



Monitoring the Australian population's intake of dietary iodine before and after mandatory fortification

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Executive Summary

This report provides results of analysis of the iodine content of breads commonly eaten by Australians, and estimates of the population's intake of dietary iodine following implementation of the food standard for the mandatory use of iodised salt in making bread. Food Standards Australia New Zealand (FSANZ) undertook this work as part of its contribution to the monitoring program of the impact of the mandatory fortification standard, Standard 2.1.1 *Cereals and cereal products*.

Mandatory iodine fortification of bread, through the replacement of salt with iodised salt in the making of bread, was implemented in October 2009 in Australia and in November 2009 in New Zealand. The standard aimed to improve the iodine status of the population, particularly in young children, females of child-bearing age and breast-feeding females, to reduce the incidence of iodine-deficiency health problems, including impaired neurological conditions in children. Bread was selected as the food vehicle for mandatory iodine fortification because it is widely consumed by all Australians and New Zealanders including the target groups.

Monitoring the impact of the mandatory fortification standard is an integral part of the standard implementation, as the policy guideline for fortification of food with vitamins and minerals specifies that: *'any agreement to require fortification should require that it be monitored and formally reviewed to assess the effectiveness of, and continuing the need for, the mandating of fortification'*¹. The monitoring framework developed for the impact of the mandatory fortification standard has several components as presented by the Australian Institute of Health and Welfare in published reports on programs to monitor mandatory folic acid and iodine fortification in Australia and New Zealand.

FSANZ's iodine fortification monitoring activities under the framework were not compliance related. They aimed to determine:

- the amounts of iodine in bread and related products on the Australian market after fortification.
- whether estimated dietary intake levels within the target group and the other sub-groups of the Australian population increased following mandatory fortification when compared to intake levels before fortification.
- major contributors to total iodine intakes before and after fortification.

To determine the amounts of iodine in the breads commonly consumed by Australians following mandatory fortification of bread, FSANZ undertook three phases of bread analytical surveys in 2010, 2012 and 2013, as part of the ISFR National Coordinated Survey Plan. The bread samples were purchased from representative food retail outlets in the capital cities of all Australian States and Territories. The phasing of the surveys enabled assessment of the consistency of iodine amounts present at different time periods. Although there were variations in the iodine amounts in the breads sampled during the two surveys, they resulted in only minor differences in the mean iodine levels for the bread types. The analytical results of the amount of iodine in the post-fortification bread samples demonstrated that bakeries were using iodised salt in the making of breads.

¹Ministerial Council Policy Guidelines for the Fortification of Foods with Vitamins and Minerals

The iodine values together with food consumption data from the two available national nutrition surveys were used to estimate the Australian population's usual intake of dietary iodine before and after mandatory iodine fortification of bread. Comparison of the post-fortification dietary iodine usual intake estimates with the population's pre-fortification iodine intake levels indicated an increase in the mean amount of dietary iodine consumed daily by all Australians, particularly the target populations.

1.0 Introduction

This report summarises the activities undertaken by FSANZ in monitoring the impact of the mandatory fortification of bread with iodine through the use of iodised salt. Standard 2.1.1 *Cereals and cereal products* of the Australian New Zealand Food Standards Code (the Code) requires the use of iodised salt for making bread except where the bread is presented as organic or salt is added to the external surface of the bread. The standard aimed to improve the iodine status of the population, particularly in young children, females of child-bearing age and breast-feeding females, to reduce the incidence of iodine-deficiency health problems, including impaired neurological conditions in children.

FSANZ's monitoring activities were part of the monitoring framework for mandatory food fortification to determine the effectiveness of the iodine and folic acid fortification standard. The monitoring framework was established by the Food Regulation Standing Committee (FRSC) and agreed by the Australian Population Health Development Principal Committee in August 2007, and accepted by Australian Health Ministers' Advisory Council (AHMAC) in October 2007.

Details of the framework are provided in the Australian Institute of Health and Welfare's first report on monitoring mandatory iodine and folic acid fortification in Australia and New Zealand (AIHW 2011a). Information on baseline estimates of dietary intakes of iodine and folic acid in Australia, based on work undertaken by FSANZ during the standard development phase, was published in a supplementary monitoring report (AIHW 2011b).

The mandatory iodine fortification standard was also mandated in New Zealand. Monitoring and reporting on the dietary iodine intake of New Zealanders is the responsibility of the New Zealand Ministry for Primary Industries.

The impact of the implementation of the mandatory fortification standard is currently undergoing an independent review by FRSC and the AHMAC in a three stage process that includes an evaluation of: the effectiveness of the public health initiative; the level of compliance of the food industry with the standard and impact on enforcement agencies; and, the adequacy of the monitoring framework.

FSANZ's fortification monitoring activities under the framework were not compliance related. They aimed to determine:

- the amounts of iodine and folic acid in bread and related products on the Australian market after fortification

- whether estimated dietary intake levels within the target group and the other sub-groups of the Australian population increased following mandatory fortification when compared to intake levels before fortification
- major food or food group contributors to total folic acid and total iodine intakes before and after fortification.

In addition, consumers' attitudes to fortification of food were also researched by FSANZ. The reports on two surveys (qualitative and quantitative) on consumer awareness, attitudes and behaviour to fortified foods were published previously on the FSANZ website and are not part of this report (FSANZ 2010 and FSANZ 2013)².

2.0 Background to development of the iodine fortification standard

In response to the advice from Health Ministers in 2008, FSANZ developed the mandatory iodine fortification standard for Australia and New Zealand in 2009. The new food standard required the replacement of non-iodised salt with iodised salt in making wheat-flour based breads except breads represented as 'organic'. The Australia New Zealand Food Standards Code requires iodised salt to consist of potassium iodide or iodate, or sodium iodide or iodate equivalent³ with the iodine component given as a range of 25-65 mg of iodine/kg of salt.

Bread was selected as the food vehicle because it is widely consumed within the Australian and New Zealand populations, and by the target groups. The specific purpose of the regulatory measure was to reduce the prevalence of iodine deficiency in Australia and New Zealand, especially in children. The reduction was to be to the maximum extent possible so as to reduce the risk of physical and mental impairment in children, and thyroid disease across all age groups. The identified target groups for mandatory iodine fortification were therefore young children aged 2-3 years, breast-feeding females and females of child-bearing age (16-44 years old). The concentration of iodine in iodised salt added to bread was set such that the general population, especially young children, was protected from iodine intakes that exceeded recommended upper levels.

3.0 FSANZ's bread surveys

As part of the FSANZ monitoring activities several bread surveys were undertaken to determine the amount of iodine and folic acid in commonly consumed breads available on the Australian market with assistance from the states and territories as part of the Implementation Subcommittee on Food Regulation (ISFR) National Coordinated Food Survey Plan. Three surveys were to determine the amounts of iodine in the different bread types commonly consumed by Australians following implementation of the mandatory fortification standard.

² FSANZ consumer attitudes to fortification reports are available at:
<http://www.foodstandards.gov.au/publications/Pages/Consumers-awareness-attitudes.aspx>

³Standard 2.10.2 of the Australia New Zealand Food Standards Code.

The first bread survey (phase 1) was in June/July 2010, nine to ten months after implementation of the mandatory fortification standard. The second bread survey (phase 2) was in March/April 2012 and the third (phase 3) was undertaken in late April, through May into early June 2013. The bread samples for phases 1 and 2 were purchased from representative food retail outlets in the capital cities of all Australian States and Territories. Phase 3 samples were only sourced from four jurisdictions, Western Australia, Victoria, Queensland and the Australia Capital Territory.

The approach was important in determining the amounts of iodine in breads consumed by Australians in all the jurisdictions and the consistency in iodine amounts at different points in time. Figure 1 is a representation of FSANZ's bread survey sampling periods.

The samples were chemically analysed by the National Measurement Institute (NMI) of Australia's food analytical laboratories in Melbourne.

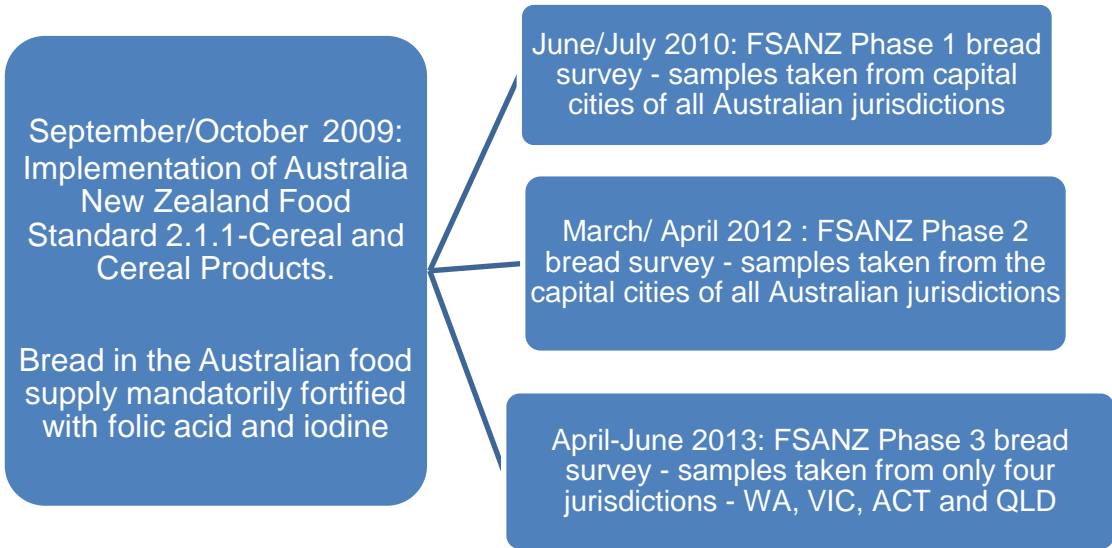


Figure 1: Diagrammatic representation of FSANZ's iodine bread survey sampling periods

3.1 Survey Methodology

3.1.1 General sampling protocol

To undertake the first bread survey in 2010, FSANZ researched market share data from the 2009 Retail World's Australasian Grocery Guide (19th edition, p59). The information presented showed that in Australia, 'Bread loaf' was the bread type with the highest market share (58%) of the *Bread, Rolls and Hotplate* food category. It also provided data on the major bread loaves that were commonly consumed. FSANZ therefore decided to sample for its bread surveys the three main types of sandwich breads (*bread loaf*) consumed by Australians.

FSANZ developed and provided specific sampling plans for the purchase of the bread types required. The sampling plan and protocol provided details of where the samples were to be

purchased, how many of each bread type was to be bought and how they were to be packaged for transportation to the laboratory. A template was provided for recording the details required for each bread sample purchased.

Each jurisdiction was provided with their specific sampling plan and the full sampling plan was provided to NMI, the contracted food analytical laboratory. The sampling plan ensured that the purchase of samples reflected the market share of the bread types consumed, and adequate samples were purchased from big commercial industry bakeries, supermarket chain bakeries and small-scale local bread shops. The description of retail outlets in the different bakery categories used is:

- Supermarket bakeries - include bakeries owned by supermarket shops such as Woolworths, Coles, Supabarn and Aldi.
- Local small-scale bakeries - include hot bread shops and pastry shops.
- Industry bakeries - include George Weston Foods and Goodman Fielder, the two major ones in the country that account for brands such as Tip Top, Helga's, Burgen, Wonder White and Buttercup and franchise bakeries.

Details of the samples purchased from the different retail outlets for the surveys and an example of the sampling plan is provided in Appendix 1.

3.1.2 Phase 1 sampling

A total of 100 samples of bread from seven bread types were purchased from major supermarkets and small bread shops in the capital cities of the eight states and territories. The first bread survey (phase 1) was undertaken in June and July of 2010. Although the focus was on the three main bread types consumed by Australians (white, wholemeal and multigrain), since this was the very first survey, a small number of other sandwich bread types were sampled to assess the amounts of iodine they contained.

The bread types sampled in phase 1 were:

- White bread
- Wholemeal bread
- Multigrain and seeds bread
- Flat breads i.e. Wraps, Focaccia, Naan, and Lavash.
- English Muffins
- Organic bread
- Gluten free bread

3.1.3 Phase 2 sampling

The second bread survey (phase 2) was conducted in March/April 2012, about two and a half years after the standard was implemented. This survey only sampled the commonly consumed three main bread types i.e. white, wholemeal and multigrain and seeds breads. Ninety-six bread samples were purchased from all the states and territories using

representative food retail outlets similar to those used in phase 1. For this phase of sampling, FSANZ prepared four loaves of 'unfortified bread samples' using unfortified wheat flour and non-iodised salt. These FSANZ samples were to be used as blanks to assess the amount of iodine they contained for comparison with those bought from the bakeries.

3.1.4 Phase 3 sampling

The third bread survey was undertaken from late April through to early June 2013. This sampling was carried out about three and a half years after implementation of the fortification standard. Unlike the previous two surveys, samples were sourced from only four jurisdictions, Western Australia, Victoria, Queensland and the Australia Capital Territory. However, the samples were purchased from representative food retail outlets in the capital cities of these jurisdictions as were those for phases 1 and 2.

4.0 Sample preparation and analysis

The NMI food analytical laboratory in Melbourne was contracted to undertake the iodine analysis, and used the same sample preparation and analytical methods for bread samples from all the surveys. Samples from all the jurisdictions were individually coded and weighed on arrival at the laboratory. One-half of each loaf of bread was then taken and air-dried overnight at about 37 degrees Celsius and the other half was stored frozen. The dried bread samples (crust and crumb) were each separately homogenised to below 0.25mm particle size (preferably <0.125mm) and stored in labelled air-tight containers. The particle size is important to enable complete iodine extraction. The required sub-sample of the well-homogenised test sample of individual breads, were then taken for analysis.

The FSANZ-baked unfortified samples of the three bread types were similarly prepared for analysis to determine the amount of naturally occurring iodine they contained.

4.1 Analytical method used

Iodine in the bread samples was extracted using tetramethyl-ammonium hydroxide at elevated temperature. Following dilution and filtration, the iodine level in the extracted solutions were determined by inductively coupled plasma-mass spectrometry (ICP-MS) using Agilent 7500CE. The analytical method used is accredited by the National Association of Testing Authorities, Australia (NATA). The method used is recognised as valid and suitable for analysis of iodine in food.

The moisture content of the bread samples were also determined but whereas phase 1 and 3 samples were individually analysed for their moisture content, phase 2 samples had moisture content determined for composite samples of each bread type. Each composite consisted of a bread sample from each jurisdiction. Each analysis was done in duplicate.

The limit of reporting (LOR) for the method was 0.01 mg/kg. Acceptable recovery was set at 80-120% and acceptable Relative Percent Difference (RPD) on duplicates at 38% for results <10 times LOR and 24% for results >10 times LOR. The quality assurance protocols per sample batch included one blank for every 20 samples with a minimum of 2 blanks per batch

and one sample reference material (SRM) every batch. One sample spike and one blank spike every 20 samples.

5.0 Survey results – Post-fortification amounts of iodine in breads

The summary of the analytical results for all three phases of the bread survey are shown in Table 1. The mean, minimum and maximum amounts of iodine measured in white, wholemeal and multigrain & seeds breads (the three main bread types) for each survey are shown separately. The iodine results provided by the laboratory for the bread samples are on as purchased weight basis, although the samples were dried for the analysis. The results showed all the bread samples from the different sampling periods contain levels of iodine that indicate iodised salt had been used. Table 2 shows the iodine levels of the four unfortified* bread samples baked by FSANZ and indicate the amounts that would have been present if fortified wheat flour had not been used, hence these results served as a baseline for iodine in bread.

Table 1: Summary data all surveys - amount of analysed iodine in the bread samples

Bread Type	Bread Fortification Monitoring Program	No. of samples	Iodine ($\mu\text{g}/100\text{g}$)			Standard Deviation	Mean Moisture Content ($\text{g}/100\text{g}$)
			Mean	Min	Max		
White bread	Phase 1	28	62.77	0.5	270	46.38	38.20
	Phase 2	32	66.69	18	140	27.57	38.10
	Phase 3	37	55.92	20	110	19.29	37.67
Wholemeal bread	Phase 1	16	70.06	38	140	36.76	39.83
	Phase 2	32	68.50	22	140	23.09	38.50
	Phase 3	28	52.86	23	95	16.53	38.84
Multigrain and seeds bread	Phase 1	17	56.53	30	140	32.60	36.73
	Phase 2	32	63.03	22	150	30.04	38.20
	Phase 3	30	59.93	33	91	14.68	37.81

Information on the amount of iodine in the organic, gluten free, English muffin and flat bread samples purchased for survey 1 is provided in Appendix 1. These values were not used to derive the mean iodine levels in bread for estimating the Australian population's dietary intakes of iodine.

Table 2: Iodine and moisture content of FSANZ prepared unfortified* bread samples - bread survey 2

Bread type	No. of samples	Mean iodine value (µg/100g)	Mean moisture content (g/100g)
White Bread	2	1.7	41.95
Wholemeal Bread	1	1.8	44.1
Multigrain Bread	1	2.3	39.8

*Unfortified samples made with unfortified bread-making flour and non-iodised salt.

5.1 Summary of results from the surveys

The average amount of iodine measured in bread samples before the introduction of mandatory iodine fortification was less than 2.0 µg/100g (NUTTAB 2006). This value was verified by the analysed mean iodine values of the unfortified bread samples prepared by FSANZ.

The results show an increase in the amount of iodine present in the bread samples following mandatory iodine fortification. Despite the noted differences in the mean iodine values for the bread types, the range of values reported within each phase and the variations in the values for samples collected for the three phases indicate that the bakeries were using iodised salt in making bread. One possible exception was noted in phase 1 where the minimum iodine content of the bread sample was 0.5 µg iodine/100g. The mean iodine content of the iodised salt used was estimated to range from 53-70 µg/100g.

Results for iodine content in breads from the 2010, 2012 and 2013 surveys, together with food consumption data from national nutrition surveys were used to: estimate the Australian population's intake of dietary iodine before and after the implementation of fortification of salt for use in bread making in October 2009; compare estimated iodine intakes for different population groups with relevant nutrient reference values; and identify food groups that were major contributors to iodine intake before and after fortification. The focus of the estimates was primarily on the target population.

The results of the bread surveys were also used to update the Australian food composition database that is compiled by FSANZ (FSANZ 2014).

6.0 Estimated usual intake of dietary iodine

The Australian population groups most vulnerable to iodine deficiency are developing foetuses and young children up to three years of age. For that reason although the dietary iodine intake of all Australians needed to be at optimum levels, young children, pregnant and breast-feeding females were identified as the target populations for mandatory iodine fortification of bread.

6.1 Methodology

6.1.1 Calculations required to estimate iodine intakes

Dietary intake assessment requires data on concentrations of the nutrient of interest (iodine) in the foods consumed, and food consumption data that have been collected through a national nutrition survey. To estimate the Australian population's intake of dietary iodine following mandatory iodine fortification of bread, FSANZ used the analytical results from the bread surveys and food consumption data from the 1995 National Nutrition Survey (1995 NNS) for estimating iodine intakes for adults and the 2007 Children's Nutrition and Physical Activity Survey (2007 ANCNAPS) for children aged 2-16 years of age.

The bread survey data was used to revise the iodine content of foods coded as bread, contained bread (e.g iced bun), or were mixed dishes that contained components made of bread for the post-fortification calculations. The nutrient content of other foods that may contain iodine were also updated for the post-fortification iodine intake calculations, using the Australian food composition database, prepared for the 2007 ANCNPAS.

It is best practice to compare usual nutrient intakes to current Nutrient Reference Values (NRVs) for nutrients. Usual intakes are an estimate of what people 'usually' eat, as opposed to what they reported eating on the particular days they were surveyed. The methodology involved use of the 2nd day statistical adjustment method that accounts for intra-individual variation and a custom model that used recipes. The recipe approach enabled the capture of amounts of iodine consumed through use of discretionary iodised salt, mixed foods containing bread, foods with naturally occurring iodine, in addition to iodine from bread. To capture the iodine contributed to dietary iodine intake from use of discretionary iodised salt, a set addition of iodised table salt, assigned a value of 45 mg of iodine per kilogram of salt (the mid-point of the food standard for salt iodisation), was included in some models. A market weighted model (representing the mid-point of the population's consumption of iodised foods) and a consumer behaviour model (representing the polarity in the population's consumption of discretionary iodised salt) were run to determine the iodine intake levels before and after fortification. Detailed information on FSANZ's dietary modelling principles and practices are available on the FSANZ website at:

[http://www.foodstandards.gov.au/science/exposure/Documents/Principles%20 %20practices %20exposure%20assessment%202009.pdf](http://www.foodstandards.gov.au/science/exposure/Documents/Principles%20%20practices%20exposure%20assessment%202009.pdf)

The model was run through DIAMOND (FSANZ custom-developed computer program) to determine the total amount of iodine consumed by each individual respondent using food consumption data from the two national nutrition surveys. The iodine intake estimates for children aged 2-16 years used data from the 2007 ANCNAPS, noting these data were not available for use in modelling during the development of the mandatory iodine fortification standard. The 1995 NNS food consumption data were used for estimates for Australians aged 16 years and above as they are the only available national food consumption data for this age group.

To ensure that the food consumption data used for the estimates were representative of the Australian population, where necessary, the data were weighted to reflect the weighting used for the survey samples. Despite the differences in the methodologies for the two surveys, the iodine intake estimates presented in this report reflect as accurately as possible, the

Australian population's intake of dietary iodine following implementation of the food standard for mandatory use of iodised salt in making bread.

As a new custom model was developed for the iodine estimates, the pre-fortification usual iodine intake estimates were re-calculated using this model to generate the baseline for comparison with the post-fortification intake estimates, with results being of a similar magnitude. Four scenarios of post-fortification estimates of usual iodine intake values for the Australian population were modelled based on the analysed mean iodine value for samples in each of the three bread surveys and on a weighted mean of analysed values of all samples in the three analytical surveys. As results were basically similar for each of these scenarios this report presents the post-fortification usual iodine intake estimates derived from the weighted mean of the three surveys to compare with the pre-fortification estimate. Full details of the estimated usual iodine intake using data from each of the bread surveys and the weighted mean are provided in Appendix 1.

The estimates of dietary usual iodine intake in this report are based on the amounts of iodine present in all foods including bread consumed by the individual before and after fortification. The post-fortification intake includes the mean amount of iodine present in the bread samples analysed, taking account of amounts eaten from mixed foods containing bread.

6.1.2 Australian Health Survey Data

New food consumption data for the Australian population were published from the 2011-12 National Nutrition and Physical Activity Survey (NNPAS) component of the Australian Health Survey (AHS) by the Australian Bureau of Statistics in 2014 (ABS, 2014a). The survey data have not yet been incorporated into FSANZ's dietary modelling system and therefore could not be used to assess the nutrient fortification scenarios required. Bread consumption data for regular breads and rolls from the 2011-12 NNPAS were summarised and a comparison made with previous surveys in general terms (see Appendix 1, Table A.7).

For children aged 2-16 years the proportion of consumers and mean consumption for consumers for bread and rolls only were similar to those from the 2007 ANCNPAS. For adults 19 years and above and females aged 16-44 years, the proportion of consumers and mean consumption of regular bread and rolls for consumers only for the 2011-12 NNPAS were lower than those for the 1995 NNS, with mean consumption of bread and rolls being around 20 grams per day less (one slice of bread is equivalent to around 30 grams). These differences could be real differences but could also partly be due to other factors: differences in the recording and coding of composite foods, such as bread in sandwiches and bread based dishes being assigned to different food groups; and/or due to the increase in under-reporting in the 2011-12 NNPAS compared to the 1995 NNS, which was reported to a greater extent in males and described as due to higher carbohydrate foods, of which bread is one (ABS, 2014b). Further in-depth research is required on these differences and potential impact on estimated folic acid and total DFE intakes.

6.2 Estimated mean dietary usual iodine intakes

The estimated mean dietary usual iodine intake for the different age groups of the Australian population following mandatory use of iodised salt in making bread, and the amount by which they increased are shown in Table 3. Figures 2 and 3 show plots of the estimated mean

usual iodine intakes (market weighted model) before and after fortification, based on age group and gender for Australian adults and children respectively.

6.2.1 Usual intake estimates for the target populations

The priority population groups for mandatory iodine fortification were young children aged 2-3 years and females of child-bearing age (16-44 years old) including breast-feeding females.

The estimates of the post-fortification mean usual iodine intake for all children aged 2-3 years indicated an increase of 37 µg/day, a 29% increase on the pre-fortification mean usual intake values. The estimated increases were the same for both the market weighted model and the consumer intake model. The increase in the estimated usual iodine intake was very similar to the increase projected for the target group when the intake assessments were determined for the development of the mandatory iodine fortification standard (FSANZ 2008). The usual iodine intake estimates for 2-3 year old children by gender, indicated boys to have higher increases in mean usual intake compared to girls (31% increase in mean usual intake compared to 28% for the girls, Table 4).

Table 3: Estimated mean usual dietary iodine intake for Australians 2 years and above

Estimated mean usual intake of dietary iodine ($\mu\text{g}/\text{day}$)					
Age group (both sexes)	Market weighted model			Consumer behaviour model	
	Pre-fortification	Post-fortification [@]	Increase in mean intake	Pre fortification	Post-fortification [@]
2-3 years[#]	127	164	+37	120	157
4-8 years[#]	120	171	+51	111	161
9-13 years[#]	141	196	+55	127	182
14-16 years[#]	154	216	+62	136	198
2-16 years[#]	135	187	+52	122	175
17-18 years[*]	119	182	+63	108 - 159	171 - 225
19-29 years[*]	116	180	+64	106 - 154	170 - 219
30-49 years[*]	108	170	+62	99 - 144	161 - 207
50-69 years[*]	103	162	+59	93 - 142	152 - 201
70 years and above[*]	94	151	+56	85 - 131	141 - 187
17 years and above[*]	107	168	+61	97 - 144	158 - 206
16-44 years[*] (Females)	98	149	+51	89 - 133	139 - 185

[@]Weighted average of estimated post-fortification mean intake of results from the three bread surveys.

[#] Derived using the 2007 Australian Children's national Nutrition and Physical Activity Survey (includes quantified salt consumption), 2nd day adjusted usual intake estimates.

^{*} Derived using the 1995 Australian National Nutrition Survey, 2nd day adjusted usual intake estimates.

[^] In the consumer behaviour model, the left-hand number in the range values for adults is for consumers who never choose iodised discretionary salt and the right-hand number in the range is for consumers who always choose iodised discretionary salt, i.e. salt with a mean iodine concentration of 45 mg iodine/kg salt. No range in estimated inadequate iodine intakes is necessary for children aged 2-16 years since discretionary iodised salt consumers were identified in the short questions for the 2007 ANCNAPS.

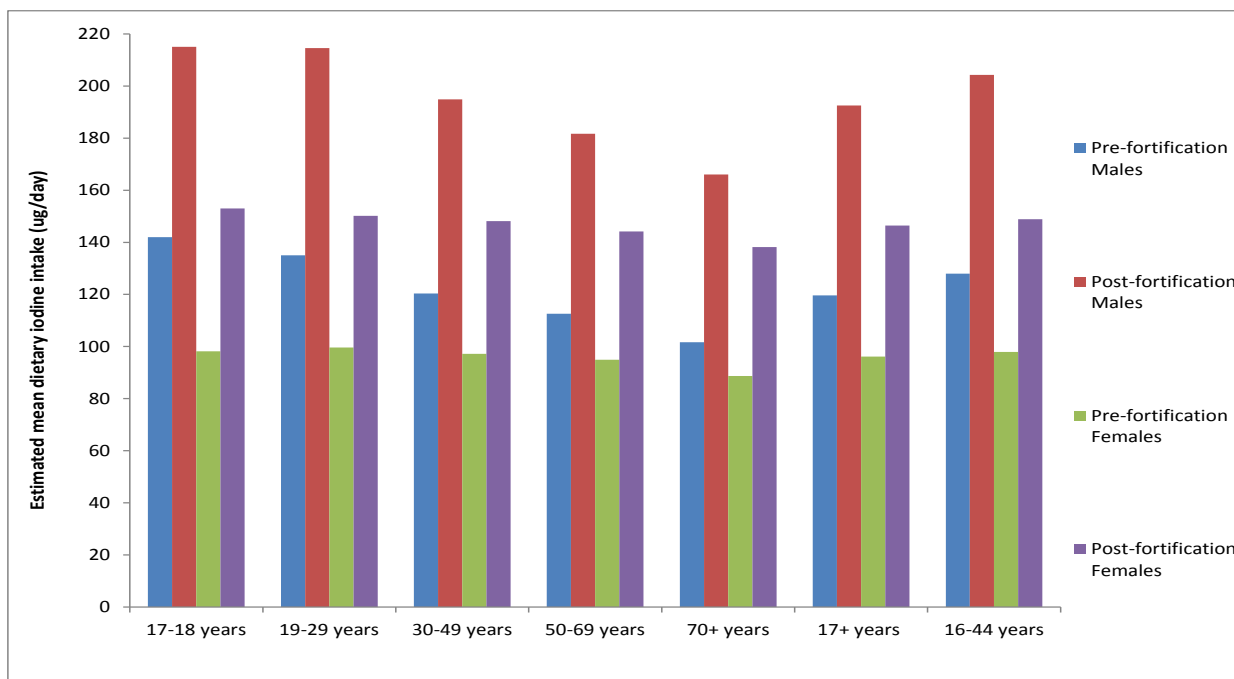


Figure 2: Estimated mean dietary usual iodine intakes for Australian adults by age group and gender

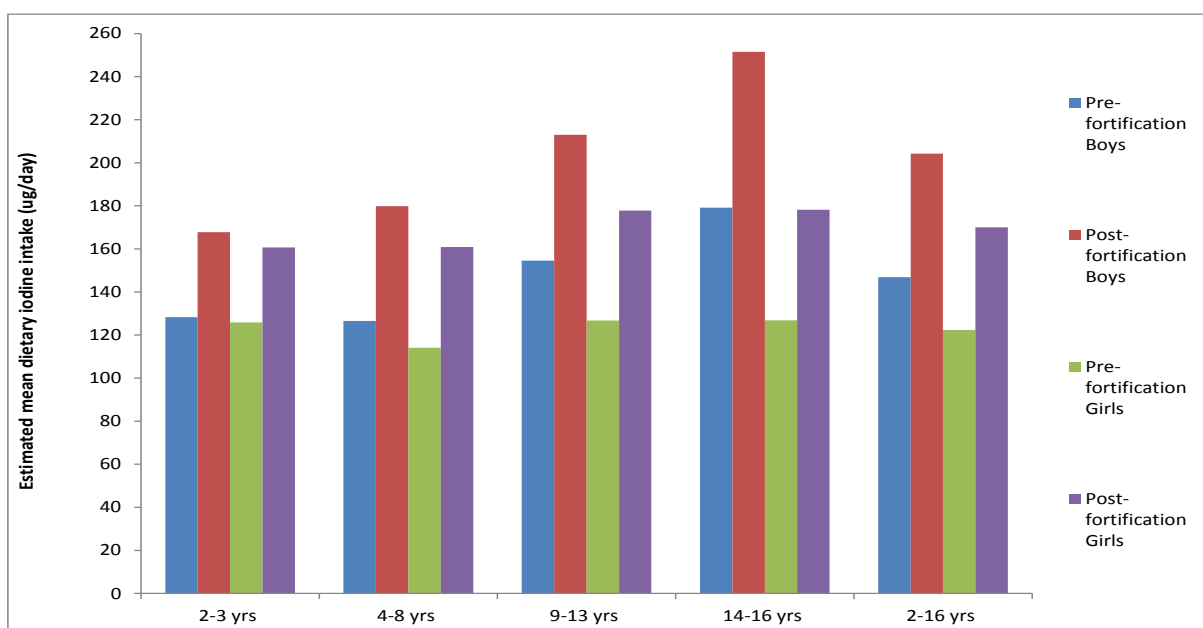


Figure 3: Estimated mean dietary usual iodine intakes for Australian children by age group and gender

The estimated increase in the mean daily iodine usual intake for females of child-bearing age (16-44 years) was 51 $\mu\text{g}/\text{day}$ after iodine fortification of bread. This represented a 52% improvement over the pre-fortification intake values and matched the increase projected during the standard development (FSANZ 2008). For adults, the two models used in assessing dietary intake gave results that are expressed differently. Although the consumer

behaviour model provided range values, they average to increases in iodine intake that are similar to those given by the market weighted model for the different age groups, including females of child-bearing age. The range values reflected the mean intake of those consumers who never chose iodised discretionary salt (lower end) and consumers who always chose iodised discretionary salt (upper end).

Table 4: Percent increases in estimated mean usual dietary iodine intake of Australians by age group and gender

Age group	Increase in estimated mean usual iodine intake over pre-fortification intake level (%)		
	Both sexes	Males	Females
2-3 years [#]	29	31	28
4-8 years [#]	42	42	41
9-13 years [#]	39	38	40
14-16 years [#]	40	40	41
2-16 years [#]	39	39	39
17-18 years [*]	53	52	56
19-29 years [*]	55	59	51
30-49 years [*]	57	62	52
50-69 years [*]	57	61	52
70 years and above [*]	59	63	56
17 years and above [*]	57	61	52
16-44 years [*]	58	60	52

Estimates for age group derived using the 2007 ANCNPAS (includes quantified salt consumption), 2nd day adjusted usual intake estimates.

*Estimates for age group derived using the 1995 National Nutrition Survey, 2nd day adjusted usual intake estimates

6.2.2 Usual intake estimates for non-target population sub-groups

The estimated increase in mean dietary iodine intake for all Australians aged 4 years and above was between 50 and 64 µg/day following mandatory iodine fortification of bread (Table 3). The percent increases in the estimated mean usual intake for males and females in this age category ranged from 42-62% for males and 41-56% for females (Table 4). For the other population sub-groups, the average increases in estimated mean usual iodine intake and the percent increases on their pre-fortification intake amounts are shown in Tables 3, 4.

- Young adults aged 19 to 29 years had an average increase of 64 µg/day (a 55% increase). The estimated increase for young men in the same age group was 80 µg/day (a 59% increase), compared to 50 µg/day for women, (a 51% increase).
- Adults aged 50 to 69 years had an average increase of 59 µg/day (a 57% increase). Men in that age group had an increase of 69 µg/day (a 61% increase), compared to 49 µg/day for women (a 52% increase).
- Adults aged 70 years and above had an average increase of 56 µg/day (a 59% increase). Men in that age group had an increase of 64 µg/day (a 63% increase) compared to 49 µg/day for women (a 56% increase).

The estimates clearly indicate that following mandatory fortification of bread with iodine, the estimated mean dietary usual iodine intakes of all Australians, including the target groups, had increased considerably (Figures 2 and 3). The amount of increase was as predicted, for some groups and more than predicted for other groups of the population, prior to implementation of the mandatory fortification standard (FSANZ 2008).

6.3 Estimates of 5th and 95th percentile dietary usual iodine intakes

The estimated values of dietary usual iodine intake at the 5th and 95th percentiles for the different Australian population age groups prior to, and after fortification of bread with iodine, are given in Table 5⁴. For ease of comparison, the estimated mean usual intake values are also provided in the table.

⁴ For nutrient intakes it is international practice to report 5th and 95th percentiles, based on second day adjusted intakes. Where nutrients have a non-normal distribution and second day adjustments are not possible, for example folic acid, other percentiles may be used.

Table 5: Estimated mean, 5th and 95th percentile usual dietary iodine intake values for Australians

Age group (Both Sexes)	Mean iodine intake (µg/day)		5th percentile iodine intake (µg/day)		95th percentile iodine intake (µg/day)	
	Pre- fortification	Post- fortification	Pre- fortification	Post- fortification	Pre- fortification	Post- fortification
2-3 years[#]	127	164	57	92	208	243
4-8 years[#]	120	171	57	101	194	250
9-13 years[#]	141	196	68	115	234	294
14-16 years[#]	154	216	71	115	269	343
2-16 years[#]	135	187	63	106	228	291
17-18 years[*]	119	182	53	96	205	293
19-29 years[*]	116	180	57	96	200	287
30-49 years[*]	108	170	58	98	176	267
50-69 years[*]	103	162	57	97	164	245
70 years and above[*]	94	151	54	94	149	221
17 years and above[*]	107	168	57	97	178	265
16-44 years[*] (Females)	98	149	52	90	157	217

[#]Estimates for age group derived using the 2007 ANCNPAS (includes quantified salt consumption), 2nd day adjusted usual intake estimates.

^{*}Estimates for age group derived using the 1995 National Nutrition Survey, 2nd day adjusted usual intake estimates.

6.4 Proportion of Australians with dietary iodine intakes outside of the relevant nutrient reference values

The dietary exposure assessment that FSANZ undertook to determine the Australian population's intake of iodine following fortification of bread, also estimated the proportion of the target groups and other population age groups with dietary usual iodine intakes below the Estimated Average Requirement⁵ and above the Upper Level of Intake⁶ values.

⁵ Estimated Average Requirement – a daily nutrient level estimated to meet the requirements of half the individuals in a population and used to estimate the prevalence of inadequate intakes within a group.

⁶ Upper Level of Intake – the highest average daily nutrient intake level that is likely to pose no adverse health effects to almost all individuals in the general population. It is used to estimate the percentage of the population at potential risk of adverse effects from excessive intake.

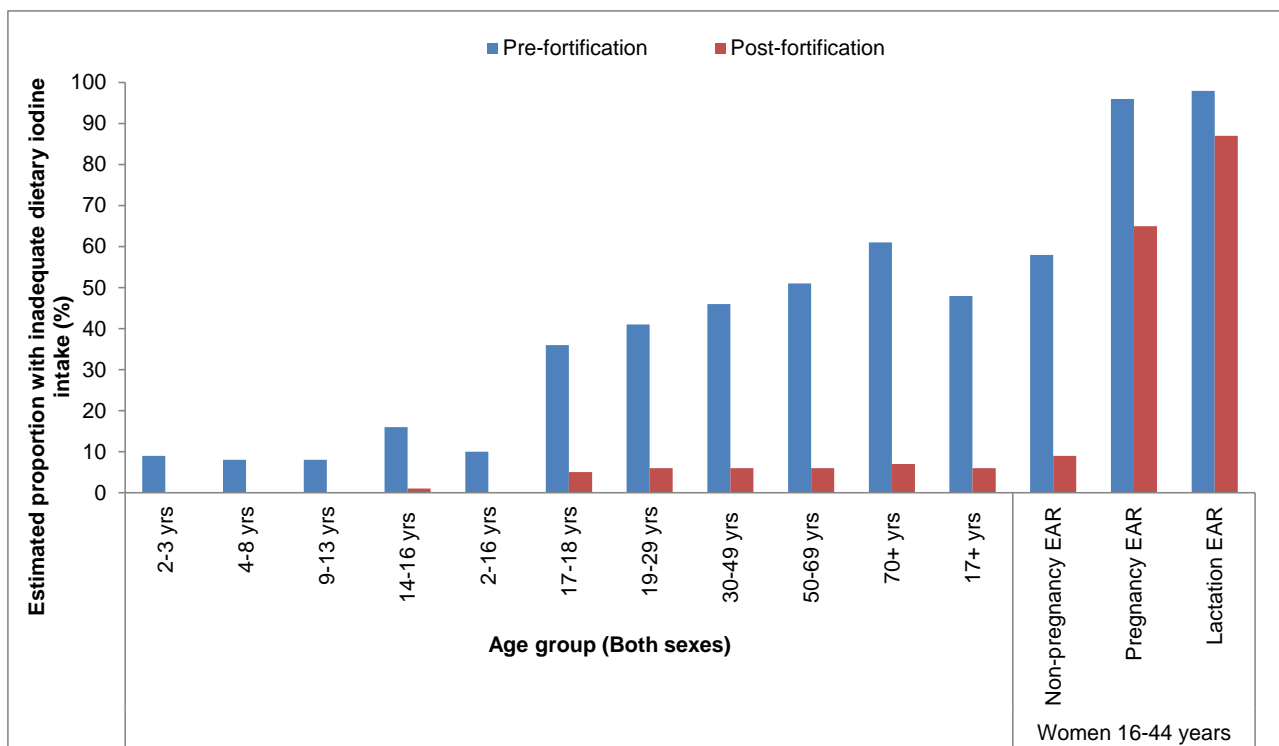


Figure 4: Estimated proportion of Australians with inadequate dietary iodine intake (below EAR)

6.4.1 Usual intake estimates below the estimated average requirement (EAR)

The proportion of the population with usual iodine intakes below the EAR indicates prevalence of inadequate iodine intake levels, while the proportion with intakes above UL indicates the proportion at potential risk of adverse health effects from excessive iodine intake. Figure 4 and Table 6 show the estimated proportions of the population by age group in these situations before and after fortification. They clearly demonstrate that following mandatory fortification of bread with iodine, the proportion of the different population age groups estimated to have inadequate iodine intake decreased that was irrespective of the assessment model used (market-weighted/consumer model), see Table 6. Figure 4 is based on estimated values from the market weighted model with values rounded to the nearest whole number (values between 1 to10) or the nearest 5% (values between 10 to100).

Table 6: Proportion of Australians estimated to have dietary iodine intake below the EAR

Age group (both sexes)	EAR (µg/day)	Proportion with dietary iodine intake below the EAR (%)			
		Market weighted model		Consumer behaviour model	
		Pre-fortification	Post-fortification	Pre-fortification	Post-fortification
2-3 years [#]	65	9	<1	10	<1
4-8 years [#]	65	8	<1	10	<1
9-13 years [#]	75	8	<1	10	<1
14-16 years [#]	95	15	1	25	2
2-16 years [#]	No value assigned	10	<1	15	<1
17-18 years [*]	95	35	5	16-43	3-7
19-29 years [*]	100	40	6	21-52	4-8
30-49 years [*]	100	45	6	22-57	3-9
50-69 years [*]	100	50	6	19-64	2-10
70 years and above [*]	100	60	7	22-75	3-13
17 years and above [*]	No value assigned	50	6	21-60	3-9
16-44 years (Females -not pregnant) [*]	95-100	60	9	30-69	6-13
16-44 years (Females -pregnancy EAR) [*]	160	95	65	70-97	34-73
16-44 years (Females -lactation EAR) [*]	190	100	85	86-99	56-91

[#]Estimates for age group derived using the 2007 ANCNPAS (includes quantified salt consumption).

^{*}Estimates for age group derived using the 1995 National Nutrition Survey.

Range values for adults with the consumer behaviour model for consumers demonstrating the variation between those who never choose iodised discretionary salt and consumers who always choose iodised discretionary salt, i.e. salt with a mean iodine concentration of 45 mg iodine/kg salt.

The proportion of children aged 2-3 years estimated to have inadequate intake levels of dietary iodine decreased from 9% before fortification to less than 1% after mandatory iodine fortification of bread. Similarly, the proportion of females of children-bearing age (non-pregnant) estimated to have inadequate iodine intakes decreased from 60% to 9% following mandatory iodine fortification of bread. Ten percent of children aged 2-16 years were

estimated to have inadequate iodine intakes levels before iodine fortification, this proportion decreased to less than 1% after fortification. Older adults also had a decrease in the proportion estimated to have inadequate iodine intakes. The estimated decrease for persons aged 50-69 years was from 50% before fortification to 6% after fortification. The proportion of the population aged 70 years and above estimated to have inadequate iodine intake decreased from 60% before fortification to 7% after fortification.

The decrease in the proportion of the target population estimated to have inadequate iodine intake is an important interim outcome for the health outcome of reducing the number of children who will be affected by the health impacts of low levels of dietary iodine intake.

6.4.2 Usual intake estimates above the upper level (UL)

A small segment of the population was estimated to have dietary usual iodine intakes above the UL both before and after fortification. Table 7 presents the results of estimates for the prevalence of excessive levels of dietary iodine intake within the Australian population following iodine fortification of bread. It indicated that the only population age group likely to have excessive iodine intakes following fortification was the 2-3 year olds, with 20% of this age group estimated to have iodine intakes above the UL after fortification, compared to 7% before iodine fortification. The increases in estimated mean usual iodine intake values and the decrease in the proportion of the different population sub-groups with inadequate iodine intake were similar to the predicted values in some cases and more than predicted in others (see section 9). The proportion of children estimated to have excessive iodine intake decreased substantially after 3 years of age with less than 1% of children aged 4-16 year olds having intakes that exceeded the upper limit of intake.

Although the estimate indicates that about one fifth of 2-3 years olds may have excessive iodine intakes, the extent to which the age group exceeds the upper limit will depend on the amount of discretionary iodised salt consumed in the diet.

In considering whether the proportion of 2-3 year olds estimated to have iodine intakes above the UL are likely to have any adverse health problems related to their levels of intake, it is important to note that age-specific ULs are not absolute thresholds for toxicity of intake. They represent intake limits that were derived based on findings in adults and extrapolated to children based on their relative metabolic body weights. Therefore, exceeding the UL although not desirable does not automatically lead to an adverse health outcome.

A study of children aged 1^{1/2} and 4^{1/2} years in the UK COT study (COT 2000) showed that children's iodine intake could vary from 87-307 µg/day with almost all the dietary iodine intake derived from the consumption of milk. Dietary iodine intake of 307 µg/day was almost 54% above the UL for 2-3 year olds. However, the Scientific Committee on Food on the Tolerable Upper Intake level of iodine noted that '*an UL is not a threshold of toxicity but may be exceeded for short periods without an appreciable risk to the health of the individual concerned*'. Further, the iodine chapter of the 2004 WHO/FAO document on vitamin and mineral requirements in human nutrition recommends a 50 µg/kg/day upper limit of iodine intake for 2-3 year olds (WHO/FAO 2004). Based on the WHO/FAO iodine intake upper limit, a toddler weighing 15.5kg (average body weight for 2 to 3 year olds from the Australian 2007 National Nutrition and Physical Activity Survey) could have an iodine intake as high as 775 µg/day before the UL is exceeded. The total dietary iodine intake of 2-3 year olds exceeding

the NHMRC UL after fortification was about 32% of the higher WHO recommended UL by body weight.

The iodine intake estimates indicate that for children the period of iodine intake that exceeds the UL is transient, and less than 1% of them have estimated iodine intakes above the UL when they turn 4 years. Although it is generally undesirable to exceed the UL, there is evidence to indicate that young children are able to exceed their respective estimated ULs by 2-3 times without apparent adverse consequences. This and the reversible nature of the endpoint (sub-clinical hypothyroidism) means such intakes are unlikely to represent a health and safety risk to young children, though a reduced margin of safety exists (FSANZ 2007; FSANZ 2008).

Table 7: Proportion of Australians with dietary iodine intake above the UL

Age group (both sexes)	UL (µg/day)	Proportion with dietary iodine intake above the UL (%)			
		Market weighted model		Consumer behaviour model	
		Pre-fortification	Post-fortification	Pre-fortification	Post-fortification
2-3 years #	200	7	20	4	15
4-8 years #	300	0	<1	0	<1
9-13 years #	600	0	0	0	0
14-16 years #	900	0	0	0	0
2-16 years #	No value assigned	<1	3	<1	2
17-18 years*	900	0	0	0	0
19-29 years*	1,100	0	0	0	0
30-49 years*	1,100	0	0	0	0
50-69 years*	1,100	0	0	0	0
70 years and above*	1,100	0	0	0	0
17 years and above*	No value assigned	0	0	0	0
16-44 years (Females)*	Ranges from 900-1,100	0	0	0	0

#Estimates for age group derived using the 2007 ANCNPAS (includes quantified salt consumption).

*Estimates for age group derived using the 1995 National Nutrition Survey.

7.0 Major food contributors to estimated dietary iodine intake of Australians

This section describes the amount of iodine each food group contributed to the total mean daily iodine intake of each individual, with major contributors identified for Australians (target group and other sub-groups of the population) both before and after iodine fortification of bread. A major food contributor to iodine intake is a food group that contributes 5% or more than to the total dietary iodine intake estimate.

7.1 Food contributors to children's dietary iodine intake

The major food contributors to the dietary iodine intake of children aged 2-3 years and 2-16 years, including the proportion they contributed are given in Figures 5 and 6. These results were derived using the 2007 ANCNPAS. The iodine amounts include dietary iodine from discretionary salt use, which was quantified in the survey results. The two figures show that the major food groups that contributed to the estimated dietary iodine for children aged 2-3 years and 2-16 years were milk products and dishes, non-alcoholic beverages, cereals and cereal products and cereal-based products and dishes.

The component foods of these major food groups are:

Milk products and dishes

- Milks (plain and flavoured), evaporated milk, condensed milk, milk powders
- Yoghurts (plain, flavoured and fruit), frozen yoghurts
- Cheeses and Creams
- Ice creams and ice confections (dairy and soy-based)
- Custards and other dairy based desserts
- Soy- based beverages

Non-alcoholic beverages

- Teas and Coffees (all forms)
- Fruit and vegetable juices and drinks
- Cordials, soft drinks and mineral waters
- Electrolyte drinks, sports drinks
- Bottled water and tap water.

Cereal and cereal products

- Grains
- Breads and rolls
- English style muffins, crumpets
- Breakfast cereals
- Cereal flours and starch powders
- Tortillas, pastas, noodles and rice

Cereal based products and dishes

- Biscuits (sweet and savoury)
- Cakes and Muffins (cake style)
- Buns, scones, pancakes, crepes, pikelets and doughnuts
- Pastries and pastry products (sweet and savoury)
- Pizzas, sandwiches, filled rolls and hamburgers
- Taco and tortilla-based dishes
- Savoury pasta and sauce dishes
- Dim-sims, spring rolls, savoury rice-based dishes

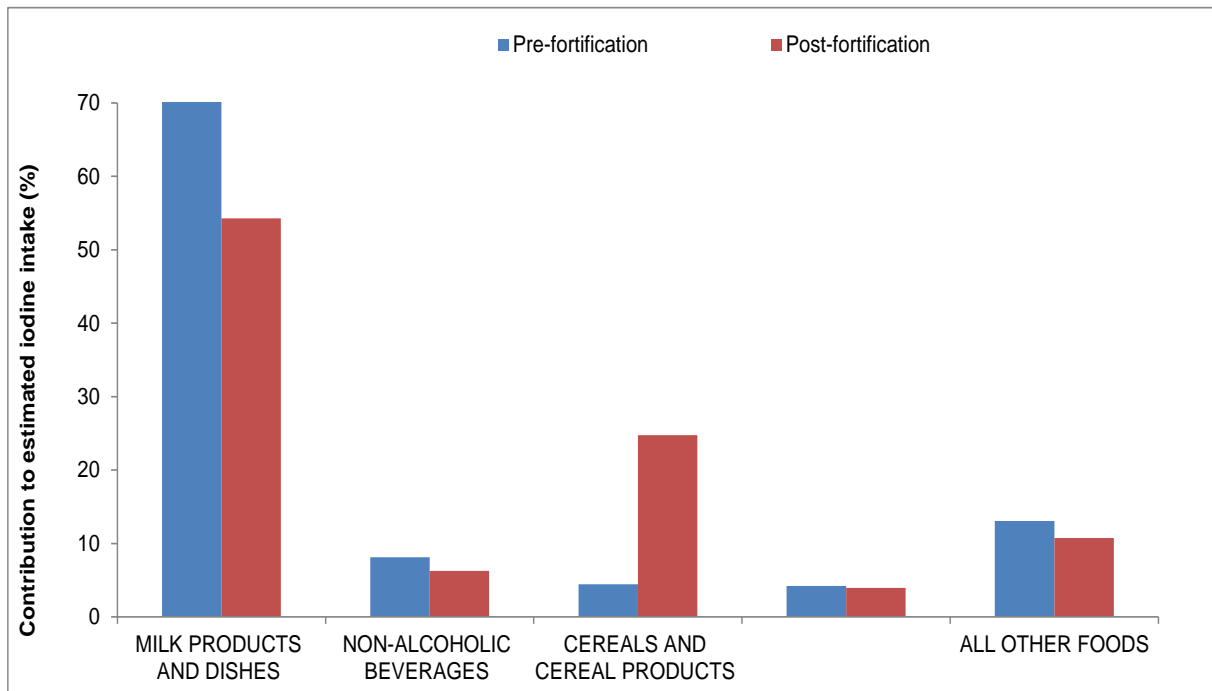


Figure 5: Major food contributors to total dietary iodine intake (%) – Australian children 2-3 years old

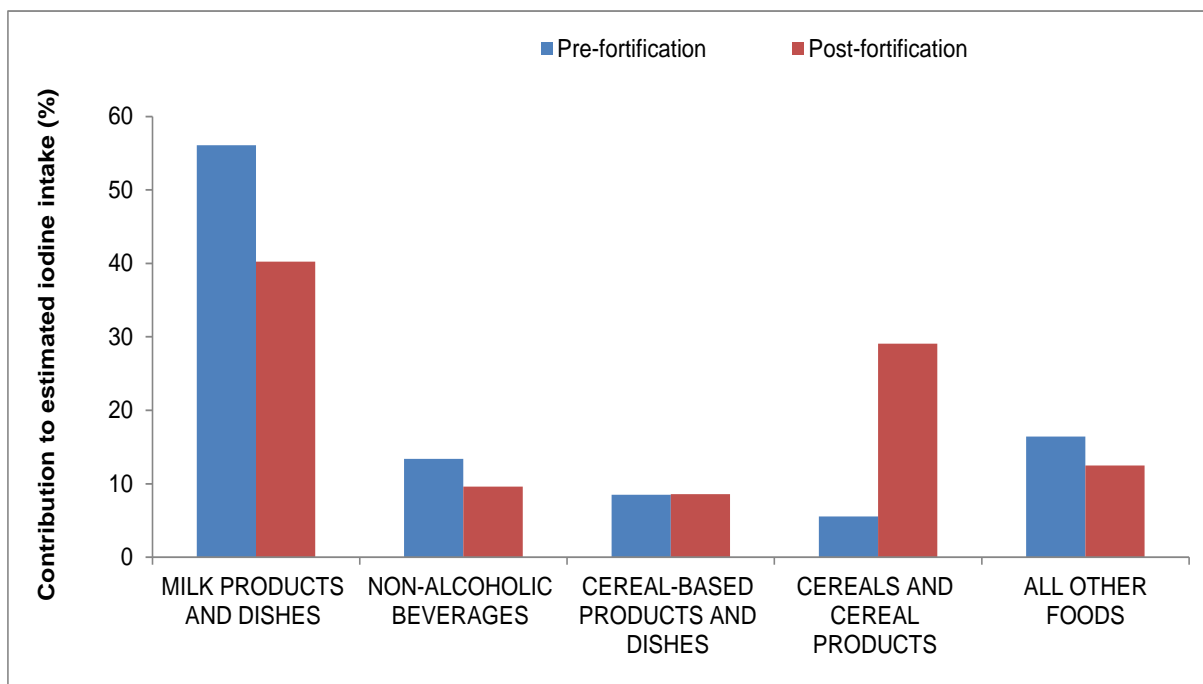


Figure 6: Major food contributors to total dietary iodine intake (%) - Children 2-16 years old

The major food group that contributed to the dietary iodine intake of all Australian children before fortification was milk products and dishes. For children aged 2-3 years, it provided 70% of their iodine intake before iodine fortification of bread and decreased to 54% after fortification. Dietary iodine intake from this food group was 56% in all children aged 2-16 years and decreased to 40% following fortification. The post-fortification change in children's dietary iodine intake from milk products and dishes was made up for by substantial increases in the percent contribution from cereal and cereal products. Following bread fortification, the percent contribution from cereal and cereal products to the total iodine intake for 2-3 year olds increased to 25% from a pre-fortification level of 4%. For all children aged 2-16 years, the contribution increased to 29% from 6%.

The percent contribution made by the three main bread types consumed by Australians (white, wholemeal and multigrain with seeds) to the iodine intake of children aged 2-3 years and 2-16 years are shown in Figures 7 and 8. The percentage contributed by wholemeal and multigrain & seeds breads increased after iodine fortification of bread compared to the pre-fortification period. The proportional increase from multigrain with seeds bread in particular was from 10% to 17% (2-3 year olds) and 6% to 12% (2-16 year olds).

The noted decrease in the post-fortification contribution of white bread to iodine intake relative to the contribution from wholemeal and multigrain and seeds breads could be related to preventative health programs promoting the importance of increased dietary fibre intake in the diet. This could have been transferred to the type of bread selected for consumption.

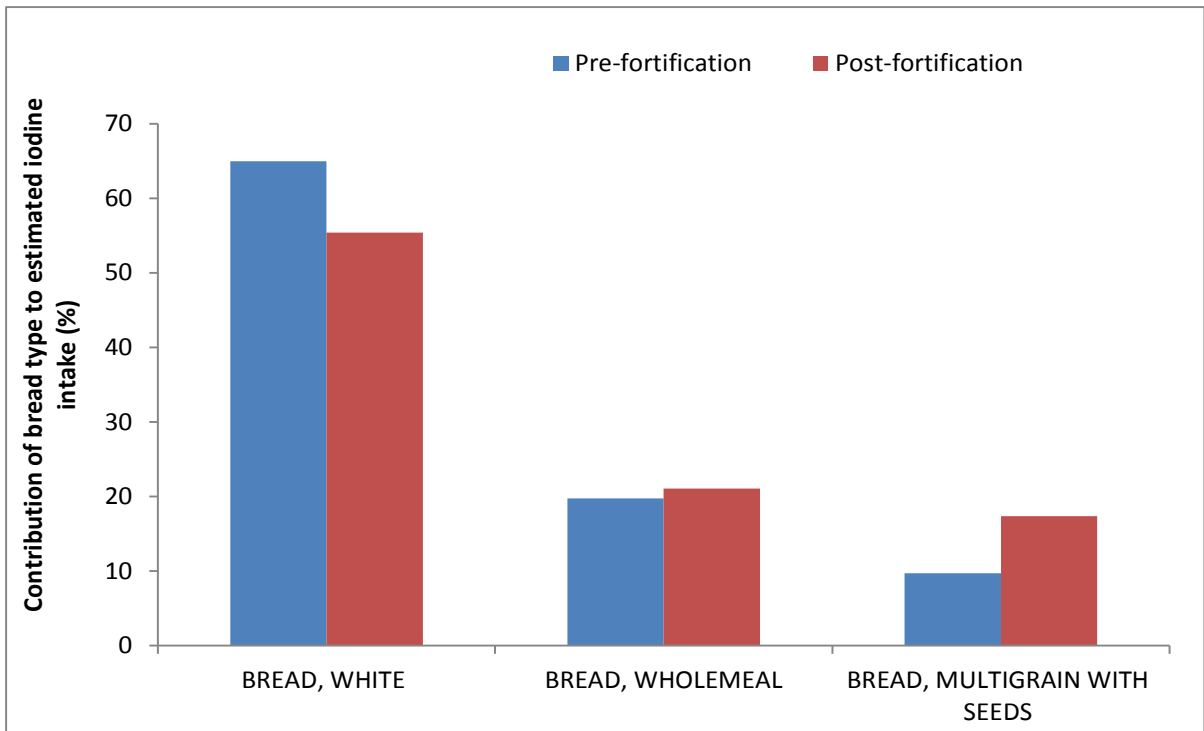


Figure 7: Contribution of different bread types to iodine intake from breads (%) – Australian children 2-3 years old

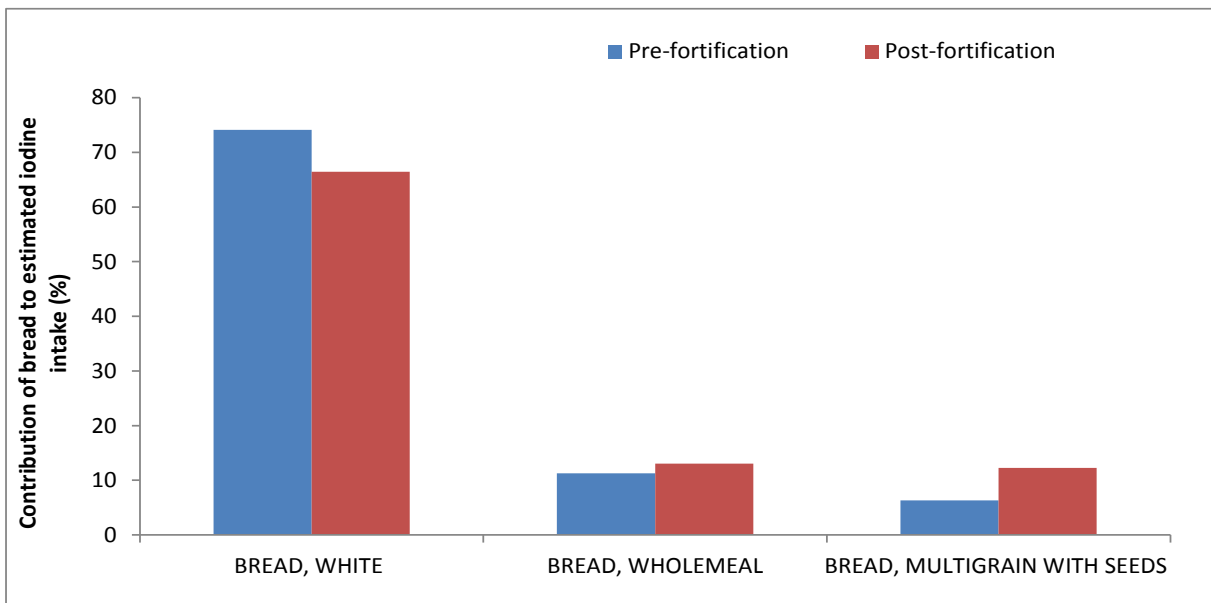


Figure 8: Contribution of different bread types to iodine intake from breads (%) – Australians 2-16 years old

7.2 Food contributors to dietary iodine intake of Australians aged 17 years and above including females of child-bearing age

Since the adult diet is more varied than that of children, it was expected that there would be more food groups contributing 5% and above to the estimated dietary iodine intake of adult Australians before and after iodine fortification of bread. However, the results for Australians aged 17 years and above, including females aged 16-44 years (target population of females of child-bearing age), showed close similarities to that of children. Except for fish and seafood products and dishes food group, the other major food contributors to dietary iodine intake were: Milk products and dishes; Non-alcoholic beverages; Cereal and cereal products; Cereal-based products and dishes

The estimated percent contribution by the four major food groups to total iodine intake for this sub-group of the Australian population before and after iodine fortification is given in Table 8. The estimates showed a substantial increase in the percent contribution of cereal and cereal products to the dietary iodine intake of the adult Australian population. The contribution by this food group to the iodine intake of females aged 16-44 years (target group) increased from 6% before bread fortification to 37% after iodine fortification of bread. The change in the contribution for all Australian adults was from 5% to 39% after fortification.

Figures 9 and 10 show the percent contribution made by the identified major food groups to the estimated dietary iodine intake for females of child-bearing age and all Australians aged 17 years and above.

Table 8: Then four major food contributors to estimated iodine intake - Australian adults and female of child-bearing age

Food group	Percent contribution to estimated total iodine intake			
	All persons aged 17 years and above		Females 16-44 years	
	Pre-fortification	Post-fortification	Pre-fortification	Post-fortification
Milk products and dishes	41	26	41	26
Non-alcoholic beverages	15	9	16	10
Cereal-based products and dishes	7	6	7	7
Cereal and cereal products	5	39	6	37

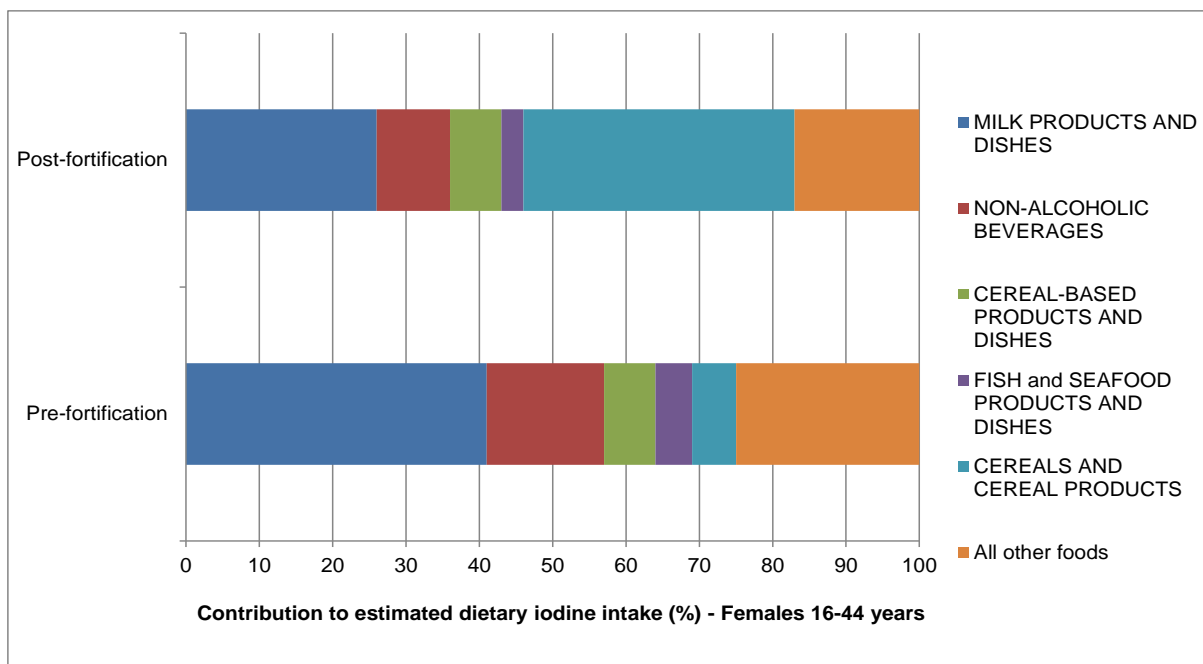


Figure 9: Contribution to estimated dietary iodine intake (%) - Australian females aged 16-44 years

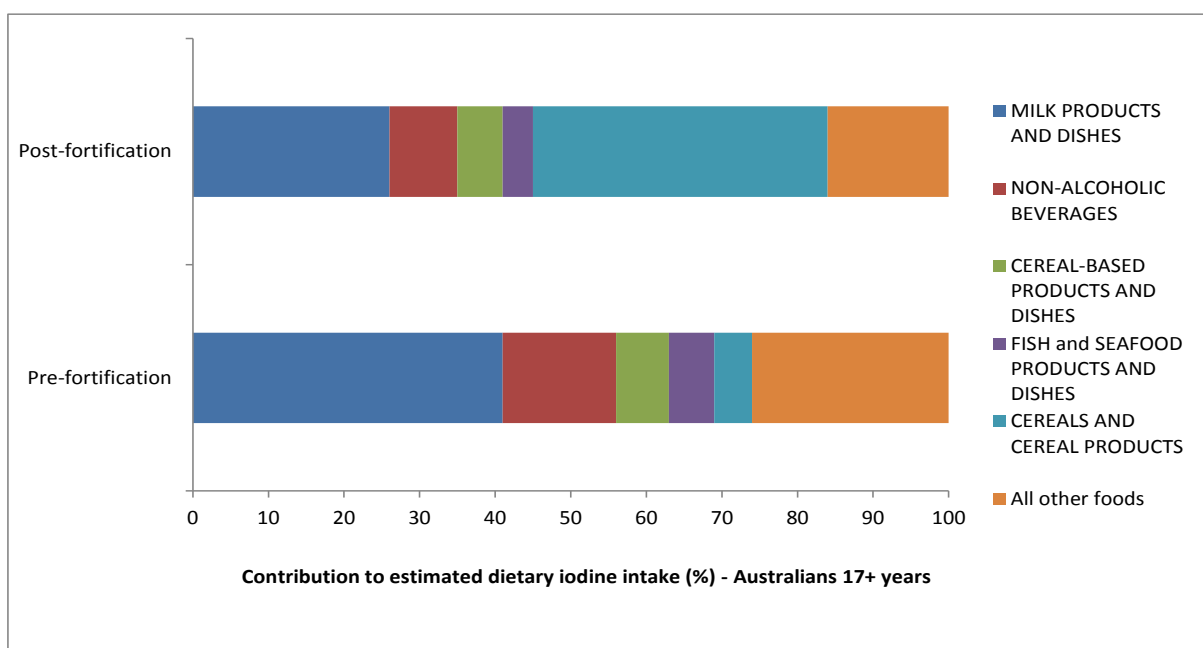


Figure 10: Contribution to estimated dietary iodine intake (%) - Australians 17 years and above

Considering bread is the food vehicle for iodine fortification, and noting the substantial increase in the percentage contribution of cereals and cereal products to dietary iodine intake, the percent contribution of the main bread types to iodine intake from bread was determined. Figures 11 and 12 give a pictorial representation of the proportion of iodine contributed by the three main bread types to iodine intake from bread, for Australian adults

aged 17 years and above, and for Australian females of child-bearing age (16-44 years) respectively before and after iodine fortification.

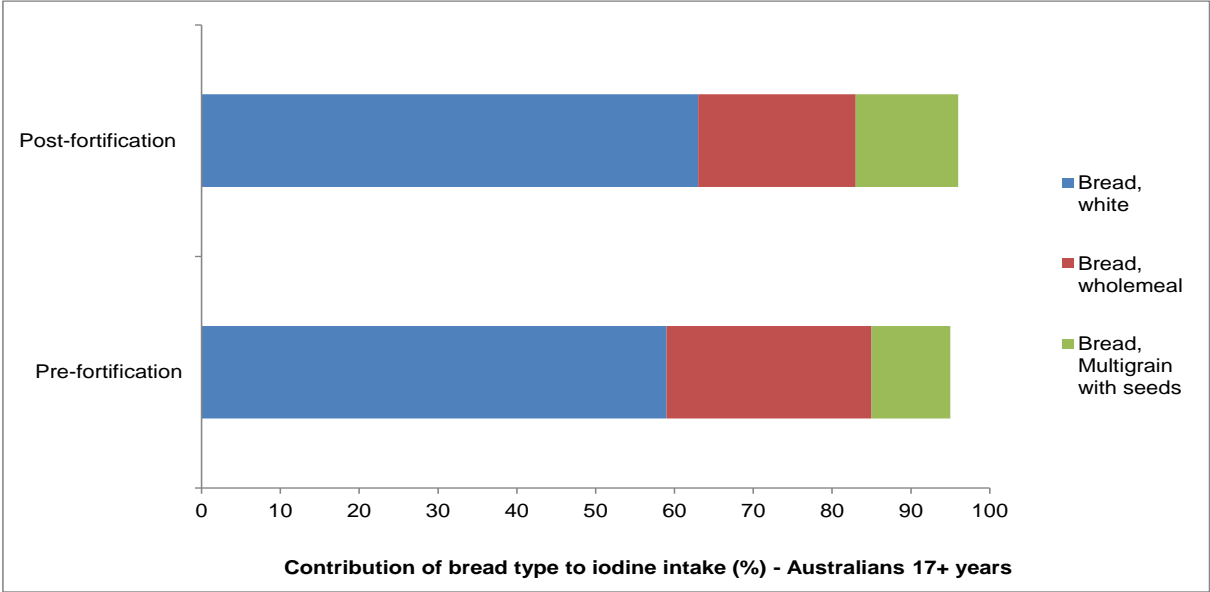


Figure 11: Contribution of bread type to iodine intake from breads (%) - Australians 17 years old and above

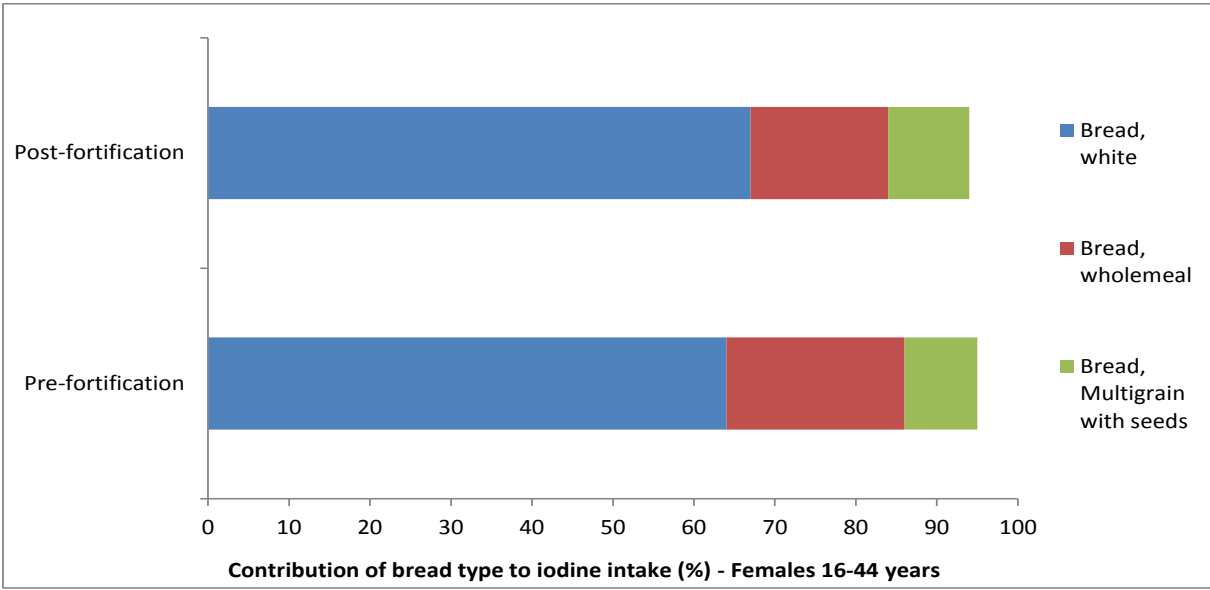


Figure 12: Contribution of bread type to iodine intake from breads (%) - Australian females aged 16-44 years

8.0 Comparison of the current dietary usual iodine intake estimates to previously predicted estimates

The increases in estimated mean usual iodine intake values after fortification and the decrease in the proportion of the different population sub-groups with inadequate iodine intake were similar to the predicted values in some cases and more than predicted in others

However, it should be noted that the population usual iodine intake estimates given in this report, for children aged 2 to 16 years, cannot be directly compared with the predicted estimates provided for the same age group in the Australian population during FSANZ's development of the iodine fortification standard (FSANZ 2008). The current estimates were derived from the 2007 ANCNPAS for children, rather than the 1995 NNS used in the 2008 report. The sampling methodologies used for these two nutrition surveys and the questions asked, were not identical. Similarly, the food composition tables for the two surveys also differ slightly, due to new foods types introduced into the market place after the 1995 survey up to the time of the period of the 2007 survey. Further, there could be some differences in the food analytical methods used to determine the amount of iodine present in the foods consumed for the 1995 and 2007 food composition data. The use of a custom model that is a hybrid of the nutrient intake methodology and the Australian Total Diet Study methodology meant the assessment methodology used in this report was also different from that used for the previous estimates for development of the fortification standard. The custom model enabled the use of recipes to calculate and allocate in a single step the amount of iodine from use of the fortified foods, discretionary iodised salt and from mixed foods that contain ingredients that are fortified.

The differences in the two surveys and their related food composition data sets meant that the pre-fortification dietary usual iodine intake estimates needed to be re-calculated for this report for children to ensure that the post-fortification iodine intake estimates could be compared with the appropriate baseline values. The pre-fortification estimates were of the same order of magnitude.

9.0 Conclusion

The iodine intake estimates provided in this report indicate that iodine fortification of salt used in making bread has brought about a substantial increase in the estimated mean dietary usual iodine intake for all Australians, particularly the target groups.

It is noted that the intake estimates derived using iodine results from each of the surveys rather than a weighted mean were very similar despite the time differences in the sampling periods (Table A2 in Appendix 1). On the whole, the time interval between the first bread survey and the third was almost three years. These results also indicate consistency in the use of iodised salt in making bread by bakers.

The estimated increase in mean usual iodine intakes ranged from 37-64 µg/day across the different Australian population age groups, with a much higher percentage contribution made by cereals and cereal products to total dietary usual iodine intake post-fortification. The percent contribution of this food group increased from 6% to 37% for females of child-bearing

age and from 5% to 39% for adults 17 years and over. The food type responsible for the increased proportional contribution of cereals and cereal products to iodine intake was bread.

The proportion of females of child-bearing age (16-44 years) estimated to have inadequate dietary iodine intake when compared to the non-pregnant EAR also decreased substantially from 50% before fortification to 9% after mandatory iodine fortification of salt used in making bread. Inadequate dietary iodine intakes in those aged 2-16 years was estimated to have decreased from 10% to less than 1%; for those aged 19-29 years from 40% to 6% after fortification. The proportion of the population aged 17 years and above with inadequate iodine intake was also estimated to have decreased from 50% to 6%.

The expected positive health outcomes from the estimated increase in the mean iodine intake of all Australians are to reduce the incidence of iodine-deficiency health problems, including impaired neurological conditions in children.

Potential adverse effects are indicated when a proportion of a given population group exceeds the UL. The usual iodine intake estimates indicated that for 2-3 year old children, the period of iodine intake that exceeds the UL is likely to be transient as less than 1% of children had iodine intakes above the UL once they turned 4 years of age. Although it is generally undesirable to exceed the UL, there is evidence to indicate that young children are able to exceed their respective estimated ULs by 2-3 fold without apparent adverse consequences. This, and the reversible nature of the endpoint (sub-clinical hypothyroidism), means such intakes are unlikely to represent a health and safety risk to young children, though a reduced margin of safety exists.

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Appendix 1

Table A.1: Main bread types and proportions sampled from different bakeries – bread survey 1

Bread type	Number of samples	Supermarket bakeries (%)	Local small-scale bakeries (%)	Industry bakeries (%)	Bakery Franchises (%)
White bread	28	39	36	18	7
Wholemeal bread	15	20	34	33	13
Multigrain and seeds bread	18	17	33	33	17

Table A.2: Main bread types and proportions sampled from different bakeries – bread survey 2

Bread type	Number of samples	Supermarket bakeries (%)	Local small-scale bakeries (%)	Industry bakeries (%)	Bakery Franchises (%)
White bread	32	25	47	19	9
Wholemeal bread	32	19	47	28	6
Multigrain and seeds bread	32	28	44	22	6

Table A.3: Main bread types and proportions sampled from different bakeries – bread survey 3

Bread type	Number of samples	Supermarket bakeries (%)	Local small-scale bakeries (%)	Industry bakeries (%)	Bakery Franchises (%)
White bread	37	27	19	46	8
Wholemeal bread	28	39	25	29	7
Multigrain and seeds bread	30	13	20	57	10

Table A.4: Amount of analysed iodine in all bread types - Summary data phase 1 bread survey: All jurisdictions

Bread Type	Number of samples	Iodine ($\mu\text{g}/100\text{g}$)			Standard Deviation	Mean moisture content (g/100g)
		Mean	Maximum	Minimum		
White bread	28	63	270	1	46	38
Wholemeal bread	16	70	140	38	38	40
Multigrain and seeds	17	57	140	30	33	37
English muffins	8	56	100	32	30	44
Flat breads/ Wraps	8	55	150	0.5	47	30
Gluten free bread	16	125	980	5	232	46
Organic bread	7	28	75	0.5	27	38
	(No Tasmanian sample)					

Table A.5: An example of the bread survey sampling plan – All jurisdictions

The sampling is to focus on major supermarkets and local bakeries in the capital cities of the States/Territories. Local bakery refers to small-scale independent bakeries or hot bread shops.										
Bread categories	Jurisdictions									Total number-samples all jurisdictions
	NSW - Purchase samples from Woolworths supermarket	VIC- Purchase samples from Coles Supermarket	Western Australia	Queensland	SA - Purchase samples from Foodland	Northern Territory	ACT	TASMANIA - Purchase samples from Coles		
Bread, white, sandwich (sliced or unsliced). Excludes rolls, buns and hamburger rolls	1 loaf each of : Abbotts village bakery rustic white bread; Woolworths Homebrand white sandwich bread; Aldi brand white sandwich bread; white sandwich bread from local bakery. Number of samples = 4.	1 loaf each of: Lawson's Original white bread; Coles brand white bread; white sandwich bread from Baker's Delight; white sandwich bread from a local bakery. Number of samples = 4	1 loaf each of: Tip Top Sunblest - White sandwich bread; Baker's Delight white sandwich bread; Aldi brand White Bread; White sandwich bread from a local bakery. Number of samples = 4	1 loaf each of: Baker's Delight white block loaf, White Farmer's loaf and regular white sandwich bread from a local bakery. In the absence of specified white bread types purchase different varieties of white bread. Number of samples = 4	1 loaf each of 2 varieties of Foodland brand white bread; 2 varieties of white bread from local small-scale bakery. Number of samples = 4	1 loaf each of white bread from an Indigenous store and from a major supermarket (different brands); 1 package white rolls from major supermarket (any brand). Number of samples = 3	1 loaf of Supabarn White bread and 1 loaf white sandwich bread from a local bakery. Number of samples = 2	1 loaf each of Coles brand white bread, White bread from a local bakery and Tip Top White thick bread. Number of samples = 3		28
Bread, wholemeal/wholegrain - sandwich (sliced or unsliced). Excludes rolls, buns and hamburger rolls	1 loaf each Abbotts village bakery, farmhouse wholemeal bread & wholemeal sandwich bread from local bakery. Number of samples = 2	1 loaf each of Gold Split wholemeal bread and Coles supermarket brand wholemeal bread. Number of samples = 2	1 loaf each of Woolworths wholemeal bread and Tip Top 9 grain wholemeal bread. Number of samples = 2	1 loaf each of Baker's Delight wholemeal bread and wholemeal bread from local bakery. Number of samples = 2	1 loaf each of Gold Max brown bread and brown/wholemeal bread from local bakery. Number of samples = 2	1 loaf each of wholemeal bread (any brand) from Indigenous store and wholemeal bread from local bakery. Number of samples = 2	1 loaf each of Buttercup wholemeal bread from a local bakery. Number of samples = 2	1 loaf of wholemeal bread from major supermarket (any brand) and 1 loaf from local bakery. Number of samples = 2		16
Bread, Multigrain with seeds including specialty grain +seeds, (sliced or unsliced). Excludes rolls, cob bread, buns and hamburger rolls	1 loaf each of Burgen wholemeal and seeds bread and Woolworths homebrand multigrain and seed bread. Number of samples = 2	1 loaf each of Molenberg 9 Grains and pumpkin seeds bread and grain and seed bread from a local bakery. Number of samples = 2	1 loaf each of grain and seed bread from Baker's Delight and Burgen Pumpkin seeds bread. Number of samples = 2	1 loaf each of Molenberg wholegrain sesame and poppy seed bread and Tip Top 9 grain plus pumpkin seeds bread. Number of samples = 2	1 loaf each of Specialty multigrain and seed bread from a local bakery. Number of samples 2	1 loaf each of multigrain and seed bread from major supermarket and from a local bakery. Number of samples = 2	1 loaf each of multigrain and seed bread from Baker's Delight and from a local bakery. Number of samples = 2	1 loaf of Woolworths Four Seed Bread and grain and seed bread from a local bakery. Number of samples = 2		16
Bread, Gluten free - White, sandwich (sliced or unsliced). Excludes rolls, buns, and hamburger rolls	1 loaf (any brand) from Woolworths and 1 loaf from a local bakery. Number of samples = 2	1 loaf (any brand) from Coles and 1 loaf from a local bakery. Number of samples = 2	1 loaf each of any brand from a major supermarket and from a local bakery. Number of samples = 2	1 loaf (any brand) from supermarket and 1 loaf from a local bakery. Number of samples = 2	1 loaf (any brand) from supermarket and 1 loaf from a local bakery. Number of samples = 2	1 loaf (any brand) from supermarket and 1 loaf from a local bakery. Number of samples = 2	1 loaf (any brand) from supermarket and 1 loaf from a local bakery. Number of samples = 2	1 loaf (any brand) from supermarket and 1 loaf from a local bakery. Number of samples = 2		16
Bread, Organic - White, sandwich (sliced or unsliced). Excludes rolls, buns and hamburger rolls	1 loaf (any brand) from Woolworths. Number of samples = 1	1 loaf (any brand) from Coles. Number of samples = 1	1 loaf (any brand) from Woolworths. Number of samples = 1	1 loaf from local bakery. Number of samples = 1	1 loaf (any brand) from Foodland/Coles. Number of samples = 1	1 loaf (any brand) from major supermarket. Number of samples = 1	1 loaf (any brand) from Supabarn. Number of samples = 1	1 loaf (any brand) from Coles. Number of samples = 1		8
Flat bread - types labelled as Flat, Wrap, Tortilla, Lavash or Naan bread	1 loaf of flat bread (any brand) labelled as 'flat bread' from Woolworths. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'wraps' from Coles. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'lavash bread' from major supermarket. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'Tortilla' from a major supermarket. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'Naan' from major supermarket. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'wraps' from a major supermarket. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'flat bread' from Supabarn. Number of samples = 1	1 loaf of flat bread (any brand) labelled as 'lavash bread' from major supermarket. Number of samples = 1		8
Bread, English muffin - white or original, wheat flour based. Excludes, wholemeal, multigrain and spicy fruit varieties	Tip Top English muffin - original. Number of samples = 1	Coles brand of plain English muffin. Number of samples = 1	Any brand of English muffin, white. Excludes Tip Top. Number of samples = 1	Any brand of English muffin, white. Excludes Tip Top. Number of samples = 1	Tip Top English muffin - original. Number of samples = 1	Any brand of English muffin, white. Excludes Tip Top. Number of samples = 1	Any brand of English muffin, white. Excludes Tip Top. Number of samples = 1	Tip Top English muffin - original. Number of samples = 1		8
Total number of samples per jurisdiction	13	13	13	13	13	13	12	11	12	100

Table A.6: Estimated mean usual iodine intake for Australians children 2-16 years above by different discretionary salt use models

Age group (All Sexes)	Estimated Mean Intake of Iodine (ug/day)														
	Consumer behaviour model (non-iodised salt)					ANCNPAS salt behaviour A					ANCNPAS salt behaviour B				
	Pre-fortification (Baseline)	Post-fortification (Scenario 1)	Post-fortification (Scenario 2)	Post-fortification (Scenario 3)	Post-fortification (Scenario 4)	Pre-fortification (Baseline)	Post-fortification (Scenario 1)	Post-fortification (Scenario 2)	Post-fortification (Scenario 3)	Post-fortification (Scenario 4)	Pre-fortification (Baseline)	Post-fortification (Scenario 1)	Post-fortification (Scenario 2)	Post-fortification (Scenario 3)	Post-fortification (Scenario 4)
2-3 yrs	120	158	160	154	157	127	165	167	161	164	126	164	165	160	163
4-8 yrs	111	163	165	157	161	120	172	174	166	171	119	171	173	165	170
9-13 yrs	127	183	186	177	182	141	197	200	191	196	139	195	198	190	194
14-16 yrs	136	199	202	194	198	154	217	220	211	216	152	215	219	210	214
2-16 yrs	122	176	179	171	175	135	189	191	183	187	134	187	190	182	186
Age group (All Boys)															
2-3 yrs	122	162	164	158	162	128	169	171	165	168	127	167	169	163	167
4-8 yrs	117	172	175	166	171	127	181	184	175	180	125	180	183	174	179
9-13 yrs	141	201	204	195	200	155	214	217	208	213	153	212	215	206	211
14-16 yrs	161	235	239	229	234	179	253	257	246	251	178	251	255	245	250
2-16 yrs	135	194	196	188	192	147	205	208	199	204	145	204	207	198	203
Age group (All Girls)															
2-3 yrs	118	153	155	149	153	126	162	163	158	161	124	160	161	156	159
4-8 yrs	105	153	155	148	152	114	162	164	157	161	113	161	163	156	160
9-13 yrs	112	164	166	159	163	127	179	181	174	178	125	177	180	172	176
14-16 yrs	109	161	164	157	160	127	179	182	174	178	125	177	180	173	177
2-16 yrs	110	158	161	154	157	122	171	173	166	170	121	170	172	165	169

Note: Data for the three post-fortification bread surveys are identified as:

Post-fortification scenario 1 = bread survey 1

Post-fortification scenario 2 = bread survey 2

Post-fortification scenario 3 = bread survey 3

Post-fortification scenario 4 = the weighted mean value for the three post-fortification bread surveys. In the report, this value is used to represent the single post-fortification value

Consumer behaviour model = quantified salt consumed not removed

ANCNPAS salt behaviour A = quantified salt consumed not removed and contributes to iodine intake

ANCNPAS salt behaviour B = quantified salt consumed removed, therefore no contribution to iodine intake from salt

Table A.7: Estimated 5th and 95th percentile usual iodine intakes for children by age group and gender

Estimated 5th and 95th percentile usual iodine intakes by age group - ANCNPAS salt behaviour A only

Age group (All Sexes)	5th percentile intake (µg/day)					95th percentile intake (µg/day)				
	Pre-fortification (Baseline)	Post-fortification (Scenario 1)	Post-fortification (Scenario 2)	Post-fortification (Scenario 3)	Post-fortification (Scenario 4)	Pre-fortification (Baseline)	Post-fortification (Scenario 1)	Post-fortification (Scenario 2)	Post-fortification (Scenario 3)	Post-fortification (Scenario 4)
2-3 years	57	93	94	90	92	208	245	247	239	243
4-8 years	57	102	104	97	101	194	251	252	246	250
9-13 years	68	116	117	112	115	234	295	297	289	294
14-16 years	71	116	120	112	115	269	345	349	340	343
2-16 years	63	107	109	104	106	228	293	296	286	291
Age group (All Boys)										
2-3 years	60	100	101	97	100	204	247	248	240	244
4-8 years	62	112	115	109	112	204	256	259	251	255
9-13 years	75	126	129	124	125	250	317	319	308	316
14-16 years	85	151	155	148	151	290	368	375	364	368
2-16 years	69	118	120	113	118	249	319	324	312	319
Age group (All Girls)										
2-3 years	55	89	90	86	89	216	243	244	237	242
4-8 years	55	93	96	89	92	183	240	243	235	239

9-13 years	62	106	110	106	107	200	259	262	254	259
14-16 years	62	106	108	105	106	208	265	270	256	263
2-16 years	59	98	100	95	98	198	252	255	247	251

Note: Data for the three post-fortification bread surveys are identified the same as in Table A6.

Table A.8: Mean consumption for consumers only of regular breads and rolls (food code 122) from various nutrition surveys*

Gender	Age Group	Measure	Nutrition Survey**		
			2007 ANCPAS	1995 NNS	2011-12 NNPAS
All	2-16 years	% consumers	76.5	NA	72.5
		Mean consumption (g/day)	89	NA	86
All	19 years and above	% consumers	NA	76.4	65.2
		Mean consumption (g/day)	NA	111	93
Females	16-44 years	% consumers	NA	76.4	58.2
		Mean consumption (g/day)	NA	97	75

* All results weighted.

** Day 1 only.