	2.1	0.1
Breakfast cereals with mixed grains/fruits/nuts (excluding muesli)	5.9	8.4	11.6	8.8
Broccoli and broccoflower	5.0	5.9	5.3	9.8
Butter and animal fats	3.4	4.5	5.1	7.9
Cabbages, Brussels sprouts and kohlrabi	0.8	2.0	3.2	7.6
Cakes and muffins (excluding fruit cakes and sponges)	5.6	7.4	6.2	6.3
Capsicums, chillies and spices	2.0	3.2	4.7	4.7
Cauliflower	2.4	3.5	3.2	6.3
Cheeses	17.6	17.7	21.0	17.6
Chocolate flavoured beverage bases	8.4	19.0	21.3	1.8
Chocolates and cocoa	6.0	10.6	9.5	5.5

Food group	Mean consumption (grams/person/day)			
	2–5 years [†]	6–12 years [†]	13–16 years [†]	17 years & above [*]
Citrus fruits and kumquats	20.2	23.3	22.6	20.0
Coconut	0.3	0.6	0.6	1.3
Coffee (from ground)	0.04	0.2	4.4	48.6
Coffee (from instant) and cereal-based beverages	0.1	0.5	13.4	373.4
Confectionery	3.6	6.0	7.3	2.6
Corn based cereals and flours	2.7	4.7	4.1	2.8
Crumpets and English style muffins	2.0	2.9	3.3	2.6
Cucumbers and chokos	3.9	4.5	4.7	6.4
Doughnuts	1.8	2.5	2.9	1.4
Dried apricots, peel, cherries, ginger and fruit leathers	1.1	1.1	1.1	1.2
Dried grapes/figs/dates	3.8	1.1	1.2	2.2
Dried pulses (except soy beans)	5.2	6.9	6.7	8.1
Egg pastas and noodles	1.3	2.2	3.3	2.2
Eggs	8.2	11.1	11.5	18.8
Flat breads	2.7	5.2	8.3	2.0
Fresh beans and bean sprouts	2.7	3.7	5.0	8.7
Fresh milks and cream	337.1	296.8	304.3	260.4
Frozen dairy based desserts	14.6	28.7	27.1	16.8
Fruit cakes and fruit puddings	0.2	0.7	0.9	1.5
Fruit juices (except prune) and ciders	104.9	122.2	149.6	77.7
Grain based (not rice and corn) cereals and flours	13.2	14.2	16.1	15.4
Grapes	10.8	8.5	5.8	7.3
Hamburgers (all meat types)	1.8	7.1	11.2	8.1

Food group	Mean consumption (grams/person/day)			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Herbal teas	0.4	2.5	3.5	19.1
Honey	1.7	1.7	1.6	1.8
Infant biscuits	0.002	NC	NC	NC
Infant cereals	0.02	NC	NC	0.01
Infant custards and yoghurts	0.3	0.4	0.1	0.02
Infant dinners	0.6	NC	NC	0.003
Infant formulas and toddler milk (dairy based)	2.2	NC	NC	NC
Infant formulas and toddler milk (soy based)	0.02	NC	NC	0.01
Lamb, mutton, kangaroo and rabbit	3.9	6.1	7.4	13.4
Leafy vegetables and herbs	3.3	6.7	11.6	12.9
Margarines and margarine spreads	5.2	5.9	6.3	18.5
Melons	17.3	14.2	9.4	10.9
Mixed vegetables (frozen and dried)	2.5	2.5	2.6	3.2
Molluscs and crustacea	0.8	1.7	1.5	4.1
Muesli	0.9	1.0	1.8	4.9
Muesli bars	1.9	2.4	3.2	0.6
Mushrooms	1.3	1.7	2.3	4.4
Non-alcoholic beverages (except milk, waters and juices)	36.0	128.5	237.3	174.9
Oats	7.3	6.1	5.1	14.6
Offal (including pate and liverwurst)	0.02	0.1	0.1	1.0
Oils	2.6	4.1	5.3	4.1
Onions, garlic, shallots, spring onions and leeks	4.9	8.1	12.4	26.6

Food group	Mean consumption (grams/person/day)			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Pasta (non-egg), noodles (except rice) and couscous	36.2	42.6	54.7	34.0
Peanuts and peanut butter	1.4	2.0	2.6	2.5
Pears and loquats	9.6	8.1	6.8	10.6
Peas (fresh, dried and sprouts) and broad beans	4.9	5.8	7.7	12.5
Pikelets/pancakes from shaker	1.0	2.6	2.9	0.1
Pikelets/pancakes ready-to-eat	1.2	0.9	0.4	0.7
Pineapple and jackfruit	3.6	4.3	4.1	5.5
Pizzas (commercial)	3.3	11.0	19.2	9.3
Plain fish	5.6	6.6	7.3	13.3
Pork (except bacon) and deli meats (except frankfurts and poultry-based)	10.9	13.4	14.2	17.4
Poultry (excluding skinless)	6.4	11.9	19.3	28.4
Poultry (skinless)	11.4	16.9	21.2	9.0
Processed milks and creams	1.2	1.5	2.5	8.5
Prunes and prune juice	0.4	0.3	0.01	0.8
Pumpkins, squash, marrows and zucchini	8.0	8.3	8.7	18.5
Red/rose wines, sherry, port and brandy	0.1	0.2	0.2	20.1
Rice and rice products	22.6	33.2	39.5	43.6
Rice based cereals and flours	3.2	4.1	3.3	0.6
Root vegetables (non-starchy)	11.4	14.3	14.7	24.7
Root vegetables (starchy)	41.9	63.4	82.6	104.4
Sausages and frankfurts	9.1	9.5	10.8	11.3

Food group	Mean consumption (grams/person/day)			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Savoury biscuits and crackers	5.8	6.4	4.7	4.1
Savoury fancy breads	1.3	2.0	2.7	2.1
Savoury pastries (excluding spring rolls and dim sims)	8.0	15.5	22.6	18.3
Savoury sauces (excluding tomato)	2.3	4.2	7.4	3.9
Savoury sauces (tomato)	6.7	7.2	8.7	3.1
Savoury snacks	4.7	10.3	11.3	3.4
Seafood (battered)	0.01	0.01	0.05	3.2
Seafood (crumbed)	5.2	5.3	6.1	2.5
Seeds and tree nuts (excluding coconut)	1.1	1.2	1.4	2.3
Soy beverages, soy beans and tofu	15.2	4.6	6.9	5.6
Sponge cakes	0.9	1.3	1.4	2.0
Spring rolls, dim sims, wontons and dumplings	0.8	2.3	3.7	2.5
Stalk and stem vegetables	1.7	2.5	3.5	5.8
Stone fruits (furry skinned)	4.9	3.7	3.5	12.1
Stone fruits (smooth skinned) and figs	1.6	2.8	1.9	8.3
Sugars and syrups	9.3	13.3	15.4	25.0
Sweet fancy breads	3.3	3.8	3.2	5.0
Sweet pies and pastries	0.8	2.3	5.2	6.0
Sweet/plain/filled biscuits	7.6	8.1	8.0	7.8
Sweetcorn	6.1	6.2	5.3	4.9
Takeaway battered and crumbed poultry	0.1	1.1	2.0	3.0
Tea (except herbal)	3.8	14.4	31.7	390.6

Food group	Mean consumption (grams/person/day)			
	2–5 years ^φ	6–12 years ^φ	13–16 years ^φ	17 years & above [*]
Tomatoes/eggplant/okra (cooked or processed)	12.0	15.8	22.4	23.0
Tomatoes/eggplant/pepino (raw or sun-dried)	9.0	11.6	15.4	32.4
Tropical fruits (rough or furry skin, except pineapples and jackfruit)	1.4	1.2	1.1	2.0
Tropical fruits (smooth-skinned, except bananas, plantains, avocadoes and olives)	1.1	1.0	0.8	4.3
Water (bottled/plain mineral/soda)	27.0	41.6	74.4	14.1
Water (non-bottled)	642.6	861.5	982.2	953.8
White breads (including high-fibre white)	36.4	51.9	59.0	59.3
White wines, wine coolers, rice and ginger wines	0.03	0.02	0.1	34.5
Wholemeal breads	16.0	13.7	10.4	21.7
Yoghurt (except frozen)	44.5	27.3	24.7	15.8

^φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey.

^{*} derived using the 1995 Australian National Nutrition Survey.

NC = not consumed.

Table A7.6: Mean food consumption amounts derived from the 2007 ANCNPAS and the 1995 NNS for consumers only, from the aluminium dietary exposure assessment

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [§]	6–12 years [§]	13–16 years [§]	17 years & above [*]
Apples and quinces	94.4	114.2	125.3	119.5
Avocadoes and olives	24.1	19.1	22.7	52.6
Bacon	12.3	19.4	22.4	36.5
Bananas and plantains	74.9	72.7	76.7	90.2
Battered and crumbed poultry (not takeaway)	46.0	65.6	78.8	124.9
Beef, veal and venison	34.9	51.9	69.8	131.1
Beer, liqueurs and spirits	0.7	17.1	64.2	923.6
Beetroot	20.5	17.2	14.6	29.1
Berries	23.5	19.8	16.7	18.7
Breads containing grains and seeds	42.4	49.3	58.9	90.8
Breakfast bars	16.8	17.1	18.4	46.8
Breakfast cereals with mixed grains/fruits/nuts (excluding muesli)	23.2	32.6	47.2	60.4
Broccoli and broccoflower	18.9	23.4	22.7	75.9
Butter and animal fats	4.5	5.8	6.6	19.0
Cabbages, Brussels sprouts and kohlrabi	14.5	25.2	33.0	48.8
Cakes and muffins (excluding fruit cakes and sponges)	36.6	45.3	49.4	82.2
Capsicums, chillies and spices	3.1	4.4	5.8	22.9
Cauliflower	24.5	32.0	32.1	49.1
Cheeses	22.5	24.2	31.0	36.9
Chocolate flavoured beverage bases	29.4	49.9	68.5	23.3

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [§]	6–12 years [§]	13–16 years [§]	17 years & above [*]
Chocolates and cocoa	9.3	14.2	15.2	21.1
Citrus fruits and kumquats	62.5	74.6	79.7	98.7
Coconut	2.3	4.5	4.7	23.8
Coffee (from ground)	18.3	39.3	85.8	377.6
Coffee (from instant) and cereal-based beverages	33.1	60.0	145.6	698.9
Confectionery	10.8	16.2	22.9	28.5
Corn based cereals and flours	5.2	8.0	7.8	19.6
Crumpets and English style muffins	30.1	45.5	42.8	77.9
Cucumbers and chokos	20.8	20.5	20.3	38.4
Doughnuts	31.6	40.5	49.0	91.5
Dried apricots, peel, cherries, ginger and fruit leathers	4.5	4.9	5.1	14.2
Dried grapes/figs/dates	13.4	7.1	8.1	13.0
Dried pulses (except soy beans)	44.0	57.6	58.3	114.2
Egg pastas and noodles	44.3	54.6	103.8	266.0
Eggs	14.9	17.2	16.6	37.6
Flat breads	26.2	39.1	57.7	92.3
Fresh beans and bean sprouts	17.3	19.6	25.3	44.5
Fresh milks and cream	348.7	307.2	323.8	289.7
Frozen dairy based desserts	38.0	60.6	68.3	99.9
Fruit cakes and fruit puddings	24.3	39.1	56.6	74.7
Fruit juices (except prune) and ciders	129.7	153.8	186.5	150.6
Grain based (not rice and corn) cereals and flours	17.3	19.5	23.0	25.1
Grapes	36.4	44.7	44.7	134.2

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Hamburgers (all meat types)	54.9	91.4	109.8	227.6
Herbal teas	97.8	236.5	215.7	499.2
Honey	6.8	8.2	8.3	17.4
Infant biscuits	3.5	NC	NC	NC
Infant cereals	17.6	NC	NC	54.0
Infant custards and yoghurts	93.3	111.7	98.2	57.6
Infant dinners	138.1	NC	NC	33.0
Infant formulas and toddler milk (dairy based)	126.7	NC	NC	NC
Infant formulas and toddler milk (soy based)	28.4	NC	NC	152.4
Lamb, mutton, kangaroo and rabbit	27.9	40.0	46.7	113.1
Leafy vegetables and herbs	6.0	10.2	16.4	31.4
Margarines and margarine spreads	7.2	8.2	9.0	22.7
Melons	88.9	132.7	139.2	242.2
Mixed vegetables (frozen and dried)	22.1	27.5	29.6	82.9
Molluscs and crustacea	27.4	34.6	30.1	101.8
Muesli	34.7	63.6	69.6	83.2
Muesli bars	17.8	19.0	23.1	38.1
Mushrooms	11.1	17.3	21.5	39.4
Non-alcoholic beverages (except milk, waters and juices)	131.7	253.5	387.9	568.6
Oats	50.6	54.8	60.6	188.7
Offal (including pate and liverwurst)	10.4	24.0	52.8	57.3
Oils	3.5	5.2	6.4	12.4

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Onions, garlic, shallots, spring onions and leeks	7.8	12.3	17.2	42.2
Pasta (non-egg), noodles (except rice) and couscous	65.5	81.6	109.6	183.9
Peanuts and peanut butter	6.8	8.3	10.6	17.5
Pears and loquats	40.6	48.3	47.6	124.4
Peas (fresh, dried and sprouts) and broad beans	14.7	19.1	23.0	55.7
Pikelets/pancakes from shaker	28.1	47.8	51.6	79.3
Pikelets/pancakes ready-to-eat	39.6	33.7	44.9	90.9
Pineapple and jackfruit	21.6	28.7	33.6	73.0
Pizzas (commercial)	66.8	105.2	147.9	207.9
Plain fish	38.8	49.2	59.8	111.9
Pork (except bacon) and deli meats (except frankfurts and poultry-based)	25.4	30.7	37.4	65.7
Poultry (excluding skinless)	33.1	50.4	67.2	110.3
Poultry (skinless)	43.1	63.2	76.8	122.0
Processed milks and creams	5.4	5.2	9.6	62.3
Prunes and prune juice	42.5	74.2	7.0	44.5
Pumpkins, squash, marrows and zucchini	31.1	40.4	49.4	90.5
Red/rose wines, sherry, port and brandy	3.2	6.0	6.9	235.5
Rice and rice products	51.2	87.0	113.0	234.7
Rice based cereals and flours	16.7	23.1	29.0	28.5
Root vegetables (non-starchy)	17.5	22.4	23.3	53.2
Root vegetables (starchy)	57.4	84.5	107.2	176.1

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years [‡]	6–12 years [‡]	13–16 years [‡]	17 years & above [*]
Sausages and frankfurts	34.3	43.5	51.5	112.8
Savoury biscuits and crackers	13.3	17.8	20.3	26.7
Savoury fancy breads	44.2	47.5	55.0	102.7
Savoury pastries (excluding spring rolls and dim sims)	58.7	85.5	108.4	193.1
Savoury sauces (excluding tomato)	8.9	13.3	18.7	11.0
Savoury sauces (tomato)	17.1	17.3	20.7	19.5
Savoury snacks	17.1	25.0	29.1	44.7
Seafood (battered)	33.5	33.5	33.5	141.7
Seafood (crumbed)	42.1	55.4	77.6	88.1
Seeds and tree nuts (excluding coconut)	4.2	3.9	5.0	18.7
Soy beverages, soy beans and tofu	183.7	93.8	113.3	183.8
Sponge cakes	10.4	16.8	19.7	61.4
Spring rolls, dim sims, wontons and dumplings	42.2	52.1	84.9	129.0
Stalk and stem vegetables	10.0	12.5	14.6	25.4
Stone fruits (furry skinned)	24.9	24.9	26.3	84.2
Stone fruits (smooth skinned) and figs	43.3	63.2	60.7	146.3
Sugars and syrups	10.1	14.1	16.3	30.5
Sweet fancy breads	29.1	36.5	41.9	82.9
Sweet pies and pastries	49.0	54.4	90.8	160.0
Sweet/plain/filled biscuits	13.4	14.2	17.2	28.8
Sweetcorn	22.9	27.6	29.4	48.1
Takeaway battered and crumbed poultry	20.4	56.3	95.3	NC

Food group	Mean consumption (grams/consumer/day) [#]			
	2–5 years ^φ	6–12 years ^φ	13–16 years ^φ	17 years & above [*]
Tea (except herbal)	75.1	160.0	209.9	754.6
Tomatoes/eggplant/okra (cooked or processed)	35.1	40.7	55.7	118.2
Tomatoes/eggplant/ pepino (raw or sun-dried)	36.2	40.3	43.6	80.6
Tropical fruits (rough or furry skin, except pineapples and jackfruit)	28.2	28.3	30.4	52.2
Tropical fruits (smooth-skinned, except bananas, plantains, avocados and olives)	20.0	24.0	22.9	64.5
Water (bottled/plain mineral/soda)	262.8	371.4	423.9	408.4
Water (non-bottled)	644.3	863.6	990.2	1037.6
White breads (including high-fibre white)	51.9	66.8	78.1	103.3
White wines, wine coolers, rice and ginger wines	6.4	8.5	12.5	352.0
Wholemeal breads	45.5	51.4	52.0	90.8
Yoghurt (except frozen)	87.0	85.3	105.3	155.5

^φ derived using the 2007 Australian National Children's Nutrition and Physical Activity Survey.

^{*} derived using the 1995 Australian National Nutrition Survey.

[#] Different food groups have different numbers of consumers.

NC = not consumed.



FOOD STANDARDS
Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

AUSTRALIA

Boeing House
55 Blackall Street
BARTON ACT 2600

PO Box 7186
Canberra BC ACT 2610
Australia

P +61 2 6271 2222
F +61 2 6271 2278
E info@foodstandards.gov.au

NEW ZEALAND

Level 3
154 Featherston Street
WELLINGTON 6011

PO Box 10559, The Terrace
Wellington 6143
New Zealand

P +64 4 978 5630
F +64 4 473 9855
E info@foodstandards.govt.nz