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

CONSIDERATION OF MANDATORY FORTIFICATION WITH IODINE FOR AUSTRALIA AND NEW ZEALAND

DIETARY INTAKE ASSESSMENT REPORT MAIN REPORT

April 2008

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Summary

Dietary intake assessments were conducted for various scenarios in order to assess the potential impact the introduction of mandatory fortification of food with iodine (via iodised salt) in New Zealand and Australia would have on iodine intakes among the target groups. These were identified as children aged up to 3 years, women of child-bearing age (assumed to be 16-44 years) and the population in general (New Zealand – 15 years and above; Australia – 2 years and above). The aim was to determine a level of fortification that maximised iodine intakes for the target groups while minimising the proportion of the population with inadequate dietary iodine intakes[1] and dietary iodine intakes above the Upper Level of Intake (UL). Numerous scenarios were assessed at Final Assessment for P230, each producing similar outcomes to those scenarios presented at Draft Assessment for P230.

Between the Draft and Final Assessment reports, following consultations and consideration of submissions for P230, a number of changes were made to the dietary intake assessments for both New Zealand and Australia. These changes were:

1. **Revision of the amount of discretionary salt** assumed to be consumed by New Zealand and Australian population groups.

2. **Inclusion of information on the proportion of discretionary salt that is iodised** in New Zealand and Australia, which was then incorporated in dietary intake assessments for a 'market weighted' assessment.

3. **Change in the focus of the assessments** from:

    a. all cereal based foods to three scenarios with different cereal based foods (breads, breakfast cereals and biscuits; breads and breakfast cereals; breads only); and
    b. all processed foods to universal salt iodisation (i.e. a mandatory fortification permission for iodised table salt).

This resulted in the following four scenarios being considered and presented at Final Assessment for P230 and compared to the established baseline (see Figure 2):

1. ***Baseline*** to estimate current iodine intakes from food alone, based on current naturally occurring iodine concentrations in foods and iodine concentrations in foods resulting from permitted uses of iodine in the Code. The consumption of discretionary salt was also considered. The iodine concentration in iodised discretionary salt was assumed to be 45 milligrams (mg) iodine per kg of salt for dietary intake assessment purposes and was based on industry-supplied data, noting that it is also the midpoint of the range of currently permitted voluntary iodine fortification of salt (25–65 mg iodine per kg salt).

[1] Estimated dietary iodine intakes were compared with the Estimated Average Requirement (EAR) for each age and gender group for iodine, from the NRVs released in 2006 for Australia and New Zealand (National Health and Medical Research Council, 2006). These are shown in Table A3.1 in Appendix 3. When certain conditions are met, the proportion of the population group with intakes below the EAR can be used to estimate the prevalence of inadequacy.

2. ***Scenario 1 – Breads, breakfast cereals and biscuits*** – non-iodised salt was replaced with iodised salt containing 30 mg iodine per kg of salt in breads, breakfast cereals and biscuits. The voluntary permission for iodine fortification of discretionary salt was reduced from 25-65 mg iodine/kg salt to 30 mg iodine/kg salt.

3. ***Scenario 2 – Breads and breakfast cereals*** – non-iodised salt was replaced with iodised salt containing 40 mg iodine per kg of salt in breads and breakfast cereals, with 35 mg iodine per kg salt remaining in the salt of fortified breads and breakfast cereals after baking/processing. The voluntary permission for iodine fortification of discretionary salt was reduced from 25-65 mg iodine per kg salt to 40 mg iodine per kg salt.

4. ***Scenario 3 – Breads*** – non-iodised salt was replaced with iodised salt containing 45 mg iodine per kg of salt in breads, with 40 mg of iodine per kg of salt remaining in the salt of iodine-fortified bread after baking. The iodine concentration in iodised discretionary salt was assumed to be 45 mg iodine per kg salt for dietary intake assessment purposes and was based on industry-supplied data, noting that it is also the midpoint of the range of currently permitted iodine fortification of salt (25 – 65 mg iodine per kg salt).

5. ***Universal salt iodisation*** – non-iodised salt was replaced with iodised salt containing 15 mg iodine per kg of salt in processed foods. The voluntary permission for iodine fortification of discretionary salt was made mandatory and was reduced from 25-65 mg iodine per kg salt to 15 mg iodine per kg salt.

Through submissions to P230, two alternative fortification options were proposed and their potential impact on iodine intakes considered:

1. **A restricted breads only mandatory fortification scheme** where heavy grain breads are excluded from mandatory fortification.

2. **A voluntary fortification scheme**, as proposed by the food industry, where food manufacturers would sign on to a 'Memorandum of Understanding (MOU)' to fortify certain brands of breads, breakfast cereals and biscuits foods with iodine (***MOU Scenario – Market weighted***). This scenario assumed that non-iodised salt would be replaced with iodised salt containing 45 mg iodine per kg of salt in approximately 30% of breads, 15% of breakfast cereals and 15% of biscuits on a voluntary basis. Assuming that there would be a 10% loss of iodine from the salt during baking/ cooking/ extruding, iodised salt was deemed to contain 40 mg iodine per kg salt for dietary intake assessment purposes. A market-weighted intake estimate represented the likely impact of a voluntary iodine fortification scheme across the population over a period of time. The use of discretionary iodised salt was not considered.

Since the mandatory fortification of bread was the preferred option at Final Assessment for P230, this section of the report presents the finding from the *Baseline* and *Scenario 3 – Breads* options only. The discussion on all other scenarios can be found in Attachments 2-5.

Food consumption patterns were assessed for groups in both New Zealand and Australia with low and high intakes of iodine with the aim of identifying other food vehicles preferentially consumed by people with low iodine intakes that could potentially more effectively target the appropriate population groups.

Although some data on the use of complementary medicines (Australia) or dietary supplements (New Zealand) were collected in the National Nutrition Surveys (NNSs), data were either not in a robust enough format to include in the FSANZ dietary modelling computer program, DIAMOND, or have simply not been included in the DIAMOND program to date. Therefore the dietary intake assessments did not take into account iodine from the use of iodine supplements or multi-vitamin supplements containing iodine.

Additionally, potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. Any changes would however be captured in the future in ongoing monitoring programs.

The dietary intake assessment results indicated that mean iodine intakes increase under *Scenario 3 – Breads*. It should be noted that:

- The impact of a mandatory bread fortification program (*Scenario 3 – Breads*) is much greater for the low baseline iodine intake groups as their iodine intakes would increase by a greater proportional amount.
- The 2003/04 New Zealand Total Diet Survey (NZ TDS) estimated dietary iodine intakes for 25 year old females at 59-61 μg/day (lower bound to upper bound). When discretionary salt consumption is not considered, FSANZ's estimated dietary iodine intakes for New Zealand women aged 16-44 years (66 μg/day) was similar to that predicted in the 2003/04 NZ TDS for women aged 25 years.
- The food group milk, milk products and dishes was the major contributor to iodine intakes at *Baseline* for all population groups examined. Fish and seafood products and dishes, and eggs and egg products and dishes were also major contributors to iodine intakes for New Zealand population groups aged 15 years and above.
- For *Scenario 3 – Breads*, there was a reduction in the estimated proportion of the population with inadequate dietary iodine intakes from *Baseline* for all of the population groups assessed, as determined using the proportion of the population with intakes below the Estimated Average Requirement (EAR).
- As age increased, there was a general tendency for there to be a greater proportion of the population estimated to have inadequate dietary iodine intakes, particularly for the *Baseline* scenario.
- Of all of the population groups assessed, women aged 16-44 years had the highest proportions of the population group estimated to have inadequate dietary iodine intakes for *Baseline* and *Scenario 3 – Breads*, especially when dietary iodine intakes were compared with the EARs for pregnancy and lactation.
- While mandatory fortification (*Scenario 3 – Breads*) has the capacity to reduce the proportion of the population groups with inadequate dietary iodine intakes when compared to *Baseline*, the proportion of Australian children aged 2-8 years with dietary iodine intakes above the UL increases.
- For *Scenario 3 –Breads*, estimated 95th percentile dietary iodine intakes exceeded the UL for Australian children aged 1 year (120-130% UL) and were close to or exceeded the UL for New Zealand children aged 1-3 years (95-130% UL), the upper end of the range being for children who consumed one serve of milk as formulated supplementary foods for young children (FSFYC), which have a higher iodine content than ordinary milk.
- When the proportion of discretionary salt in Australia that is iodised is taken into account, 6% of Australian children aged 2-3 years have estimated dietary iodine intakes

that exceed the UL for *Scenario 3 –Breads*. At *Baseline*, <1% of the population groups assessed have estimated intakes above the UL. If all discretionary salt was iodised, the proportion of 2-3 year old children with iodine intakes exceeding the UL under mandatory fortification would increase to 10%.

- Of all of the population groups assessed, Australian children aged 2-3 years had the largest proportion of the group exceeding the UL.
- Children aged 2-3 years and 4-8 years were identified as the most likely to have dietary iodine intakes that exceeded the UL. Living in an area with high iodine water appeared to make very little difference to the risk of iodine intakes exceeding the UL for 4-8 year olds, but resulted in a small increase in risk of exceeding the UL for 2-3 year olds (14% >UL if water has the high iodine content compared to 6% >UL noted above), with the maximum predicted iodine intake increasing from 328 μg iodine/day to 353 μg iodine/day (8% increase).

Respondents with low (bottom quintile) and high (top quintile) iodine intakes:

- The impact of a mandatory fortification program is much greater for the population groups with low iodine intakes (bottom quintile) as their iodine intakes increase by a greater proportional amount in comparison to the high iodine (top quintile) intake group.
- For the New Zealand population groups investigated, mandatory fortification of breads (*Scenario 3 – Breads*) has a bigger impact than that it does for the Australian population groups investigated because they start with lower iodine intakes.
- There were differences in the food consumption patterns between those with low iodine intakes and those with high iodine intakes. However, many of the foods/food groups consumed by higher proportions of respondents with low iodine intakes were (1) not considered to be appropriate food vehicles for mandatory fortification; or (2) already being considered for mandatory fortification; or (3) are not regulated by FSANZ (e.g. water).

New Zealand children aged 5-14 years:

- The estimated mean dietary iodine intakes for New Zealand children aged 5-14 years were lower at both *Baseline* and under the mandatory fortification of breads (*Scenario 3 – Breads*) when compared to Australian children aged 4-18 years.
- New Zealand children have much higher maximum iodine intakes than for Australian children. This was largely due to the consumption of sushi by the New Zealand children (approximately 90% or more of these individual's iodine intakes were from the consumption of sushi).
- When non-iodised discretionary salt consumption was considered, a large proportion of New Zealand children aged 5-14 years were estimated to have inadequate dietary iodine intakes at *Baseline*. Much larger proportions of New Zealand children were estimated to have inadequate dietary iodine intakes in comparison to Australian children. This could be attributed to the lower iodine concentration in milk in New Zealand in comparison to Australia.
- The estimated proportion of New Zealand children with inadequate dietary iodine intakes was markedly lower when the use of discretionary iodised salt was considered.
- The proportion of New Zealand and Australian children exceeding the Upper Level (UL) at *Baseline* and for (*Scenario 3 – Breads*) was low.

Dietary modelling approach

An international expert in dietary exposure assessments from the US Food and Drug Administration (Dr Mike DiNovi), recently reviewed all FSANZ dietary exposure assessment principles and modelling procedures and the supporting systems. The conclusions from the peer reviewer were very positive overall in terms of the FSANZ dietary modelling capability, expertise of staff and that the methodologies used by FSANZ being consistent with international best practice. The peer reviewer prepared a report on his findings which included some recommendations to enhance FSANZ capabilities further. A strategy has been put in place to deal with the recommendations.

The methodology used to assess dietary iodine intakes, the population groups assessed and the limitations and assumptions used in the assessments are discussed in Attachment 1.

An overview of all scenarios investigated for the P230 Draft Assessment and Final Assessment can be found in Attachment 2. However, all discussion in this section of the report has been limited to the preferred option of *Scenario 3 – Breads*.

Food vehicle

The process used to determine the preferred option of iodine fortification of breads (*Scenario 3 – Breads*) is discussed in detail in Attachment 2.

Figure 1 outlines the breads deemed to contain salt for dietary intake assessment purposes, based on information from food packages and food composition data. This was based on the definition of bread in the Code (Standard 2.1.1) that it is a product made from cereal flour, is yeast leavened and is baked.

Includes all yeast-containing plain white, white high fibre, wholemeal, grain and rye bread loaves and rolls that are baked; yeast-containing flat breads that are baked (e.g. pita bread, naan bread); focaccia; bagels (white, wholemeal, sweet); topped breads and rolls (e.g. cheese and bacon rolls); English muffins (white, white high fibre, grain, wholemeal and fruit); sweet buns; fruit breads and rolls; breadcrumbs, croutons.

Excludes steamed breads; breads cooked by frying (e.g. puri/poori); yeast-free breads (e.g. chapatti, tortilla); gluten-free breads*; doughnuts; pizzas and pizza bases; scones; pancakes, pikelets and crepes; crumpets; slices and bread mixes intended for home use.

* It is recognised that some gluten free breads can be yeast leavened, however this could not be determined from the National Nutrition Survey (NNS) food descriptors, so it was assumed that all gluten free bread was not yeast leavened.

Figure 1: Breads assumed to contain salt for dietary modelling purposes

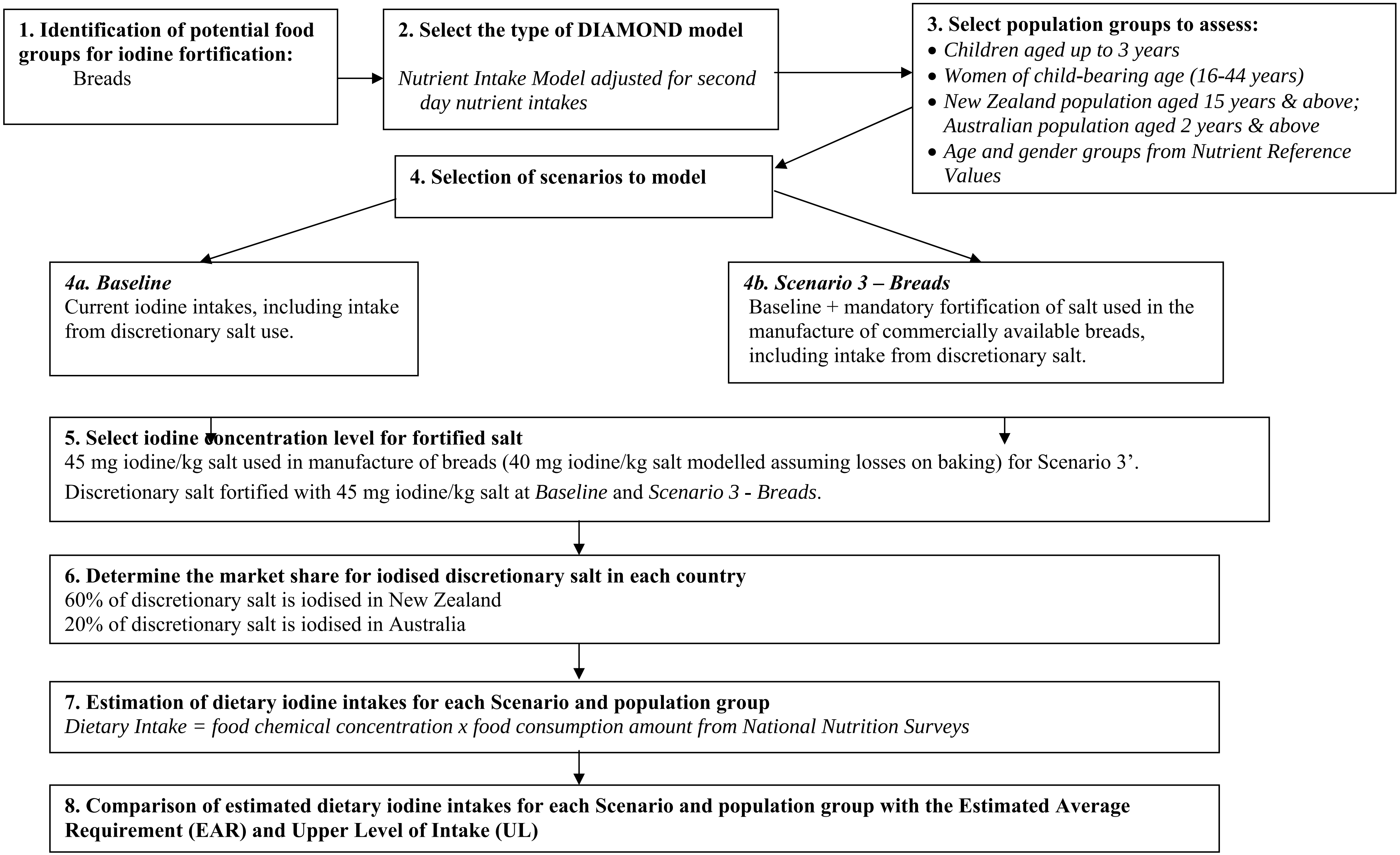


Figure 2: Dietary modelling approach used for assessing iodine intakes for New Zealand and Australia at Final Assessment for P230 (Baseline and Scenario 3 – Breads)

Scenarios and iodine concentration data

Dietary intake assessments were conducted to estimate potential dietary iodine intakes for each population group should mandatory iodine fortification of salt used in breads be introduced in New Zealand and Australia at 45 mg iodine per kg of salt, as summarised in Figure 2.

In ***Scenario 3 – Breads***, non-iodised salt was replaced with iodised salt containing 45 mg iodine per kg of salt in breads, with 40 mg of iodine per kg of salt remaining in the salt of iodised bread after baking (assumes a 10% reduction in iodine concentration, rounded down to 40 mg iodine per kg salt). The iodine concentration in iodised discretionary salt was assumed to be 45 mg iodine/kg salt for dietary intake assessment purposes and was based on industry-supplied data, noting that it is also the midpoint of the range of currently permitted iodine fortification of salt (25-65 mg iodine/kg salt).

The dietary intake assessments did not take into account iodine from the use of iodine supplements or multi-vitamin supplements containing iodine. Additionally, potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. This will be captured in any future monitoring programs.

Within the *Baseline* and *Scenario 3 – Breads* dietary intake estimates, two different model types were assessed:

(a) market share model; and
(b) consumer behaviour models.

The market share and consumer behaviour model types are discussed in detail below.

The iodine concentrations in foods that were used in the dietary intake estimates are discussed in detail in Attachment 1.

Market share model (or population estimate)

This model aimed to represent iodine intakes for the average consumer i.e. reflects the typical patterns of dietary intakes over time for a whole population or population sub-group. It cannot estimate individual behaviour or estimate iodine intakes for individuals due to the use of weighted mean iodine concentration values for discretionary salt.

Weighted mean iodine concentration levels were assigned to discretionary salt for New Zealand and Australia to reflect the current market share for iodised salt (60% for New Zealand; 20% for Australia). In the dietary intake assessments, 100% of New Zealanders aged 15 years and above and 62% Australians aged 2 years and above were assumed to be consumers of discretionary salt.

Consumer behaviour model (or individual choices model)

The voluntary permission to fortify discretionary salt with iodine presents the grocery buyer with a choice, to avoid or consciously select iodised salt according to the needs of their household.

To reflect the potential differences in **individual** consumer behaviour, two options for discretionary salt were investigated:

(a) where it was assumed that individuals always select non-iodised salt; and
(b) where it was assumed that individuals always select iodised salt.

In the dietary intake assessments, 100% of New Zealanders aged 15 years and above and 62% Australians aged 2 years and above were assumed to be consumers of discretionary salt (whether iodised or non-iodised).

The consumer behaviour models assessed iodine intakes **for groups of individuals only**. Where mean dietary iodine intakes have been presented as a range, the lower number in the range represents option (a) and the upper number in the range represents option (b).

A limitation of this model type is that it is not a population estimate but rather gives the top and bottom ends of a range of possible intakes for a group of individuals because it is not known how respondents in the National Nutrition Survey (NNS) would actually have behaved with their use of discretionary salt. It was assumed that both non-iodised and iodised discretionary salt consumers have the same food consumption patterns (excluding salt) as those reported in the 1997 New Zealand NNS and 1995 Australian NNS.

Approach to risk characterisation

Dietary iodine intakes were compared with nutrient reference values (NRVs) in order to characterise the risk in relation to inadequacy or safety, as described below.

Estimating inadequate intakes

The proportions of the population groups with dietary iodine intakes below the Estimated Average Requirement (EAR) were assessed and used as an estimation of the prevalence of inadequate iodine intakes, for *Baseline* and *Scenario 3 – Breads*. When certain conditions are met, the proportion of the population group with intakes below the EAR can be used to estimate the prevalence of inadequacy (Health Canada, 2006b).

The EARs used in this assessment were from the NRVs released in 2006 for Australia and New Zealand (National Health and Medical Research Council 2006) and are shown in Table A3.1 in Appendix 3, noting that the EARs for women who are pregnant and lactating are much higher than for other women of the same age.

The estimated dietary intakes for iodine were determined for each individual where NNS data were used for estimating dietary intakes, and were compared to the relevant EAR for age group and gender.

Estimating the impact on pregnant and lactating women is difficult because the NNSs do not contain an adequate sample of these women. Therefore, intakes from non-pregnant women of child bearing age (16-44 years) were compared to the EARs for pregnancy and lactation.

Comparison of iodine intakes with the upper level of intake (UL)

In order to determine if dietary iodine intakes will be of concern to public health and safety, the estimated *Baseline* and *Scenario 3 – Breads* intakes were compared with the Upper Level of Intake (UL). The ULs used in this assessment were from the NRVs released in 2006 for Australia and New Zealand (National Health and Medical Research Council 2006) and are shown in Table A3.2 in Appendix 3.

The estimated dietary intakes for iodine were determined for each individual respondent where the 1995 and 1997 NNS data were used to estimate dietary iodine intakes, and were compared to the relevant UL for their age group and gender.

Market Weighted Discretionary Salt Model Results

The results from the 'market weighted discretionary salt' models are representative of mean **population** intakes over a period of time and reflect that approximately 60% is iodised in New Zealand and 20% of discretionary salt is iodised in Australia.

Estimated mean dietary iodine intakes

Dietary iodine intakes were estimated for *Scenario 3 – Breads* to assess the impact that mandatory fortification of breads could have on iodine intakes in the target groups.

For all population groups assessed for New Zealand and Australia, there was an increase in estimated mean dietary iodine intakes from *Baseline* to *Scenario 3 – Breads*. Refer to Figure 3 and Figure 4 for an overview of mean dietary iodine intakes for New Zealand and Australian population groups, respectively. Additional details can be found in Table A1.1 in Appendix 1. The results indicate that the New Zealand population groups have slightly lower *Baseline* and slightly higher *Scenario 3 – Breads* mean dietary iodine intakes in comparison to the Australian population groups.

The 2003/04 New Zealand Total Diet Survey (NZ TDS) estimated dietary iodine intakes for 25 year old females at 59-61 µg/day, based on a model diet (Vannoort and Thomson, 2005f). When discretionary salt consumption is not considered, FSANZ's estimated dietary iodine intakes for New Zealand women aged 16-44 years (66 µg/day) was similar to that predicted in the 2003/04 NZ TDS for women aged 25 years (59 to 61 µg/day, based on lower bound mean iodine concentrations to upper bound mean iodine concentrations). This similarity may be due, in part, to FSANZ using the iodine concentrations from the 2003/04 NZ TDS, in conjunction with other data, in its iodine intake assessments.

Estimated increases in iodine intakes

The results show an increase in estimated dietary iodine intakes from *Baseline* to *Scenario 3 – Breads* for the target groups and all other population groups assessed. The incremental increase in iodine intake from *Baseline* for the target group of women of child bearing age (16-44 years) and children aged 2-3 years is shown in Table 1, with the increases for non-target groups shown in Table A1.1 in Appendix 1.

Table 1: Market Weighted Model: Estimated increases in mean iodine intakes for target groups should mandatory fortification of salt in breads at 45 mg iodine/kg salt be introduced

Country	Population group	***Baseline*** **mean dietary iodine intake (µg/day)**	**Increase in mean iodine intake from *Baseline* (µg/day) *Scenario 3 – Breads***
New Zealand	Women 16-44 years	99	+73
Australia	Children 2-3 years	95	+38
	Women 16-44 years	100	+46

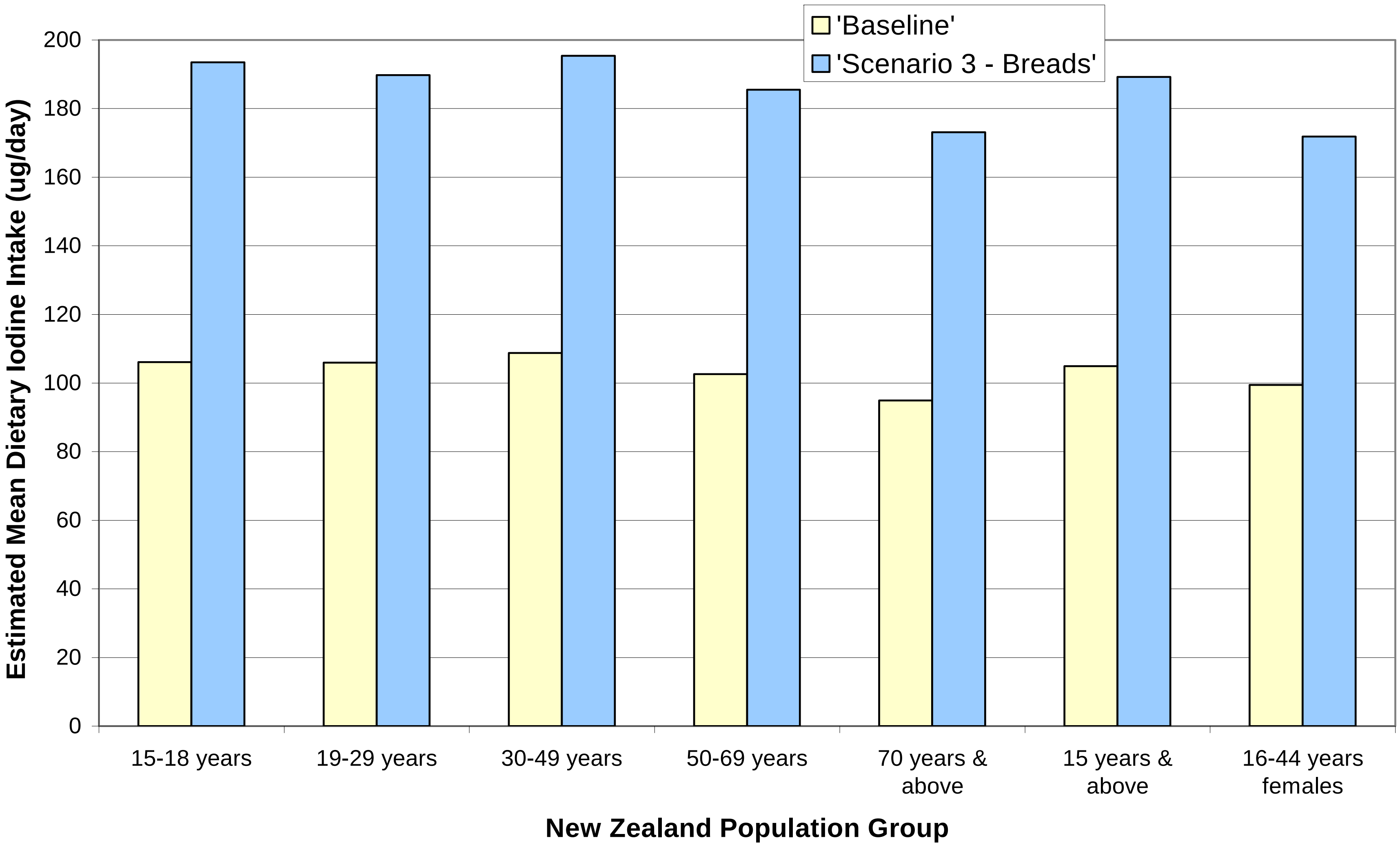


Figure 3: Estimated mean dietary intakes of iodine (µg/day) for Baseline and Scenario 3 – Breads models for New Zealand population groups.

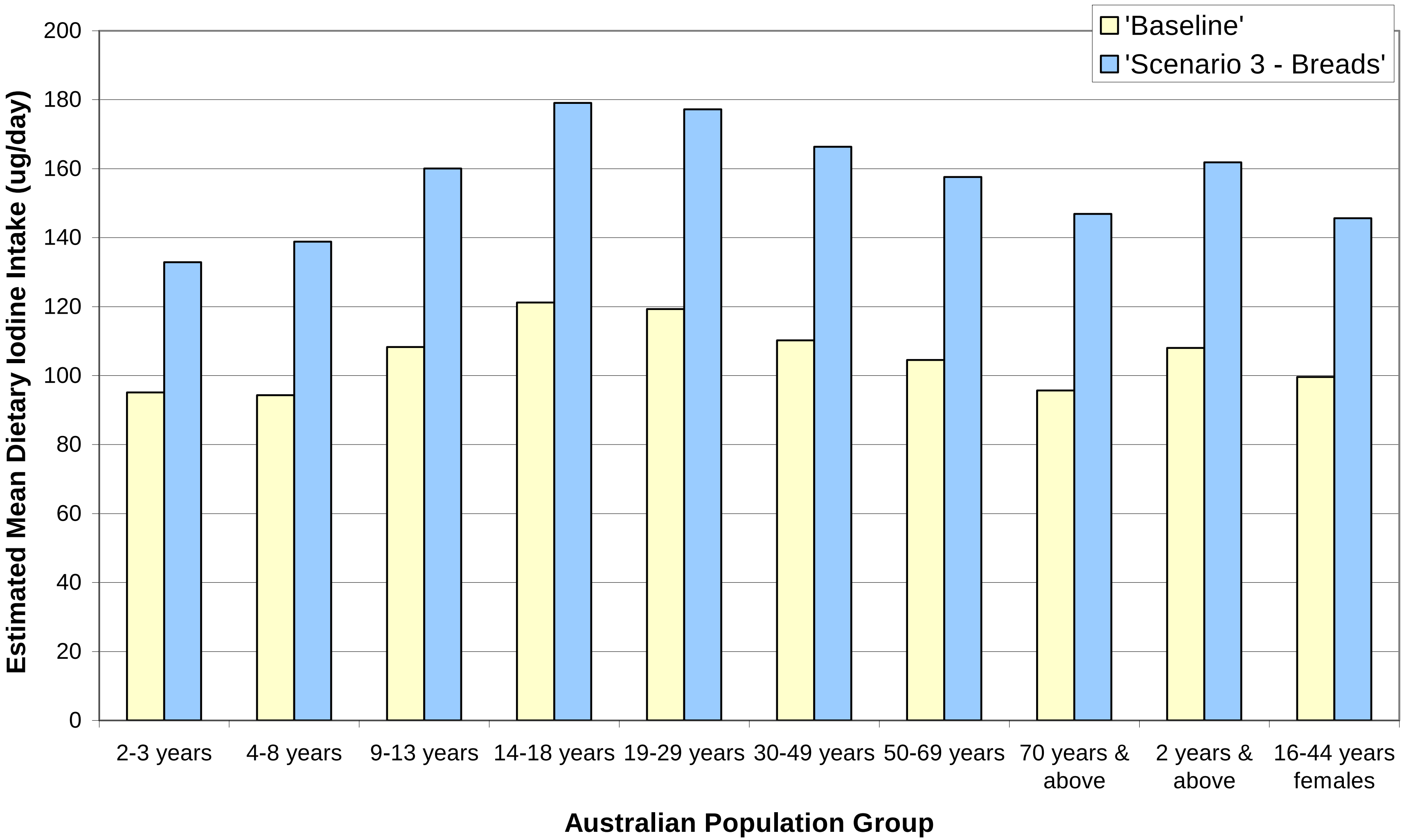


Figure 4: Estimated mean dietary intakes of iodine (µg/day) for Baseline *and* Scenario 3 – Breads *models for Australian population groups.*

Estimated proportion of the population with inadequate dietary iodine intakes

The estimated proportions of each population group with inadequate dietary iodine intakes from the market weighted models are shown in Figure 5 and Figure 6 for New Zealand and Australian population groups respectively. Full details of the estimated proportions of each population group with inadequate dietary iodine intakes can be found in Table A3.1 of Appendix 3.

At baseline, the prevalence of inadequate intakes for New Zealanders ranged between 27 and 72% for the general population groups assessed (i.e. not pregnant and lactating females). As age increases for New Zealanders, the estimated proportion of the population with inadequate dietary iodine intakes increases. Mandatory fortification of bread with iodised salt (*Scenario 3 – Breads*) results in the proportion of all populations with inadequate intakes being reduced to zero. For Australian population groups, mandatory fortification also resulted in a decrease in the proportion of each population group with inadequate iodine intakes.

Comparison of the iodine intakes of women aged 16-44 years to the pregnancy and lactation EARs suggests that 97% or more of New Zealand women in this age group would have inadequate intakes. The prevalence is reduced by mandatory fortification of bread with iodised salt (between 45% and 77%). For Australian women, at baseline, between 93% and 97% of pregnant and lactating women have inadequate iodine intakes. This is reduced to between 71% and 88% following mandatory fortification.

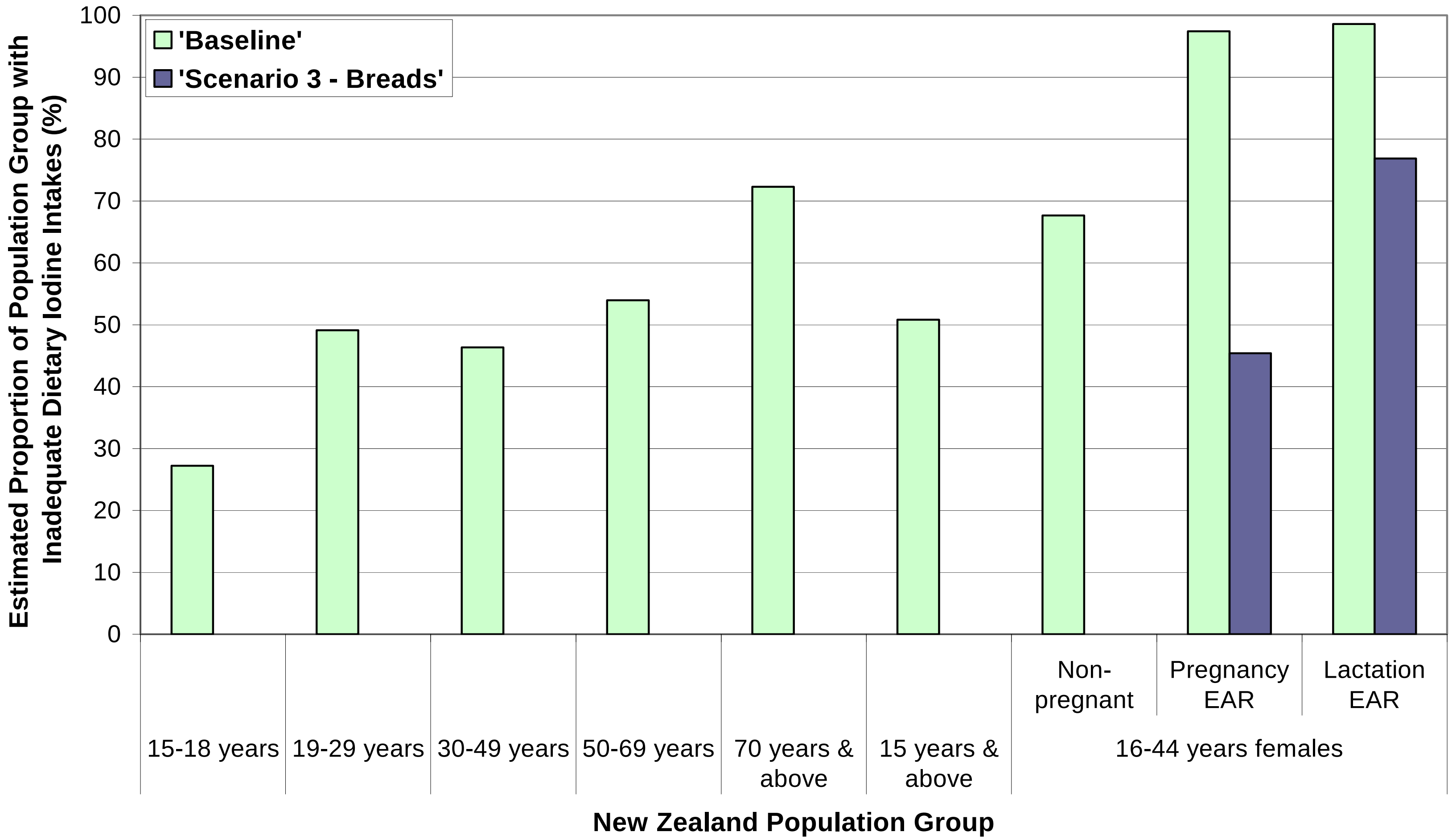


Figure 5: Market Weighted Model: Estimated proportion of New Zealand population groups with inadequate dietary iodine intakes for Baseline *and* Scenario 3 – Breads

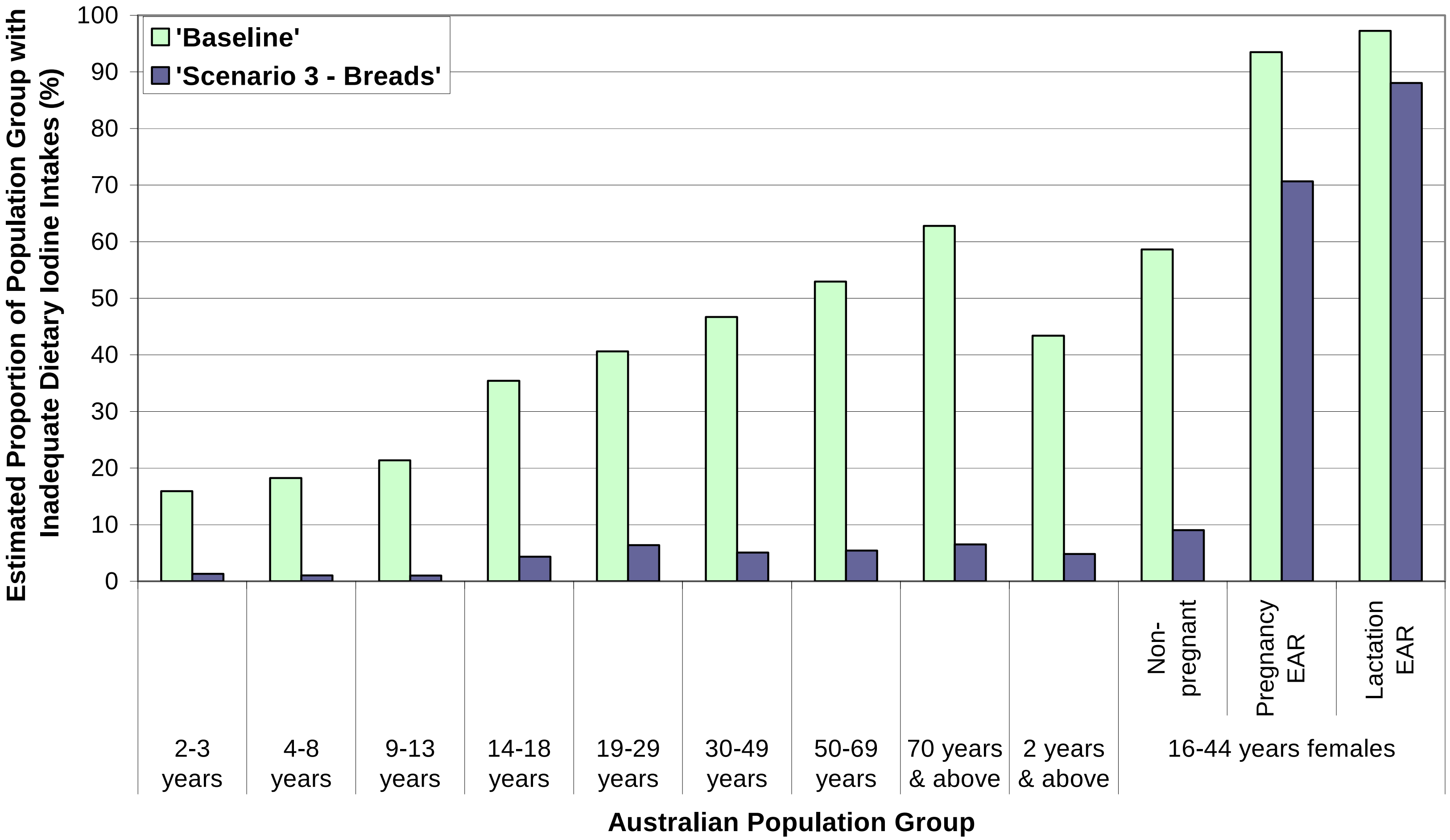


Figure 6: Market Weighted Model: Estimated proportion of Australian population groups with inadequate dietary iodine intakes for Baseline *and* Scenario 3 – Breads

Comparison of the estimated dietary intakes with the Upper Level of Intake (UL)

Full details of the proportions of each population group with estimated dietary iodine intakes from the market weighted models above the UL can be found in Table A3.2 in Appendix 3.

For New Zealanders aged 15 years and above, the estimated proportion of the population with dietary iodine intakes that exceeded the UL for *Baseline* and *Scenario 3 – Breads* was zero.

For all Australian population groups aged 2 years and above, less than 1% of the population had dietary iodine intakes that exceeded the UL at *Baseline*. For *Scenario 3 – Breads*, Australian children aged 2-3 years had the greatest proportion of the population that exceeded the UL of 200 µg per day (6%). The proportion of 4-8 year old children with iodine intakes above the UL (300 µg per day) was less than 1% of the population for *Scenario 3 – Breads*.

In order to assess any potential risks of current (*Baseline*) and future (*Scenario 3 – Breads*) iodine intakes for Australian children aged 2-3 years and 4-8 years, maximum dietary iodine intakes and the percentage of these population groups with dietary iodine intakes above 300 µg per day[2] were estimated. These data are outlined in Table 2.

Table 2: Market Weighted Model: Maximum estimated dietary iodine intakes and proportion of the population with intakes > 300 µg/day for Australian children aged 2-8 years for *Baseline* and *Scenario 3 – Breads*

Scenario	Maximum Estimated Iodine Intake (µg/day)		Proportion of Population Group with Iodine Intakes > 300 µg/day	
	2-3 years	4-8 years	2-3 years	4-8 years
Baseline	208	256	0	0
Scenario 3 – Breads	331	335	<1	<1

Figure 7 shows the dietary iodine intake distributions for *Baseline* and *Scenario 3 – Breads* for Australian children aged 2-3 years, including a comparison with the UL. Figure 8 and Figure 9 show distributions of dietary iodine intakes for women of child bearing age (16-44 years) for New Zealand and Australia respectively; however the UL (1,100 µg iodine/day) is off of the right hand scale of the distribution, and therefore can not be seen on the graphs.

[2] A level of 300 µg/day was chosen as a basis for comparison as it represents the maximum daily intake that remains within the 1.5 fold safety margin for the UL derived for 1-3 year old children (200 µg/day). Intakes up to 300 µg/day should therefore be well tolerated by young children. Less certainty exists in relation to intakes above 300 µg/day for 1-3 year olds.

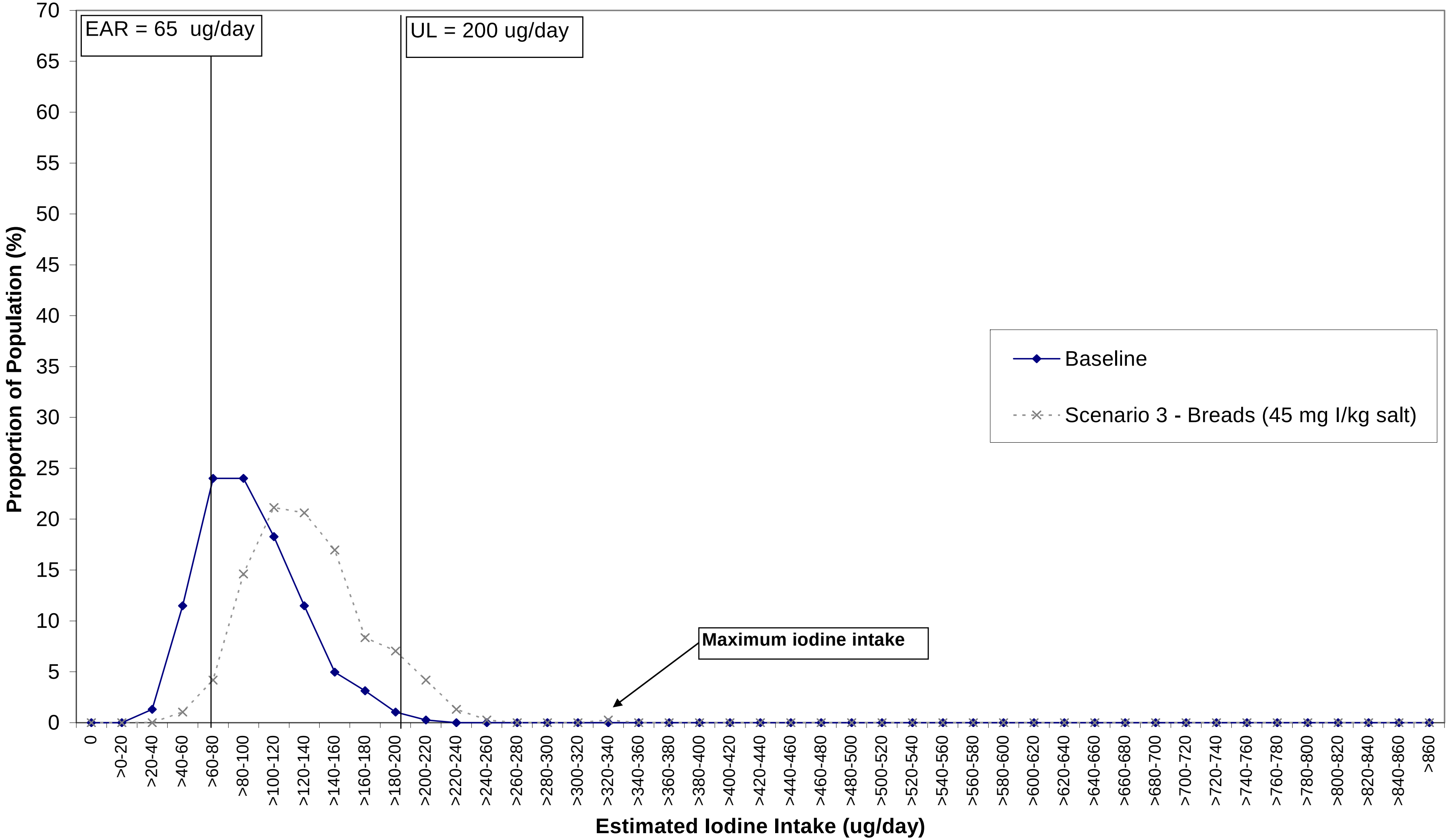


Figure 7: *Market Weighted Model: Distribution of dietary intakes of iodine (µg/day) for Australian children aged 2-3 years for* Baseline *and* Scenario 3 – Breads

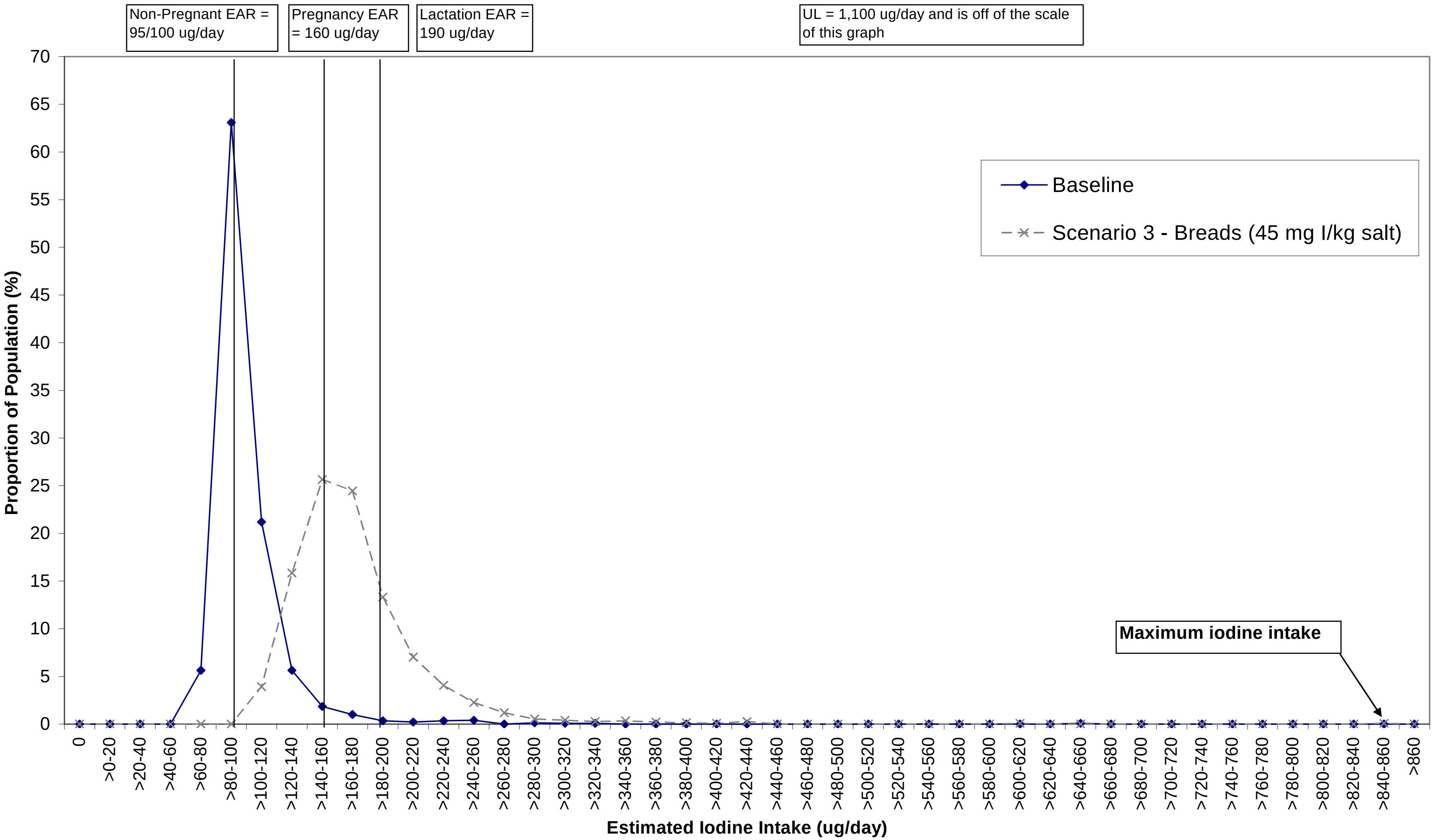


Figure 8: Market Weighted Model: Distribution of dietary intakes of iodine for New Zealand women aged 16-44 years for Baseline *and* Scenario 3 – Breads

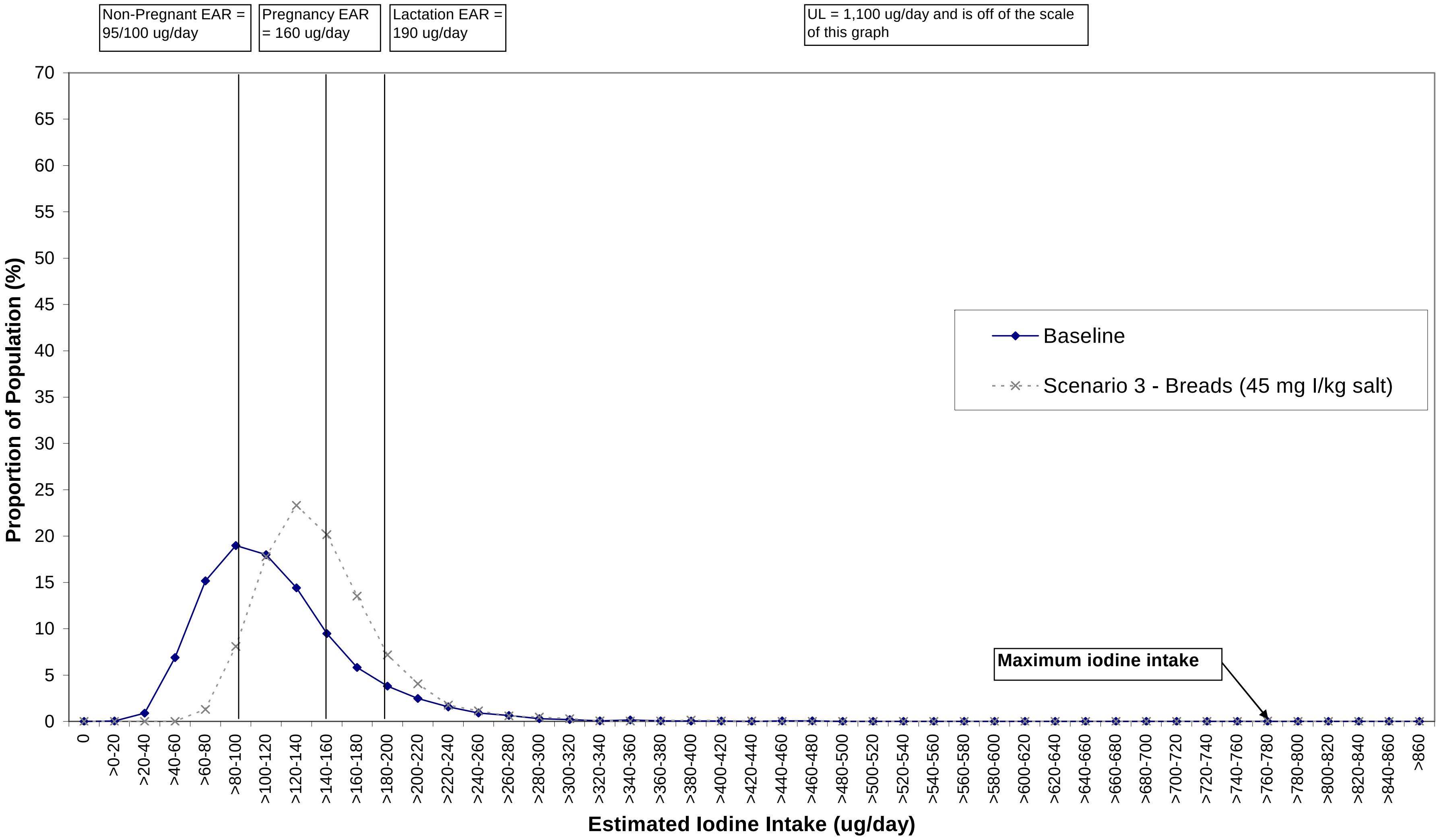


Figure 9: Market Weighted Model: Distribution of dietary intakes of iodine for Australian women aged 16-44 years for Baseline *and* Scenario 3 – Breads

Consumer Behaviour Discretionary Salt Model Results

In the 'consumer behaviour discretionary salt models', mean dietary iodine intakes and the proportions of the population groups with intakes below the EAR and above the UL are presented as ranges; the lower number in the range indicates iodine intakes for individuals who always select non-iodised salt for discretionary use (in the cooking/preparation of food and at the table); the upper number in the range indicates iodine intakes for individuals who always select iodised salt for discretionary use.

Estimated mean dietary iodine intakes

Dietary iodine intakes were estimated for *Scenario 3 – Breads* to assess the impact that mandatory fortification of breads could have on iodine intakes in the New Zealand and Australian population groups.

Results for young children

Mean dietary iodine intakes for New Zealand children aged 1-3 years and for Australian children aged 1 year were calculated using 'theoretical diets'. The range of dietary iodine intakes takes into consideration a previously assessed application (A528 – Maximum Iodine Limit in Formulated Supplementary Foods for Young Children) for changing permitted iodine levels in formulated supplementary foods for young children (FSFYC) or 'toddler milks'. The lower number in the results represents a situation where no FSFYC were consumed; the upper number represents a situation where 1 serve (226 g) of FSFYC was consumed per day instead of cow's milk.

For *Baseline* and *Scenario 3 – Breads*, New Zealand children aged 1-3 years have lower mean dietary iodine intakes in comparison to Australian children aged 1 year (refer to Table A2.1 and Table A2.2 in Appendix 2 for details). The differences between New Zealand and Australia could be due to (1) the lower milk iodine concentration in New Zealand in comparison to Australia, (2) the different age groups being assessed and/or (3) the different methods of constructing the theoretical diets. *Scenario 3 – Breads* gives lower mean dietary iodine intakes for New Zealand children aged 1-3 years and Australian children aged 1 year in comparison to the *Baseline*.

Results for all other population groups

For all other population groups, mean dietary iodine intakes were estimated based on food consumption data from the 1995 and 1997 NNSs. A range of dietary iodine intakes are presented; the lower number in the range represents a situation where non-iodised discretionary salt was consumed, and the upper number in the range represents where iodised discretionary salt was consumed, based on 100% of New Zealanders and 62% of Australians consuming discretionary salt. Figure 10 and Figure 11 show the estimated mean dietary iodine intakes for New Zealand and Australian population groups, respectively. Full details can be found in Table A2.3 in Appendix 2.

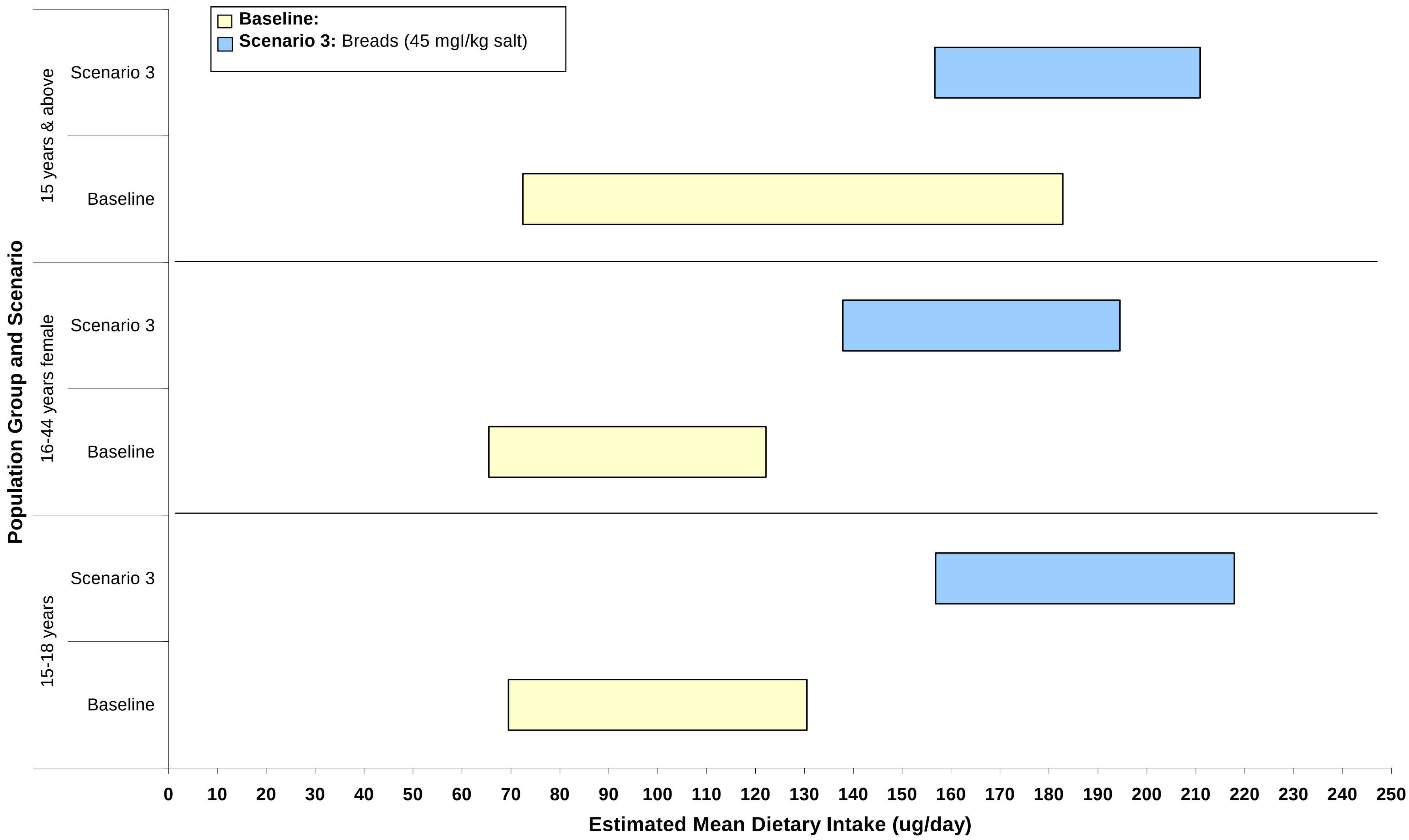
There was an increase in estimated mean dietary iodine intakes from *Baseline* to *Scenario 3 – Breads* for all population groups assessed for New Zealand and Australia. When discretionary salt was non-iodised, the results indicated that the New Zealand population groups had lower *Baseline* mean iodine intakes in comparison to the similar Australian population groups.

The lower mean iodine intakes in New Zealand could be due to the lower iodine content of some key foods, such as milk, in comparison to Australia. However, when iodised discretionary salt was considered, New Zealand and Australian population groups had similar mean *Baseline* dietary iodine intakes. This may partly be explained by the different methodology used to calculate the dietary iodine intakes where discretionary salt consumption was allocated to approximately 62% of the Australian NNS respondents (those identified as discretionary salt consumers from the NNS) whereas for New Zealand, all NNS respondents were assumed to be discretionary salt consumers. Also, as the amount of salt consumed does not change for New Zealand consumers, the difference in mean intakes between consumers and non-consumers does not change. Refer to Attachment 1 for details on how discretionary salt consumption was calculated.

Estimated increases in iodine intakes

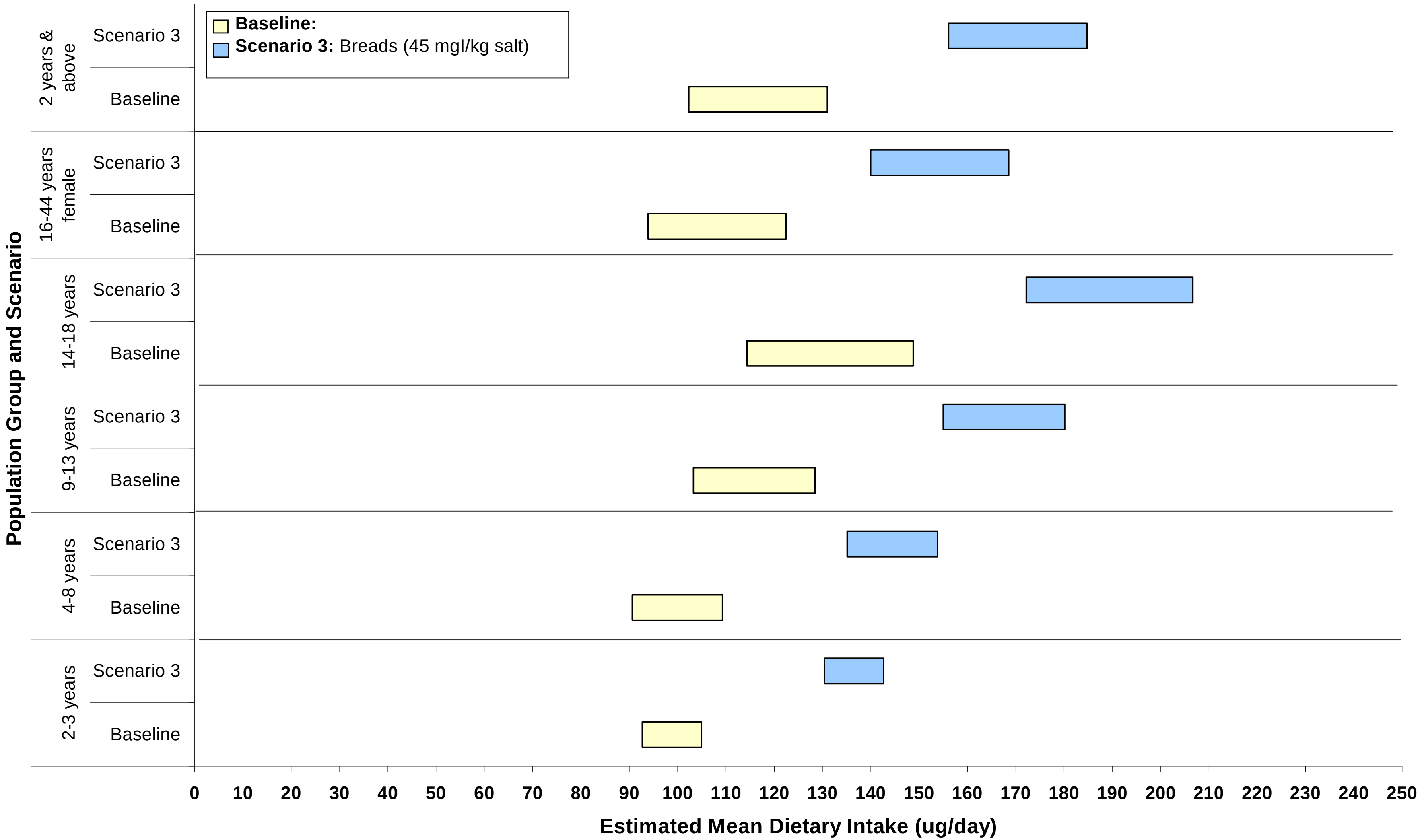
The results showed an increase in estimated dietary iodine intakes from *Baseline* to *Scenario 3 – Breads* for the target groups and all other population groups assessed. The incremental increase in iodine intake from *Baseline* for the target groups of children 2-3 years and women of child bearing age (16-44 years) are shown in Table 3.

The results indicated that, for New Zealand women aged 16-44 years, the increase in mean dietary iodine intakes from *Baseline* was higher in comparison to Australian women aged 16-44 years.



Note: in this figure, the lower number in the range is the mean dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for *Scenario 3 – Breads*.

Figure 10: Consumer Behaviour Model: Estimated mean dietary iodine intakes for New Zealand population groups



Note: in this figure, the lower number in the range is the mean dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for *Scenario 3 – Breads*.

Figure 11: Consumer Behaviour Model: Estimated mean dietary iodine intakes for Australian population groups

Table 3: Consumer Behaviour Model: Estimated increases in mean iodine intakes for target groups should mandatory fortification of salt in breads at 45 mg iodine/kg salt be introduced

a. Based on theoretical diets

Country	**Population group**	***Baseline* mean dietary iodine intake (µg/day)**		**Increase in mean iodine intake from *Baseline* (µg/day)**	
		Without FSFYC	With FSFYC	Without FSFYC	With FSFYC
New Zealand	Children 1-3 years	48	72	+29	+30
Australia	Children 1 year	79	92	+16	+15

b. Based on NNS data

Country	**Population group**	***Baseline* mean dietary iodine intake (µg/day)**	**Increase in mean iodine intake from *Baseline* (µg/day)**
New Zealand	Women 16-44 years	66 – 122	+72 – 72
Australia	Children 2-3 years	93 – 105	+37 – 38
	Women 16-44 years	94 – 122	+46 – 47

Note: in this table, the lower number in the range is the mean dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for *Scenario 3 – Breads*.

Estimated proportion of the population with inadequate dietary iodine intakes

As dietary iodine intakes for New Zealand children aged 1-3 years and for Australian children aged 1 year were calculated using a 'theoretical diet', the proportion of these population groups with dietary iodine intakes below the EAR could not be determined. Therefore mean intake was simply compared to the EAR and expressed as a percentage of the EAR, assuming either ordinary milk was consumed or one serve of FSFYC instead of milk. For New Zealand children aged 1-3 years, estimated *Baseline* mean dietary iodine intakes were below the EAR when FSFYC were not considered. Estimated mean dietary iodine intakes were above the EAR for *Baseline* with FSFYC consumption and for both *Scenario 3 – Breads* models. For both *Baseline* and *Scenario 3 – Breads*, estimated mean dietary iodine intakes were above the EAR for Australian children aged 1 year, with and without FSFYC. For further details, refer to Table A4.1 and Table A4.2 in Appendix 4.

For all other population groups, the estimated proportion of each population group with inadequate dietary iodine intakes for the consumer behaviour models is shown in Figure 12 for New Zealand population groups and Figure 13 for Australian population groups (with and without the iodisation of discretionary salt).

Full details of the estimated proportions of each population group with inadequate dietary iodine intakes can be found in Table A4.3 in Appendix 4.

The estimated proportion of each population group with inadequate dietary iodine intakes is presented as a range; the lower number in the range represents where iodised discretionary salt was consumed, and the upper number in the range represents where non-iodised discretionary salt was consumed.

For all New Zealand and Australian population groups assessed, *Baseline* models had the highest estimated proportion of respondents with inadequate dietary iodine intakes compared to *Scenario 3 – Breads* models. The population group with the highest estimated proportion of respondents with inadequate dietary iodine intakes at *Baseline* was women aged 16-44 years when their intakes were compared with the EAR for lactating women. Comparing the intakes of 16-44 year old females with the EAR for pregnant women produced the second highest proportion of respondents with inadequate dietary iodine intakes. These proportions remain high, even under the fortification scenarios being considered.

In New Zealand, the use of iodised salt is a major determinant of the prevalence of inadequate iodine intake. Among those 15 years and older, 91% of those who do not use iodised discretionary salt have inadequate intakes where as only 5% of those who do use iodised discretionary salt have inadequate intakes. If bread were to be fortified with iodised salt, then these proportions would be 8% for users of non iodised salt and 0% for users of iodised salt.

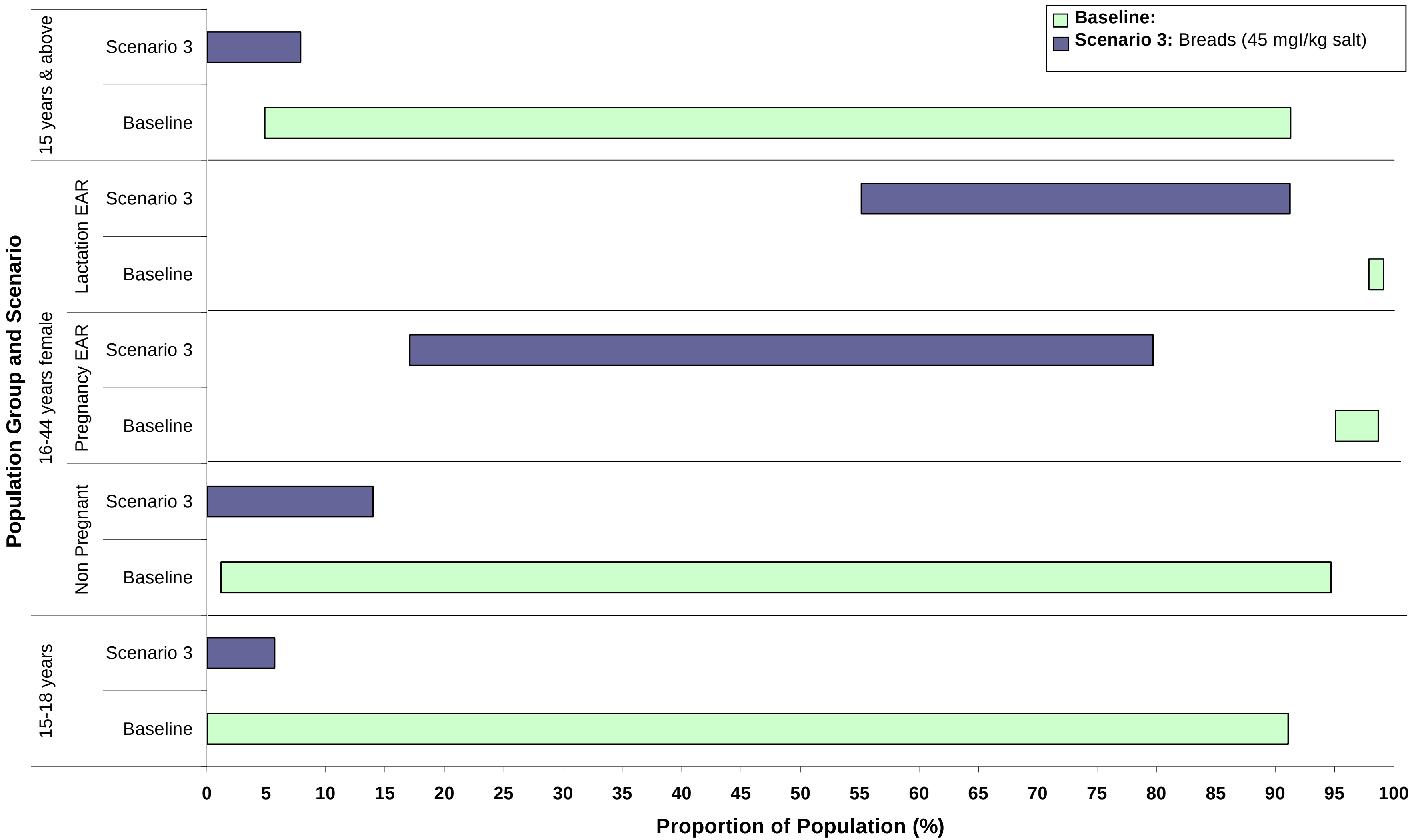


Figure 12: Consumer Behaviour Model: Estimated proportion of New Zealand population groups with inadequate dietary iodine intakes for Baseline *and* Scenario 3 – Breads

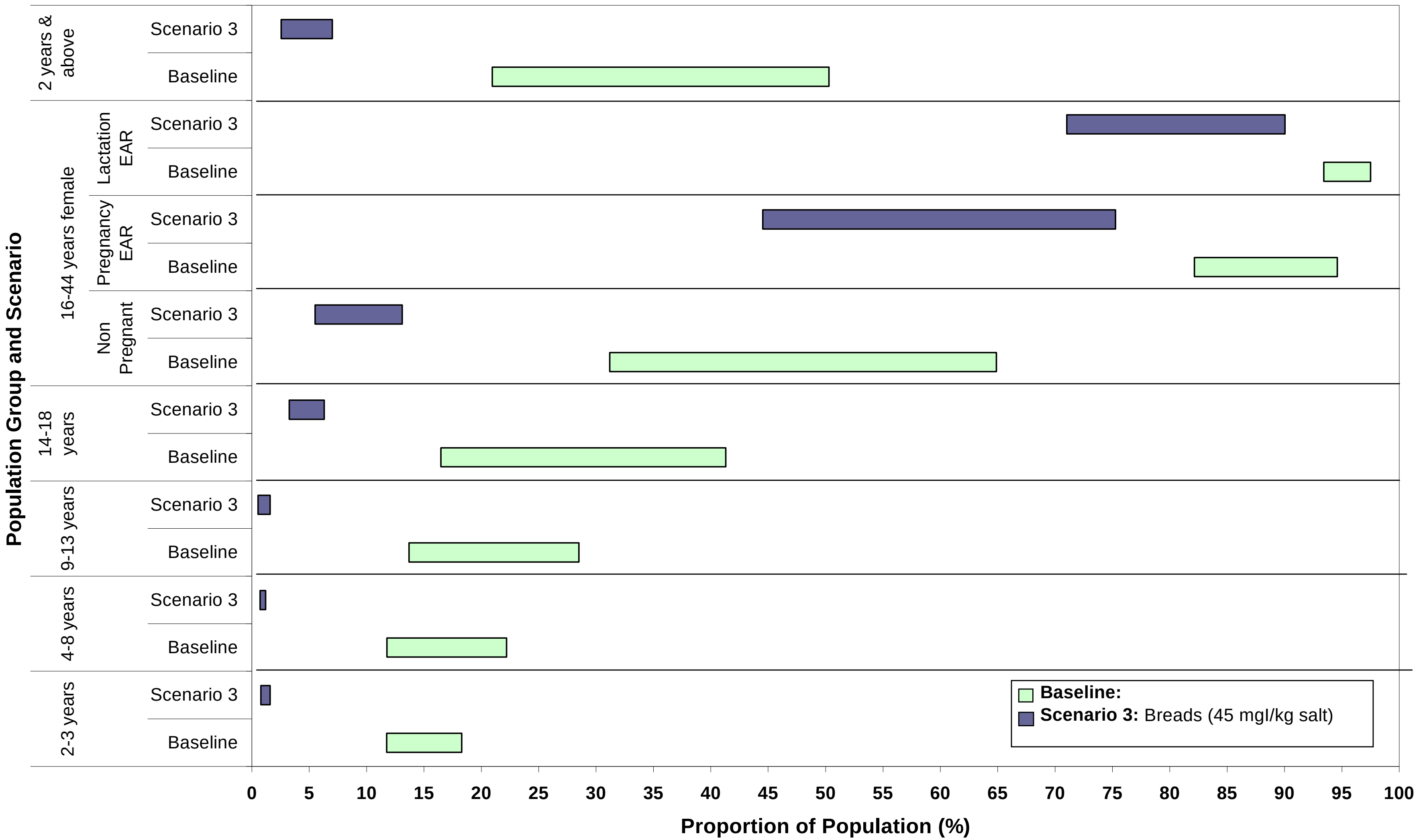


Figure 13: Consumer Behaviour Model: Estimated proportion of Australian population groups with inadequate dietary iodine intakes for Baseline and Scenario 3 – Breads

Comparison of the estimated dietary intakes with the Upper Level of Intake (UL)

Since dietary iodine intakes for Australian children aged 1 year and for New Zealand children aged 1-3 years were estimated using a 'theoretical diet', the percentage of these population groups with dietary iodine intakes above the UL could not be determined. As an alternative, the 95th percentile dietary iodine intake was estimated and then compared to the UL and expressed as a percentage of the UL for models with and without the consumption of one serve of FSFYC.

At *Baseline*, New Zealand children aged 1-3 years had 95th percentile dietary iodine intakes which were below the UL (60% of UL with no FSFYC; 90% of UL with FSFYC) while, for Australian children aged 1 year, 95th percentile intakes were equivalent to or greater than the UL (100% of UL with no FSFYC; 120% of UL with FSFYC). For *Scenario 3 – Breads*, 95th percentile dietary iodine intakes exceeded the UL for New Zealand children aged 1-3 years when FSFYC are consumed (130% of UL) and for Australians aged 1 year (120-130% UL). For New Zealand children who do not consume FSFYC, 95th percentile iodine intakes are estimated to not exceed the UL (95% of UL). For more information on the comparison of mean and 95th percentile dietary iodine intakes with the UL, refer to Table A4.4 and Table A4.5 in Appendix 4.

For New Zealanders aged 15 years and above, the estimated percentage of the population with dietary iodine intakes that exceeded the UL for *Baseline* and *Scenario 3 – Breads* was zero for non-iodised and iodised salt users.

For the population group of Australians aged 2 years and above, less than 1% of the group had estimated dietary iodine intakes that exceeded the UL for *Baseline* and *Scenario 3 – Breads* for non-iodised and iodised salt users. Australian children aged 2-3 years had the greatest proportion of the population that exceeded the UL of 200 µg per day; up to 2% at *Baseline* and up to 10% for *Scenario 3 – Breads* for iodised salt users. The proportion of 4-8 year old children with iodine intakes above the UL (300 µg per day) was less than 1% of the population for *Baseline* and *Scenario 3 – Breads* for non-iodised and iodised salt users.

In order to assess any potential risks of current (*Baseline*) and future (*Scenario 3 – Breads*) iodine intakes for Australian children aged 2-3 years and 4-8 years, maximum dietary iodine intakes and the percentage of these population groups with dietary iodine intakes above 300 µg per day were estimated[3]. These data are outlined in Table 4.

[3] A level of 300 µg per day was chosen for comparison as it represents the maximum daily intake that remains within the 1.5 fold safety margin for the UL derived for 1-3 year old children of 200 µg per day, intakes up to 300 µg per day should therefore be well tolerated by young children. Less certainty exists in relation to intakes above 300 µg per day for 103 year olds.

Table 4: Consumer Behaviour Model: Maximum estimated iodine intakes and proportion of the population with intakes > 300 µg/day for Australian children aged 2-8 years for *Scenario 3 – Breads*

Scenario	Maximum Estimated Iodine Intake (µg/day)		Proportion of Population Group With Iodine Intakes > 300 µg/day	
	2-3 years	4-8 years	2-3 years	4-8 years
Baseline	208 – 223	256 – 279	0 – 0	0 – 0
Scenario 3 – Breads	331 – 331	335 – 366	<1 – <1	<1 – <1

Note: in this table, the lower number in the range is the maximum estimated dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the maximum estimated dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for *Scenario 3 – Breads*.

Major contributors to iodine intakes

The major foods contributing ≥5% to total iodine dietary intakes are shown in Figure 14 – Figure 16 for children aged up to 3 years, Figure 17 and Figure 18 for women aged 16-44 years, and Figure 19 and Figure 20 for the New Zealand population aged 15 years and above and the Australian population aged 2 years and above, respectively. The calculations for major contributing foods were based on intakes derived from the first 24-hour recall data only and do not include discretionary iodised salt consumption. It was assumed that 1-3 year old children did not consume discretionary salt.

Further details on the percentage contribution of various foods to estimated dietary iodine intakes, including definitions of the types of foods in the major contributor food groups, can be found in Table A2.4 to Table A2.7 in Appendix 2.

New Zealand children aged 1-3 years

When FSFYC are not included in the theoretical diet for young children (1-3 years), milk, yoghurt and eggs were major contributors to iodine intakes for *Baseline* and *Scenario 3 – Breads*. For *Scenario 3 – Breads*, white and wheatmeal breads were also major contributors to iodine intakes. When FSFYC were included in the theoretical diet, the major contributor to iodine intake was FSFYC for all scenarios considered. At *Baseline*, eggs and yoghurt were also major contributors and for *Scenario 3 – Breads*, white and wheatmeal breads were major contributors to iodine intakes.

Australian children aged 1 year

When FSFYC were not included in the theoretical diet, milk was the major contributor to iodine intakes for *Baseline* and *Scenario 3 – Breads*. Bread was also a major contributor for *Scenario 3 – Breads*.

When FSFYC were included in the diet of a 1 year old child, the major contributor to iodine intake was FSFYC. Milk was also a major contributor to iodine intakes for both *Baseline* and *Scenario 3 – Breads*, with white bread being a major contributor to iodine intakes for *Scenario 3 – Breads*.

Australian children aged 2-3 years

The major contributor to iodine intakes for *Baseline* and *Scenario 3 – Breads* was milk, milk products and dishes. At *Baseline*, non-alcoholic beverages were also a major contributor. Cereals and cereal products (grains, flours, breakfast cereals, pastas, noodles etc.) were major contributors to iodine intakes for *Scenario 3 – Breads*.

Women aged 16-44 years

For New Zealand women aged 16-44 years, the major contributor to iodine intakes was milk at *Baseline* and bread (includes rolls and specialty breads) for *Scenario 3 – Breads*. Milks, fish/seafood, and eggs and egg dishes were also major contributors to iodine intakes for *Baseline* and *Scenario 3 – Breads*. At *Baseline*, non-alcoholic beverages and grains and pasta were major contributors to iodine intakes.

For Australian women aged 16-44 years, the major contributor to iodine intakes for *Baseline* was milk, milk products and dishes, with non-alcoholic beverages, water, cereal-based products and dishes, cereals and cereal products and fish and seafood products and dishes being other major contributors. For *Scenario 3 – Breads*, cereals and cereal products were the major contributor to iodine intakes with milk, milk products and dishes, non-alcoholic beverages, water, and cereal-based products and dishes being other major contributors to iodine intakes.

New Zealand population aged 15 years and above and the Australian population aged 2 years and above

For New Zealanders aged 15 years and above, the major contributors to iodine intakes for *Baseline* and *Scenario 3 – Breads* were milk, fish/seafood, and eggs and egg dishes. For *Baseline*, non-alcoholic beverages were also a major contributor to iodine intakes while, for *Scenario 3 – Breads*, bread (includes rolls and specialty breads) was also a major contributor to iodine intakes.

For Australians aged 2 years and above, the major contributors to iodine intakes for *Baseline* and *Scenario 3 – Breads* were similar to those for the target groups, that is milk, milk products and dishes, non-alcoholic beverages, water, cereal-based products and dishes, and cereals and cereal products. Fish and seafood products and dishes were also major contributors to iodine intakes for *Baseline*.

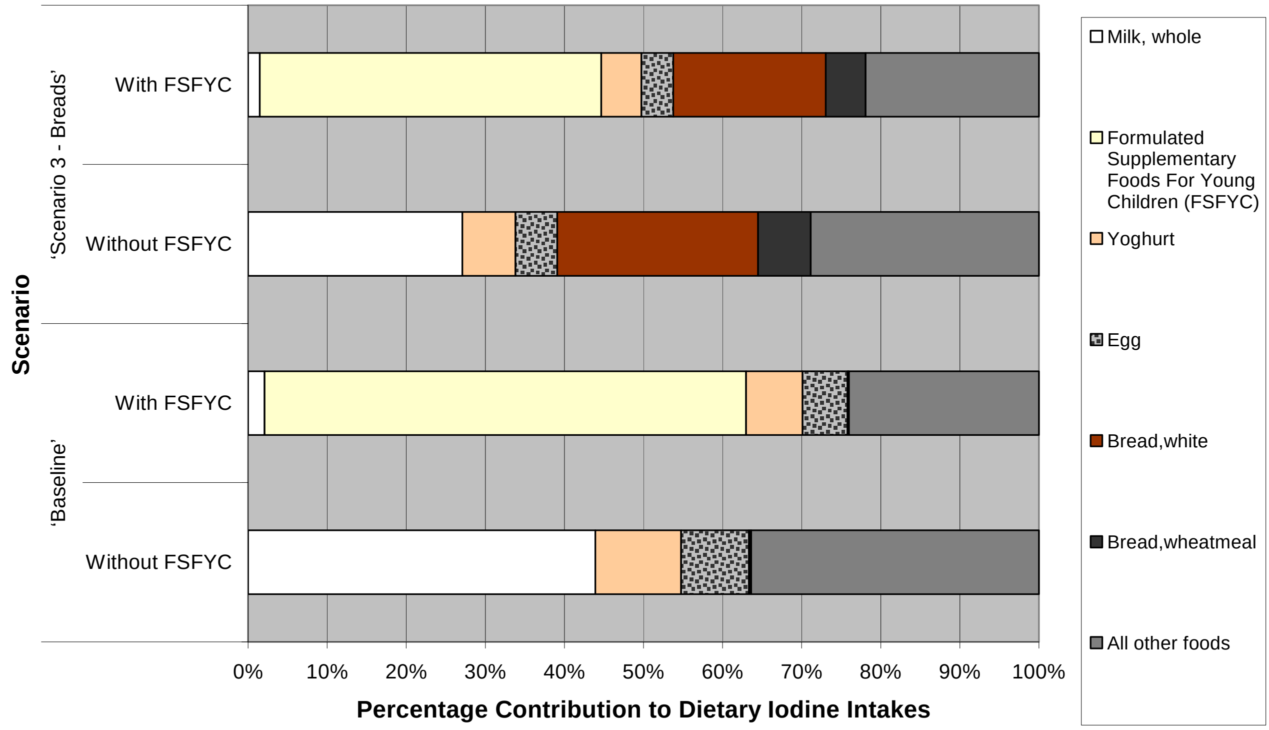


Figure 14: Major contributors to total iodine dietary intakes for New Zealand children aged 1-3 years[4]

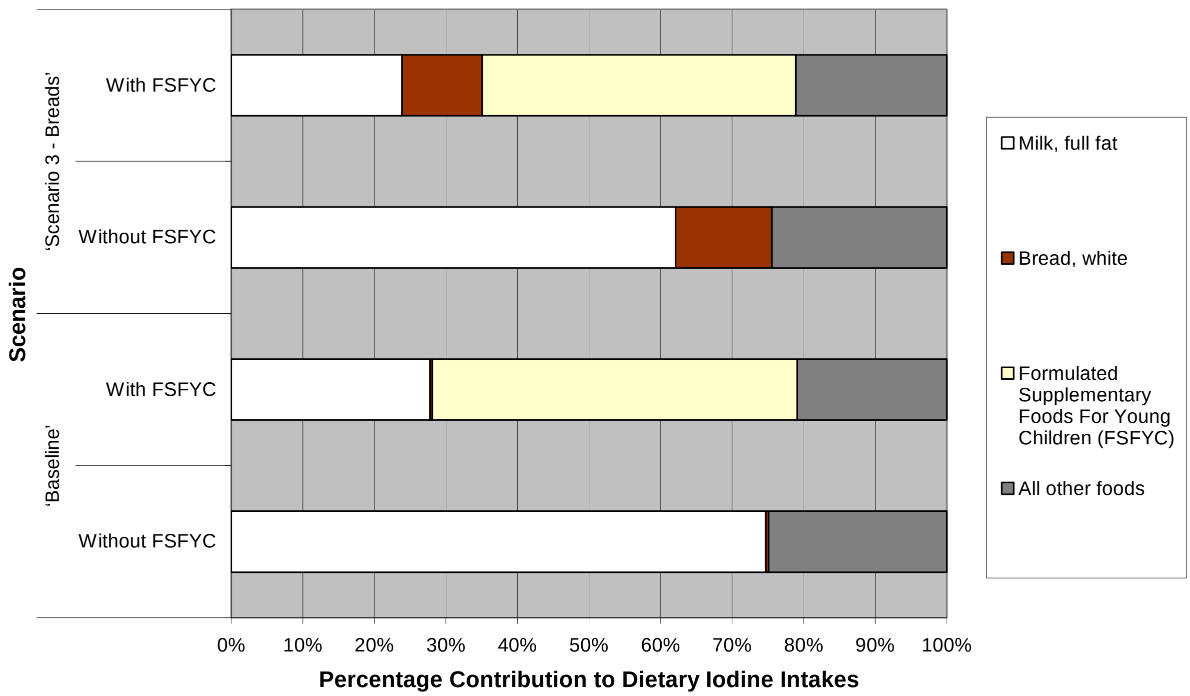


Figure 15: Major contributors to total iodine dietary intakes for Australian children aged 1 year[5]

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[4] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

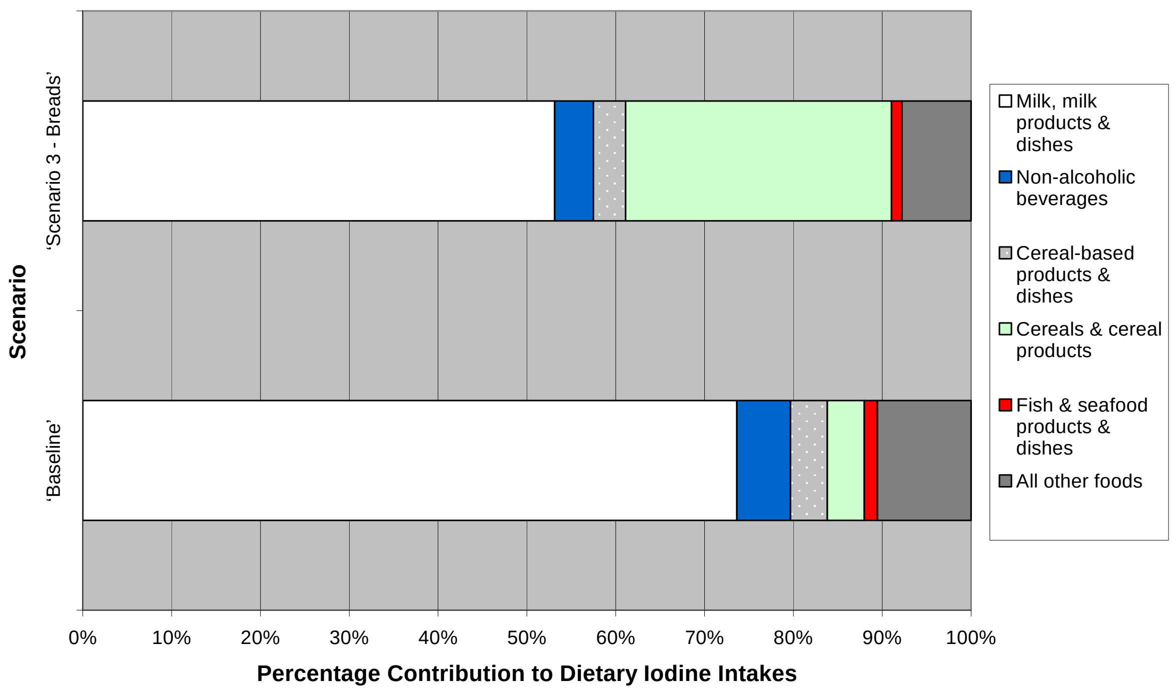

Figure 16: Major contributors to total iodine dietary intakes for Australian children aged 2-3 years[4]

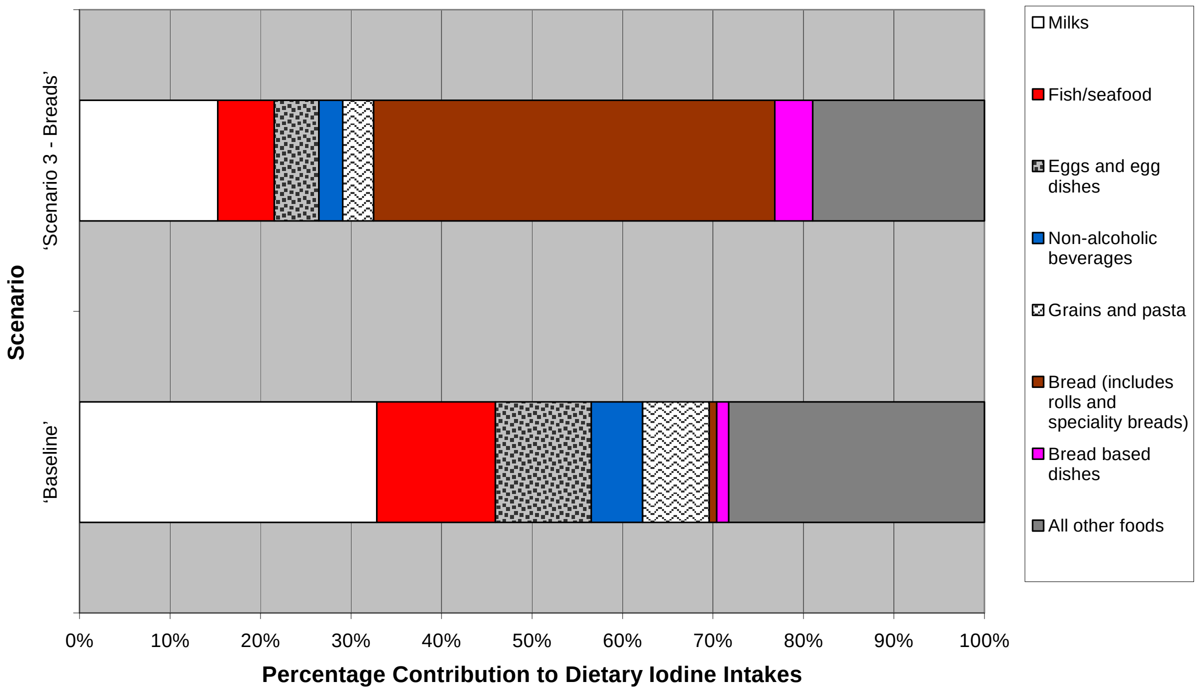

Figure 17: Major contributors to total iodine dietary intakes for New Zealand women aged 16-44 years[6]

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[5] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

[6] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

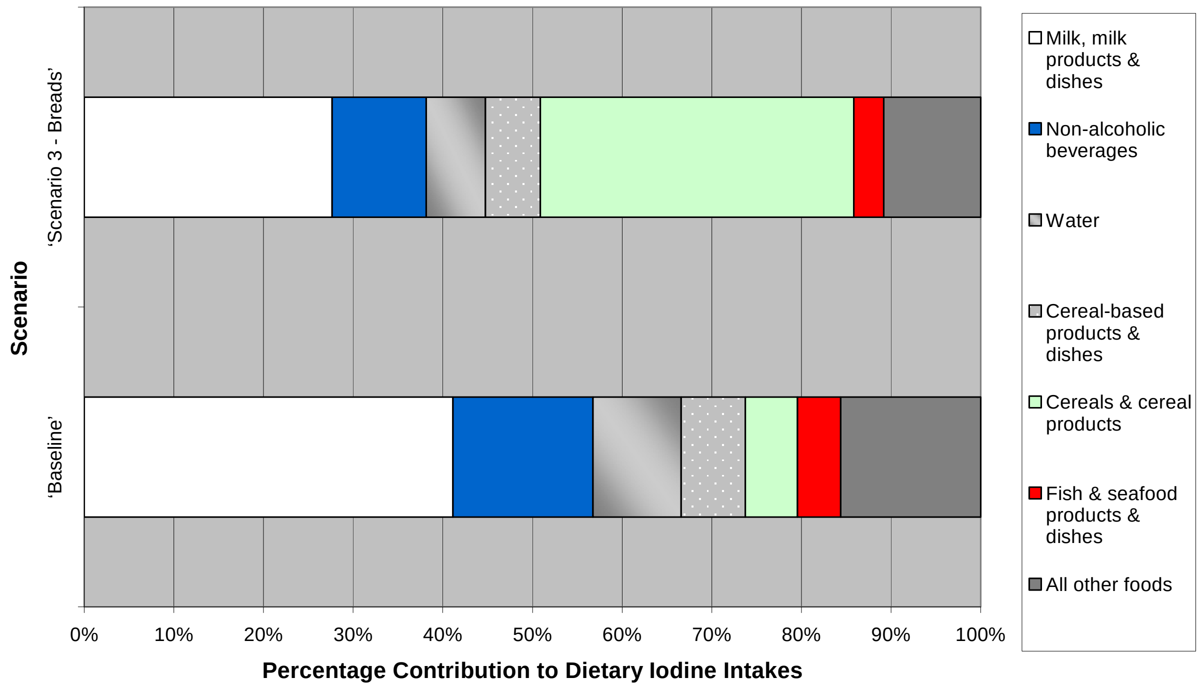


Figure 18: Major contributors to total iodine dietary intakes for Australian women aged 16-44 years[5]

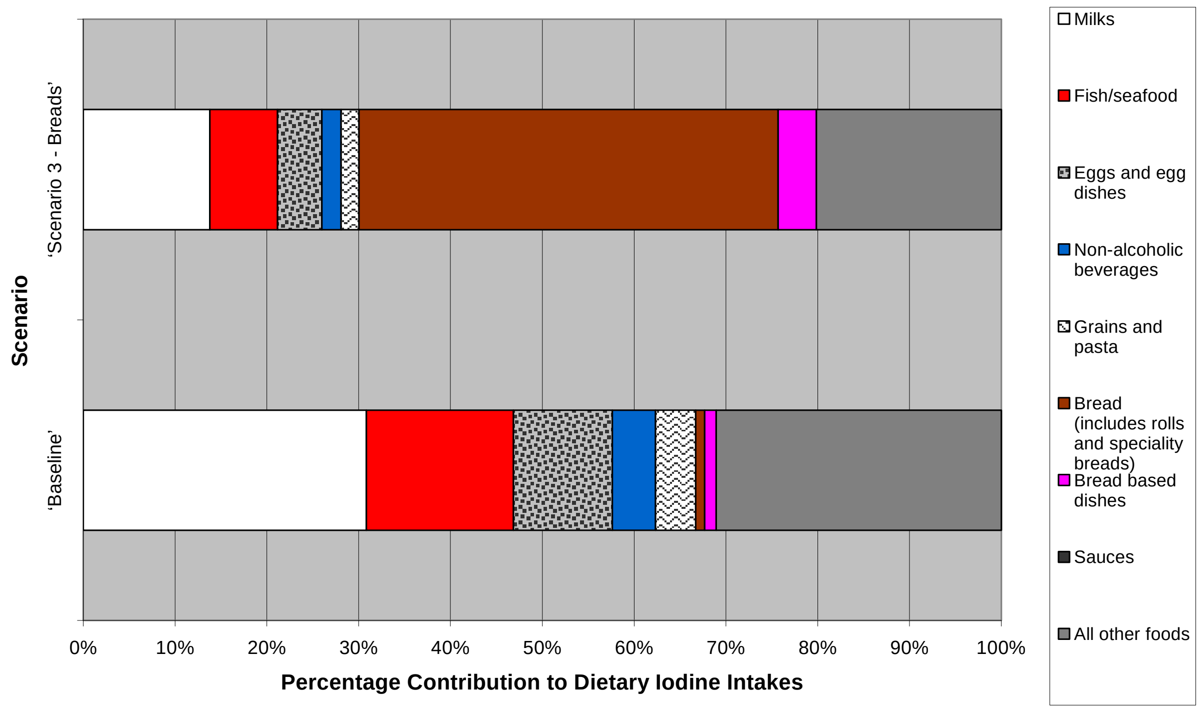


Figure 19: Major contributors to total iodine dietary intakes for New Zealanders aged 15 years and above[7]

[7] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

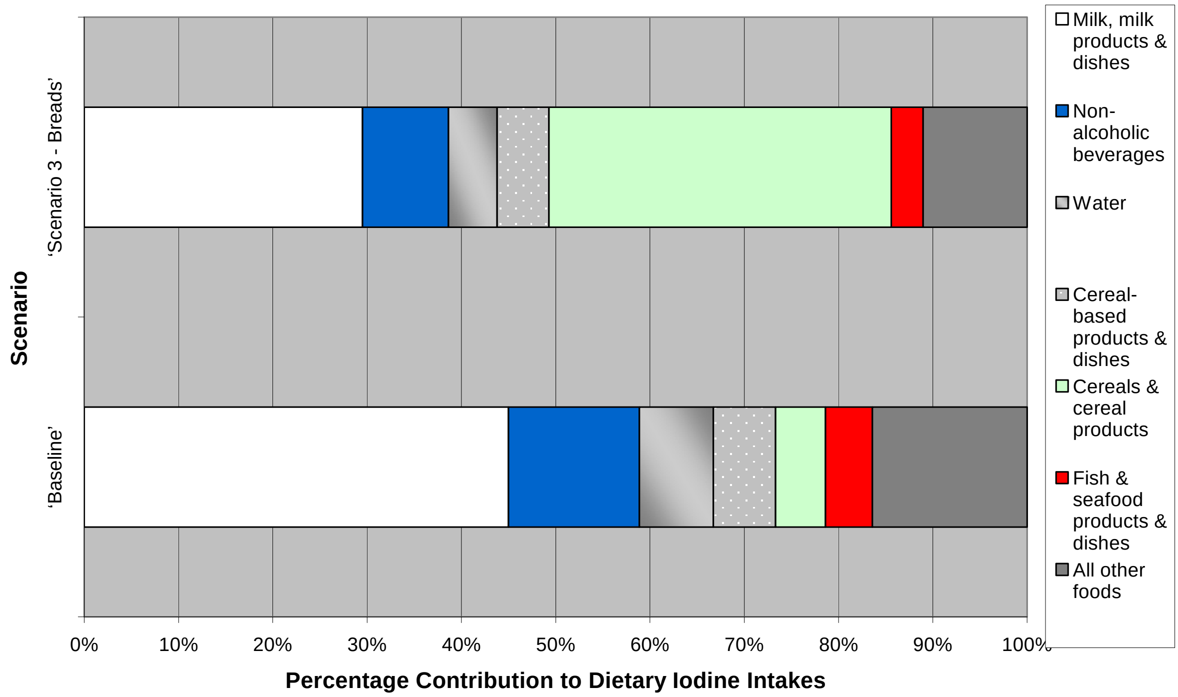


Figure 20: Major contributors to total iodine dietary intakes for Australians aged 2 years and above[6]

Food consumption patterns for respondents with low and high quintile intakes of iodine

During consultations with the food industry on P295 – Consideration of Mandatory Fortification with Folic Acid, one issue raised was the potential for identifying food vehicles that would more effectively target the required group, which for iodine would be children aged 3 years and below, women of child bearing age, and the New Zealand and Australian populations in general who currently have low iodine intakes.

In order to undertake this assessment the 1997 NZ NNS and 1995 NNS respondents were divided into five groups or 'quintiles of iodine intake' for each country based on Baseline iodine intakes, quintile 1 being the low iodine intake group (bottom 20% of iodine intakes for each population group), quintile 5 being the high iodine intake group (top 20% of iodine intakes for each population group) and the food consumption patterns of each group were assessed.

Food consumption patterns are complex. The proportion of people consuming and the amount of food they consume have an impact on both the total amount of iodine consumed and the relative contribution that each food makes to that iodine intake. Food groups other than those currently proposed to be mandatorily fortified with iodine were also investigated as potential food vehicles that would better target the low iodine intake group. The methodology used to investigate these potential differences is summarised in detail in Figure 21. Differences in iodine intakes, major contributors to iodine intakes and, in general, food consumption patterns were found between quintile 1 and 5 groups.

Population group to investigate:

- 2-3 years (Aust. only)
- Females 16-44 years (NZ & Aust)
- 15 years & above (NZ only)
- 2 years & above (Aust only)

Estimate dietary iodine intakes:
Derive iodine intakes for each individual in the population group for *Baseline* using the 2nd day adjustment methodology.

For each population group:
Divide iodine intakes into quintiles of intake.

Identify the individual respondents in each population group with iodine intakes in:

- Quintile 1 or bottom 20% (low iodine intake); and
- Quintile 5 or top 20% (high iodine intake).

What were the mean *Baseline* and *Scenario 3 – Breads* intakes of iodine for:

- Quintile 1; and
- Quintile 5 respondents?

Using food consumption patterns from Day 1 of the NNSs:
Determine & compare the major food contributors to iodine intakes for *Baseline* and *Scenario 3 – Breads* for:

- Quintile 1; and
- Quintile 5 respondents.

Using food consumption patterns from Day 1 of the NNSs:
Determine & compare the proportion of each population group consuming specific foods and beverages for:

- Quintile 1; and
- Quintile 5.

Using food consumption patterns from Day 1 of the NNSs:
Determine & compare the mean amount of specific foods and beverages eaten by respondents in each population group in:

- Quintile 1; and
- Quintile 5.

Figure 21: Methodology for investigating differences in food consumption patterns for low and high iodine consumers.

Mean iodine intakes by Quintile

For all respondents with low and high iodine intakes in all population groups assessed, the introduction of mandatory fortification of breads (*Scenario 3 – Breads*) increased the mean intake of iodine from *Baseline.* The impact of a mandatory fortification program would be much greater for the low iodine intake groups as their iodine intakes would increase by a greater proportional amount even though actual iodine intakes would be lower (New Zealand: approximately 250% and 190% for low iodine intake groups aged 16-44 year female and 15 years and above; Australia: increase of approximately 70%, 100% and 90% for low iodine intake groups aged 2-3 years, 16-44 years female and 2 years and above, respectively). See Figure 22 and Figure 23 and Table A5.1 and Table A5.2 in Appendix 5 for further details.

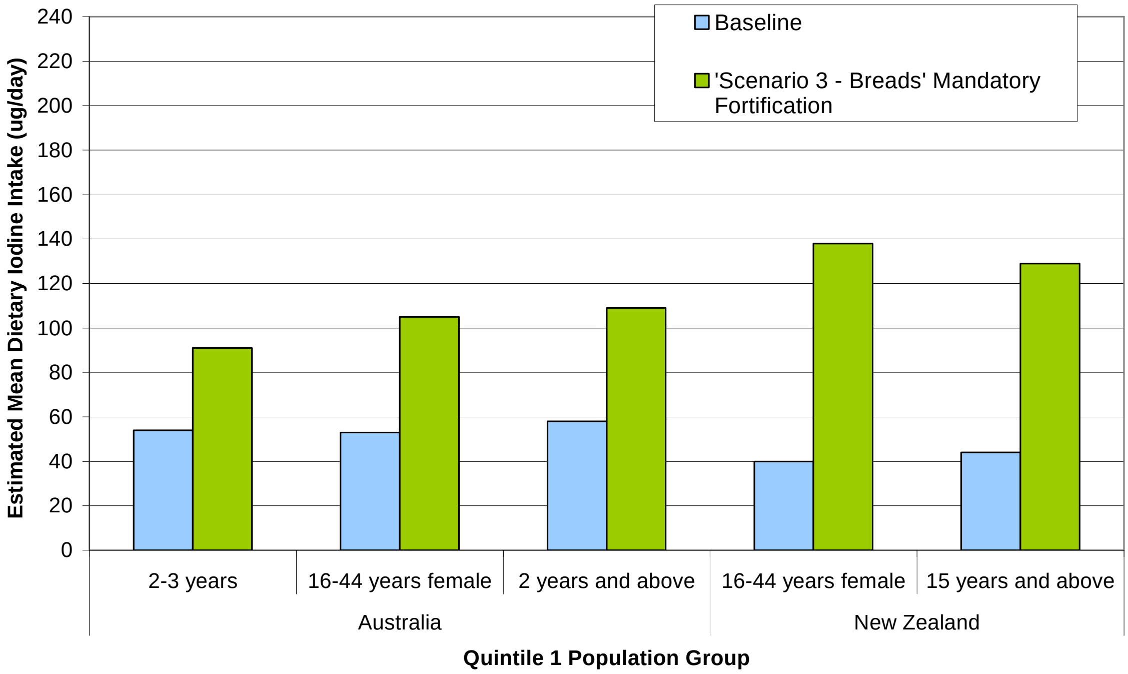


Figure 22: Mean intakes of iodine for respondents with low Baseline intakes of iodine (Quintile 1) and the effects of mandatory fortification of breads on mean iodine intakes

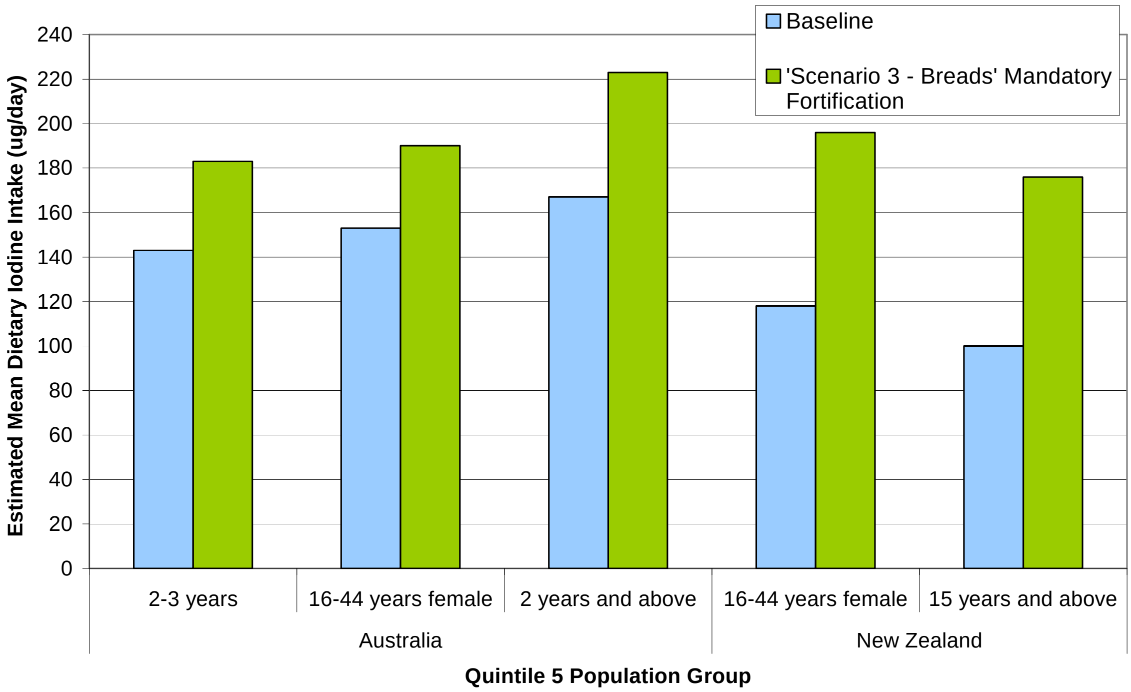


Figure 23: Mean intakes of iodine for respondents with high Baseline intakes of iodine (Quintile 5) and the effects of mandatory fortification of breads on mean iodine intakes

Major contributors to iodine intakes by Quintile

The major foods contributing ≥5% to total iodine dietary intakes for New Zealand and Australian target population groups were investigated for the low and high quintiles and are discussed below. The calculations for major contributing foods were based on intakes derived from the first 24-hour recall NNS data only. The use of discretionary salt was not considered.

New Zealand

Women aged 16-44 years

At *Baseline*, the major contributor to iodine intakes for women aged 16-44 years with low iodine intakes (Quintile 1) and high iodine intakes (Quintile 5) was milk, milk products and dishes. Cereals and cereal products, fish and seafood products and dishes, and eggs and egg dishes were major contributors to the iodine intakes of those with low and high iodine intakes. Cereal based products and dishes, and meat, poultry and game products and dishes were also major contributors to those with low iodine intakes. For those with high iodine intakes (Quintile 5), vegetable products and dishes was a major contributor to iodine intakes.

With the mandatory fortification of breads (*Scenario 3 – Breads*), the major contributor to iodine intakes for those with low and high iodine intakes was cereals and cereal products. Milk, milk products and dishes, fish and seafood products and dishes and eggs and egg dishes remained major contributors to both groups with cereal based products and dishes being major contributors for those with low iodine intakes and vegetable products and dishes for those with high iodine intakes.

Refer to Figure 24 and Table A5.3 in Appendix 5 for details on the major contributors to iodine intakes.

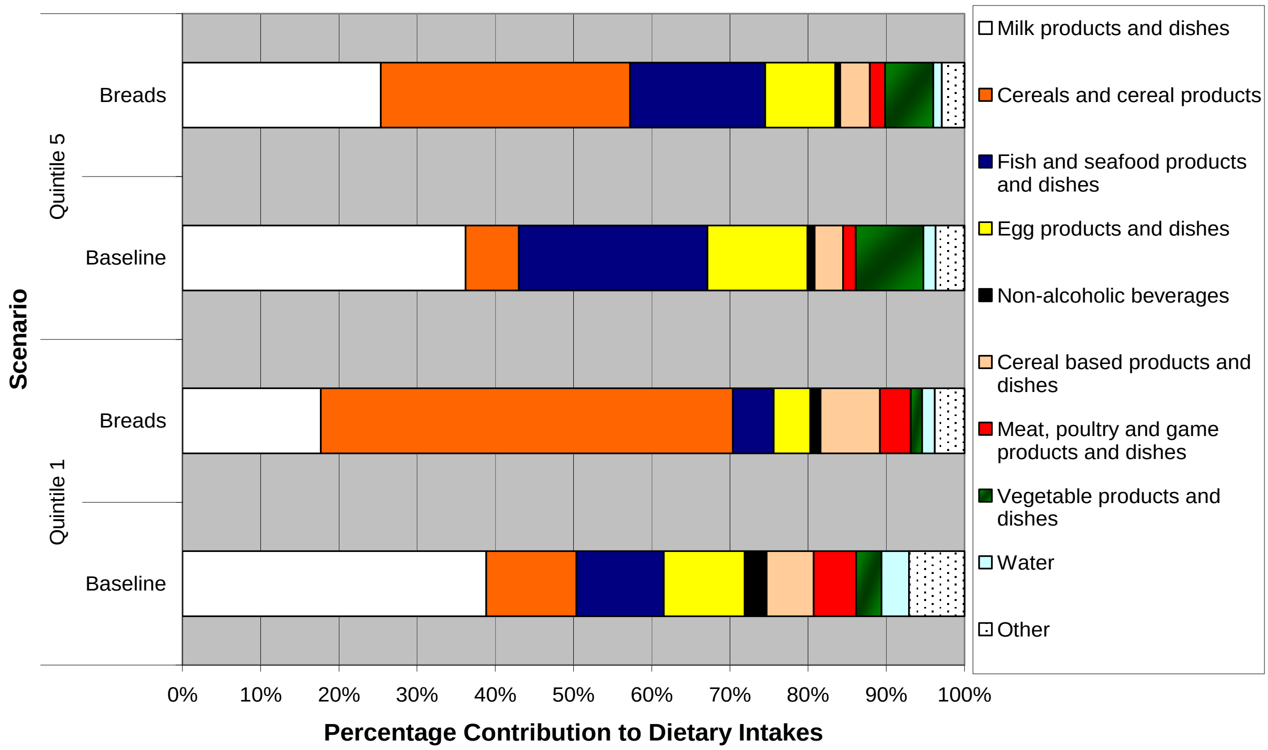


Figure 24: Contributors to iodine intakes for New Zealand women aged 16-44 years with low and high iodine intakes

Population aged 15 years and above

At *Baseline*, the major contributor to iodine intakes for New Zealanders aged 15 years and above with low iodine intakes (Quintile 1) and with high iodine intakes (Quintile 5) was milk, milk products and dishes. Cereals and cereal products, fish and seafood products and dishes, and eggs and egg dishes were major contributors to the iodine intakes of those with low and high iodine intakes. Non-alcoholic beverages, cereal based products and dishes, and meat, poultry and game products and dishes were also major contributors to those with low iodine intakes. For those with high iodine intakes, vegetable products and dishes was also a major contributor to iodine intakes.

With the mandatory fortification of breads (*Scenario 3 – Breads*), the major contributor to iodine intakes for those with low and high iodine intakes was cereals and cereal products. Milk, milk products and dishes and cereal based products and dishes were major contributors to both groups, with fish and seafood products and dishes, and eggs and egg dishes being major contributors for those with high iodine intakes.

Refer to Figure 25 and Table A5.3 in Appendix 5 for details on the major contributors to iodine intakes.

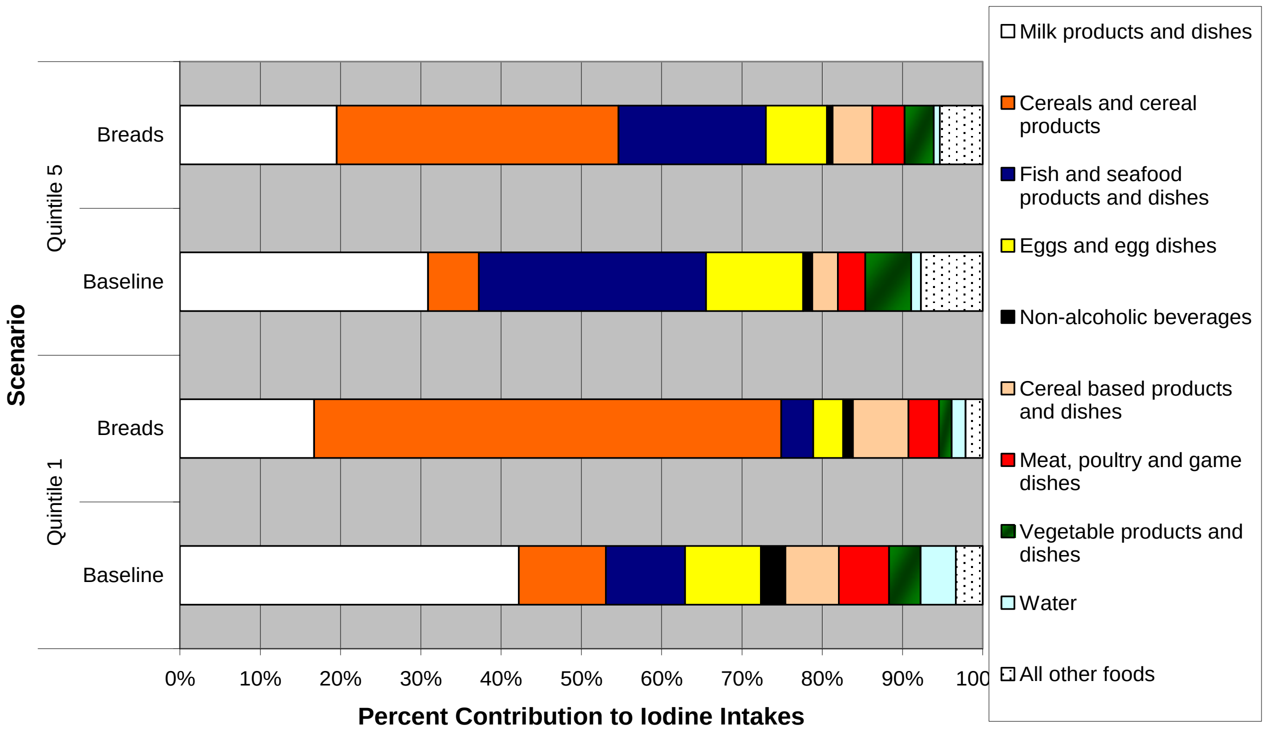


Figure 25: Contributors to iodine intakes for New Zealanders aged 15 years and above with low and high iodine intakes

Australia

<u>Children aged 2-3 years</u>

At *Baseline*, the major contributor to iodine intakes for respondents with low iodine intakes (Quintile 1) and high iodine intakes (Quintile 5) was milk, milk products and dishes. Non-alcoholic beverages, cereals and cereal products, cereal based products and dishes, and water were other major contributors to iodine intakes for those with low iodine intakes.

With the mandatory fortification of breads (*Scenario 3 – Breads*), milk, milk products and dishes remained the major contributor to iodine intakes for those with high iodine intakes, with cereals and cereal products also being a major contributor to iodine intakes for this group. For those with low iodine intakes, cereals and cereal products were the major contributor to iodine intakes under mandatory fortification (*Scenario 3 – Breads*), with milk, milk products and dishes, non-alcoholic beverages and cereal based products and dishes being other major contributors to iodine intakes.

Refer to Figure 26 and Table A5.4 in Appendix 5 for details on the major contributors to iodine intakes.

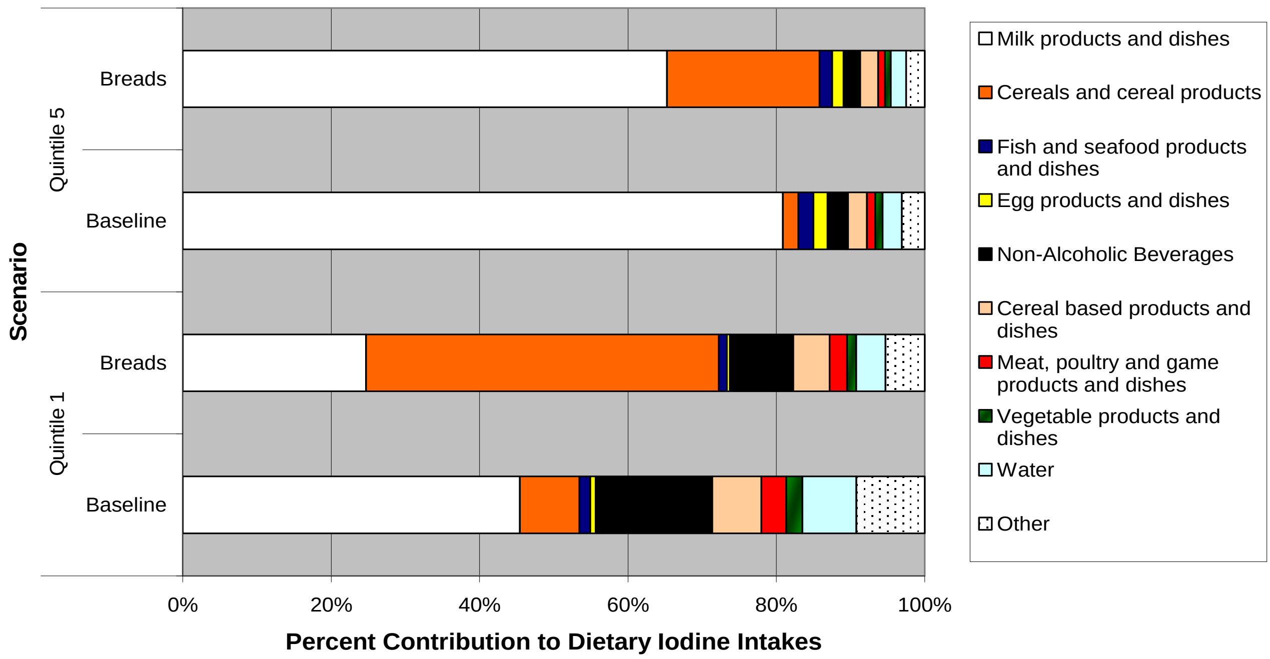


Figure 26: Contributors to iodine intakes for Australian children aged 2-3 years with low and high iodine intakes

<u>Women aged 16-44 years</u>

At *Baseline*, the major contributor to iodine intakes for women aged 16-44 years with low iodine intakes (Quintile 1) was non-alcoholic beverages, with milk, milk products and dishes, water, cereal based products and dishes, water, meat, poultry and game products and dishes, and vegetable products and dishes being other major contributors. Unlike those with low iodine intakes, milk, milk products and dishes was the major contributor to iodine intakes for those with high iodine intakes (Quintile 5). Like with respondents with low iodine intakes, non-alcoholic beverages, water, cereal based products and dishes and cereal products were major contributors to those with high iodine intakes. Fish and seafood products and dishes was also a major contributor to iodine intakes for respondents with high iodine intakes.

With the mandatory fortification of breads (*Scenario 3 – Breads*), the major contributors to iodine intakes for those with low and high iodine intakes were milk, milk products and dishes, cereals and cereal products, non-alcoholic beverages, water and cereal based products and dishes. Fish and seafood products and dishes were major contributors to iodine intakes for respondents with high iodine intakes. However, the major contributing food differed for those with low iodine intakes and high iodine intakes; cereals and cereal products for those with low iodine intakes and milk, milk products and dishes for those with high iodine intakes.

Refer to Figure 27 and Table A5.4 in Appendix 5 for details on the major contributors to iodine intakes.

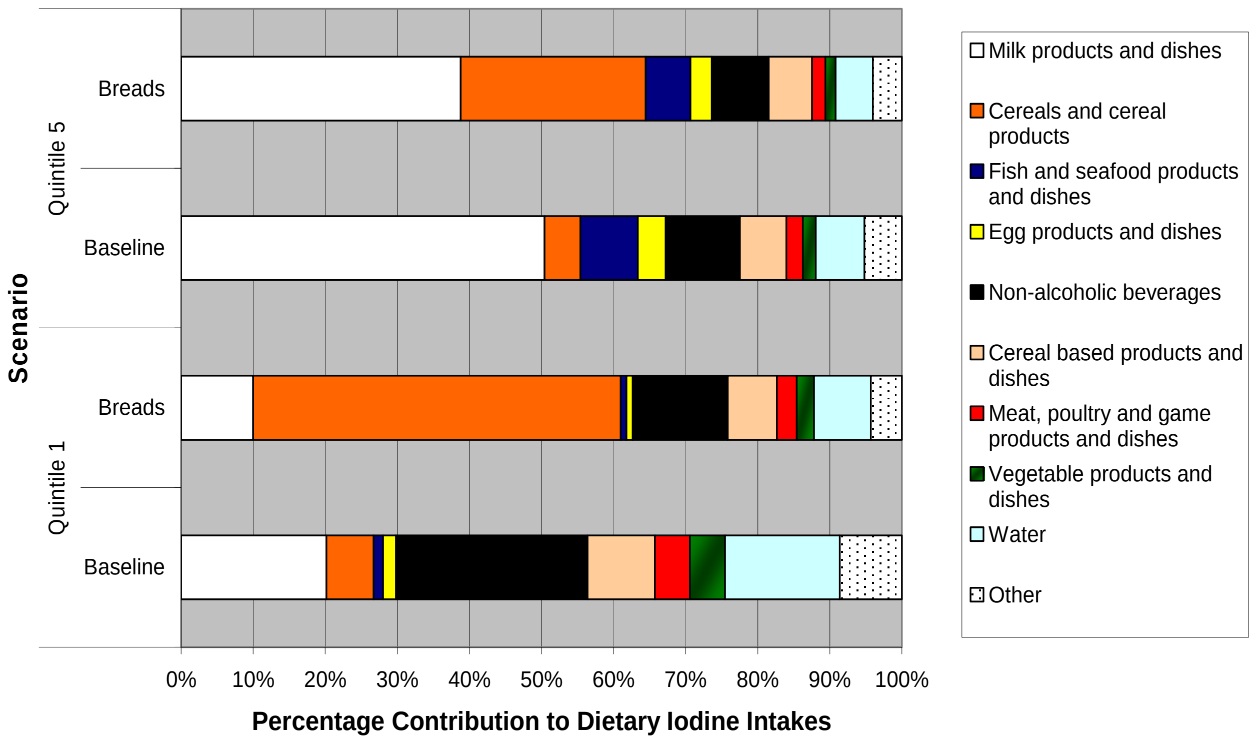


Figure 27: Contributors to iodine intakes for Australian women aged 16-44 years with low and high iodine intakes

<u>Population aged 2 years and above</u>

At *Baseline*, the major contributor to iodine intakes for Australians aged 2 years and above with low iodine intakes (Quintile 1) and high iodine intakes (Quintile 5) was milk, milk products and dishes. Other foods that were major contributors to iodine intakes for both of these groups were non-alcoholic beverages, water, cereals and cereal products, cereal based products and dishes. Meat, poultry and game products were major contributors to those with low iodine intakes while fish and seafood products and dishes were major contributors to those with high iodine intakes.

With the mandatory fortification of breads (*Scenario 3 – Breads*), the major contributors to iodine intakes for those with low and high iodine intakes are milk, milk products and dishes, cereals and cereal products, non-alcoholic beverages, water and cereal based products and dishes. Fish and seafood products and dishes were a major contributor to iodine intakes for respondents with high iodine intakes. However, the major contributing food differed for those with low iodine intakes and high iodine intakes; cereals and cereal products for those with low iodine intakes and milk, milk products and dishes for those with high iodine intakes.

Refer to Figure 28 and Table A5.4 in Appendix 5 for details on the major contributors to iodine intakes.

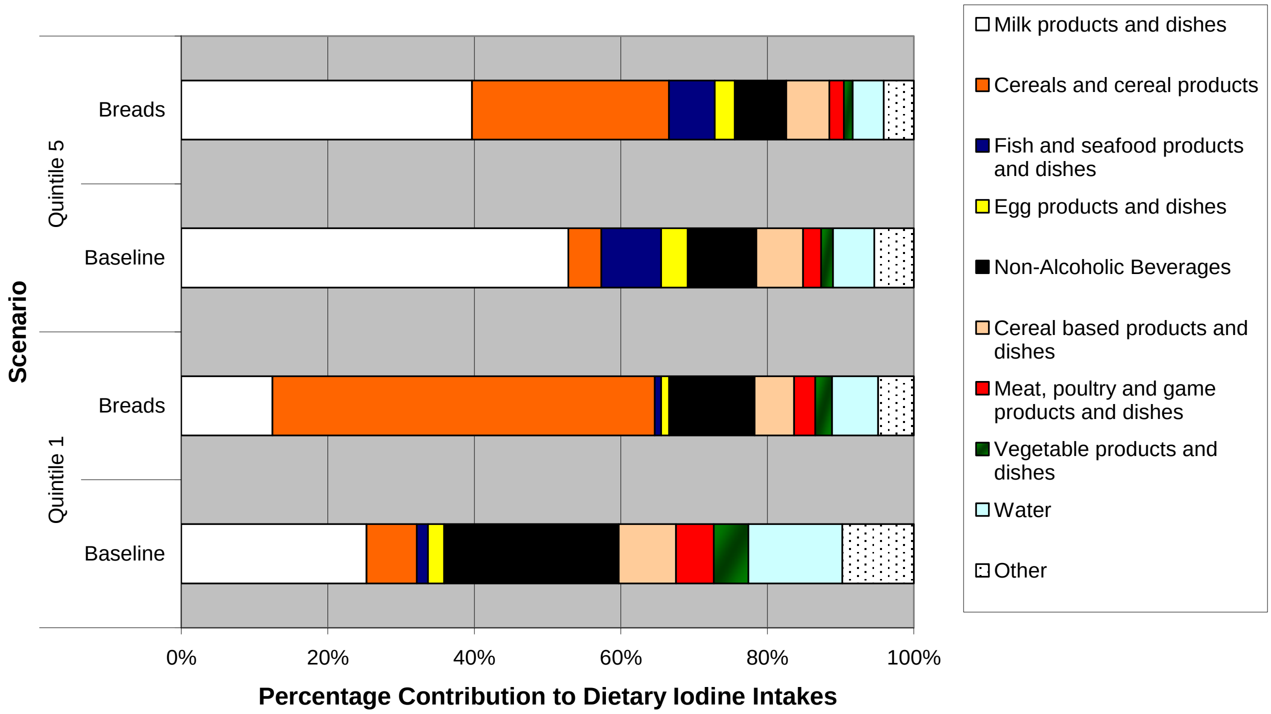


Figure 28: Contributors to iodine intakes for Australians aged 2 years and above with low and high iodine intakes

Food Consumption Patterns

Food consumption patterns were investigated to determine if there was a food(s) that children aged 3 years and under, women of child bearing age (16-44 years), and the New Zealand and Australian populations in general who currently have low iodine intakes consumed in greater quantities than those with high iodine intakes that could be targeted for iodine fortification by:

1. examining whether similar proportions of respondents[8] in Quintile 1 (low intakes of iodine) consumed specific foods in comparison to respondents in Quintile 5 (high intakes of iodine); and
2. investigating whether the amounts of food eaten by consumers[9] of the specific foods were different between Quintile 1 and Quintile 5.

There were differences in the food consumption patterns between those with low iodine intakes and those with high iodine intakes.

Proportion of respondents consuming various foods/ food groups

<u>New Zealand</u>

Generally, a greater proportion of women aged 16-44 years in Quintile 1 (low iodine intakes) consumed soft drinks, sauces and sugar than in Quintile 5 (high iodine intakes). These foods are not considered appropriate vehicles for mandatory or voluntary nutrient fortification

[8] 'Respondents' include all members of the survey population whether or not they consumed the food of interest.
[9] 'Consumers' only includes the people who have consumed the food of interest.

according to fortification Policy Guidelines. Refer to Figure 29 and Table A5.5 in Appendix 5 for details.

For the New Zealand population aged 15 years and above, a greater proportion of respondents in Quintile 1 (low iodine intakes) consumed soft drinks, polyunsaturated margarine and water than in Quintile 5 (high iodine intakes). Soft drinks are not considered appropriate vehicles for mandatory or voluntary nutrient fortification and FSANZ is not responsible for the regulation of unpackaged water (e.g. tap water). Refer to Figure 30 and Table A5.6 in Appendix 5 for details.

Australia

As shown in Figure 31, a greater proportion of respondents aged 2-3 years in Quintile 1 (low iodine intakes) consumed (1) lollies and other confectionery, (2) fruit-flavoured drink base and cordial base, (3) fruit drinks, (4) savoury sauces, (5) yeast, vegetable and meat extracts, (6) sugar, (7) polyunsaturated margarines and spreads, and (8) domestic water than in Quintile 5 (high iodine intakes). However, many of these types of food products are not considered appropriate food vehicles for fortification for reasons given above. Refer to Table A5.7 in Appendix 5 for further details.

For women aged 16-44 years, yeast, vegetable and meat extracts, polyunsaturated margarines and spreads, and white breads and rolls were consumed by a higher proportion of respondents with low iodine intakes (Quintile 1). White breads and rolls are already proposed for mandatory fortification with iodine under *Scenario 3 – Breads*. Refer to Figure 32 and Table A5.8 in Appendix 5 for further details. Similar results were obtained for respondents aged 2 years and above with low iodine intakes (Quintile 1). Refer to Figure 33 and Table A5.9 in Appendix 5 for further details.

Mean consumption amounts for various foods/food groups

New Zealand

In terms of the actual amount of foods eaten, New Zealanders aged 15 years and above in Quintile 1 (low iodine intakes) ate, on average, smaller amounts all foods in comparison to those in Quintile 5 (high iodine intakes). For New Zealand women aged 16-44 years in Quintile 1 (low iodine intakes), on average, larger amounts of potato chips/ wedges/ croquettes/ hash browns, and sauces were eaten in comparison to those in Quintile 5 (high iodine intakes). These foods are not considered appropriate vehicles for mandatory or voluntary nutrient fortification. Refer to Table A5.5 in Appendix 5 for further details.

Australia

In terms of the actual amount of foods eaten, Australian children aged 2-3 years in Quintile 1 (low iodine intakes) ate, on average, larger amounts of lollies and other confectionery fruit-based or flavoured cordials and drinks, fruit-flavoured drink base and cordial base, single fruit juices and domestic water than those in Quintile 5 (high iodine intakes). All other foods were, on average, eaten in smaller amounts. For Australian women aged 16-44 years and Australians aged 2 years and above in Quintile 1 (low iodine intakes), no foods or beverages were eaten in higher amounts than for those respondents in Quintile 5 (high iodine intakes). Refer to Table A5.7 to Table A5.9 in Appendix 5 for further details.

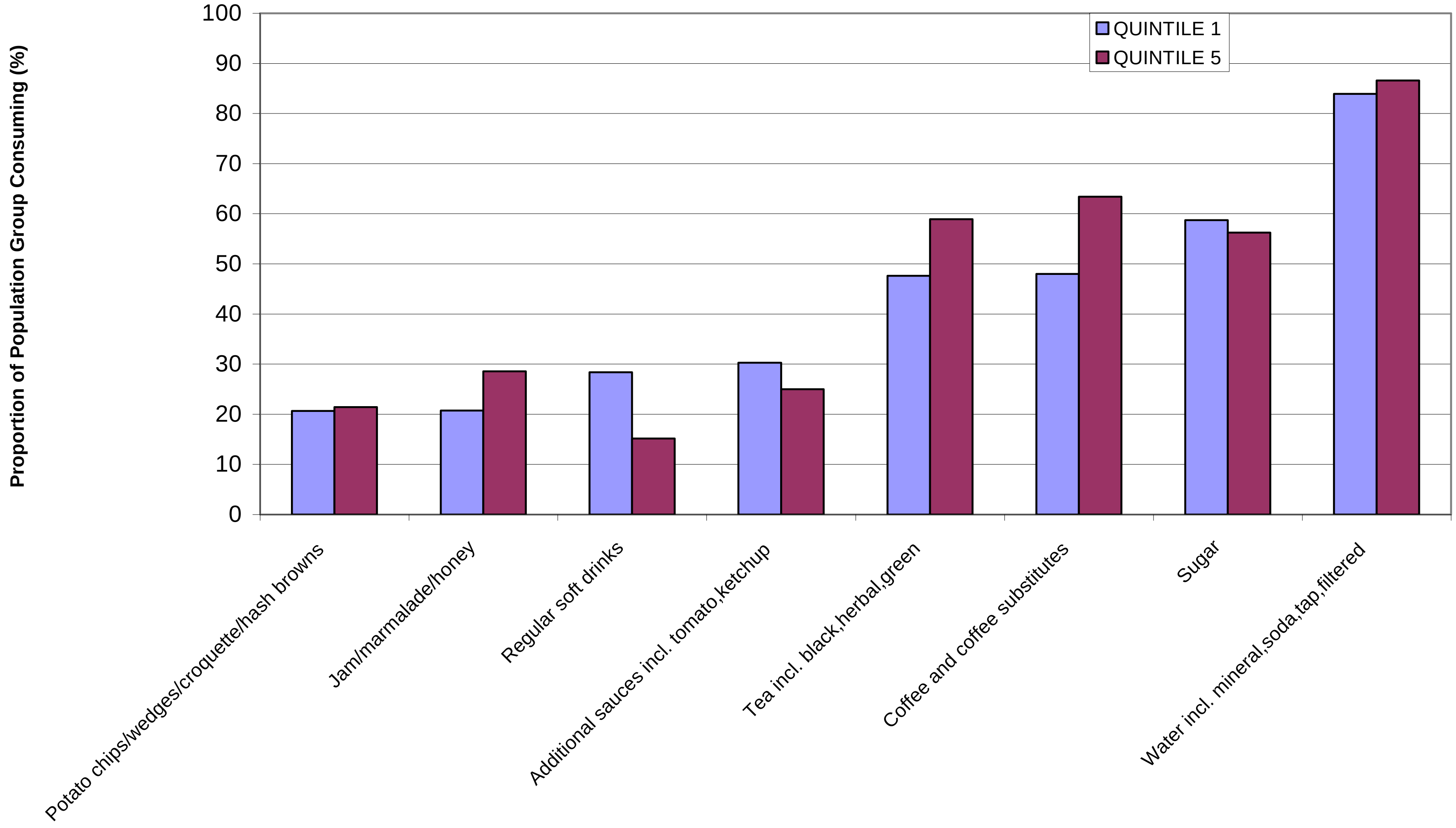


Figure 29: Proportion of New Zealand women aged 16-44 years consuming various foods/ food groups

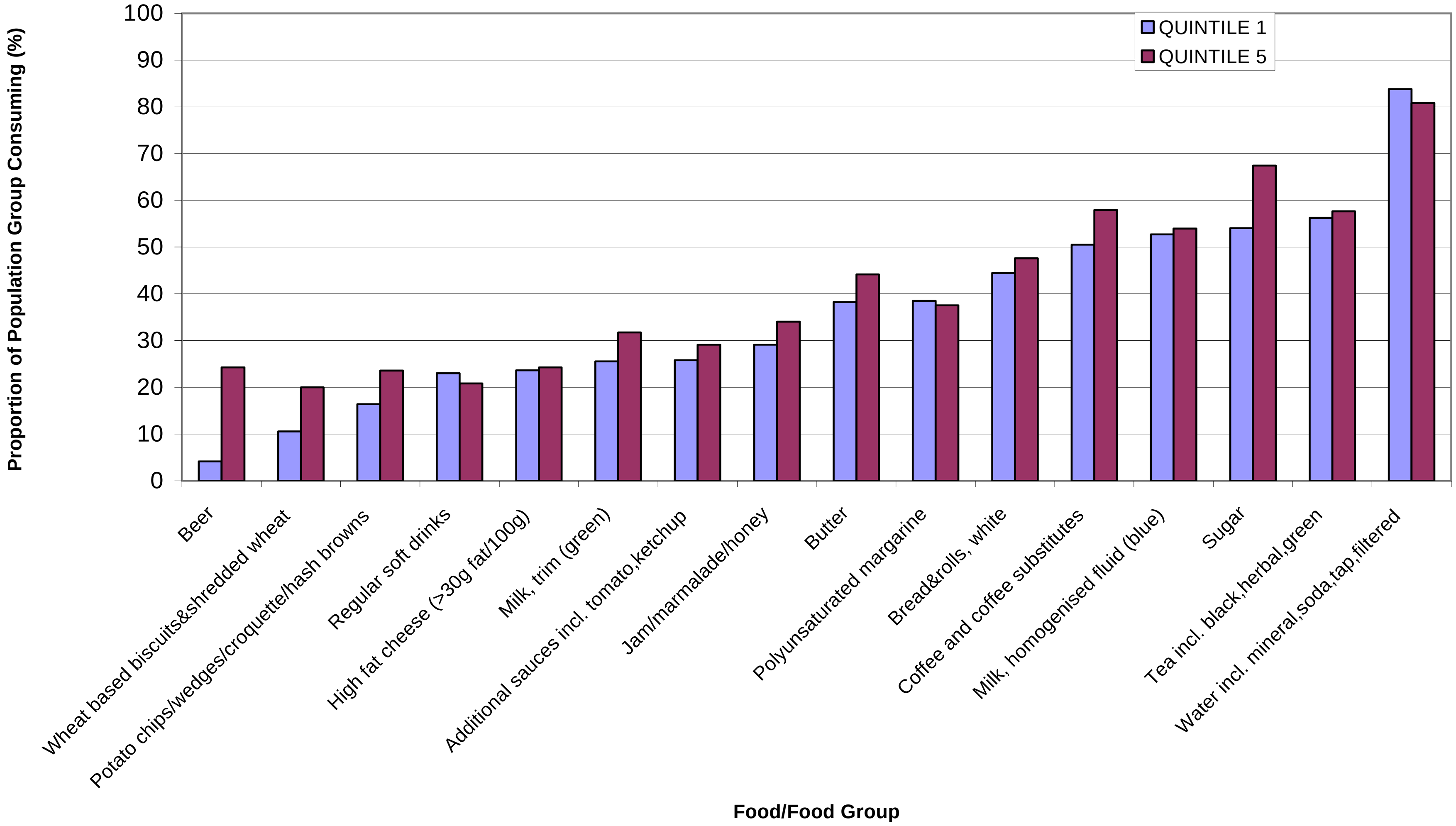


Figure 30: Proportion of New Zealanders aged 15 years and above consuming various foods/ food groups

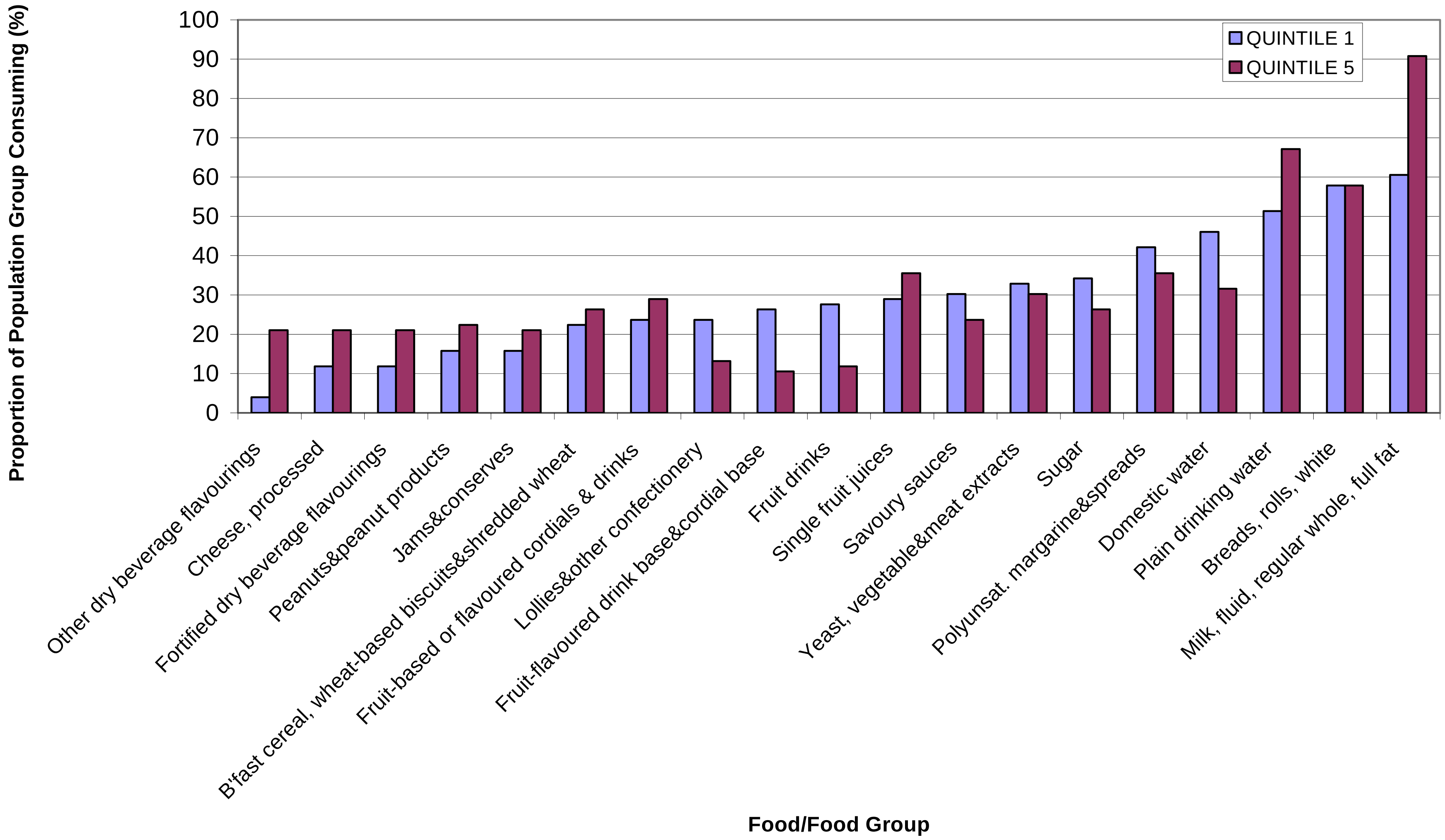


Figure 31: Proportion of Australian children aged 2-3 years consuming various foods/ food groups

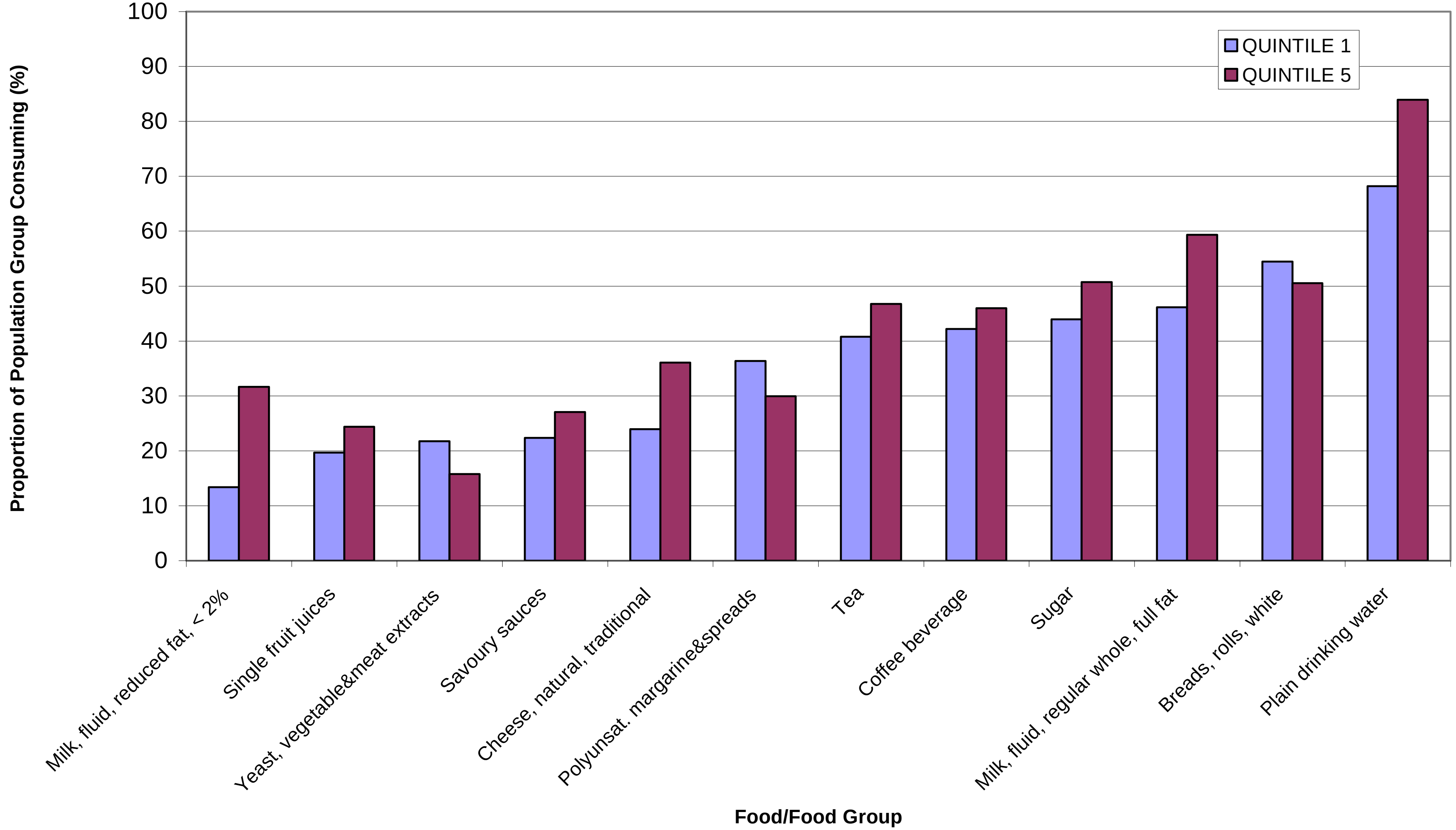


Figure 32: Proportion of Australian women aged 16-44 years consuming various foods/ food groups

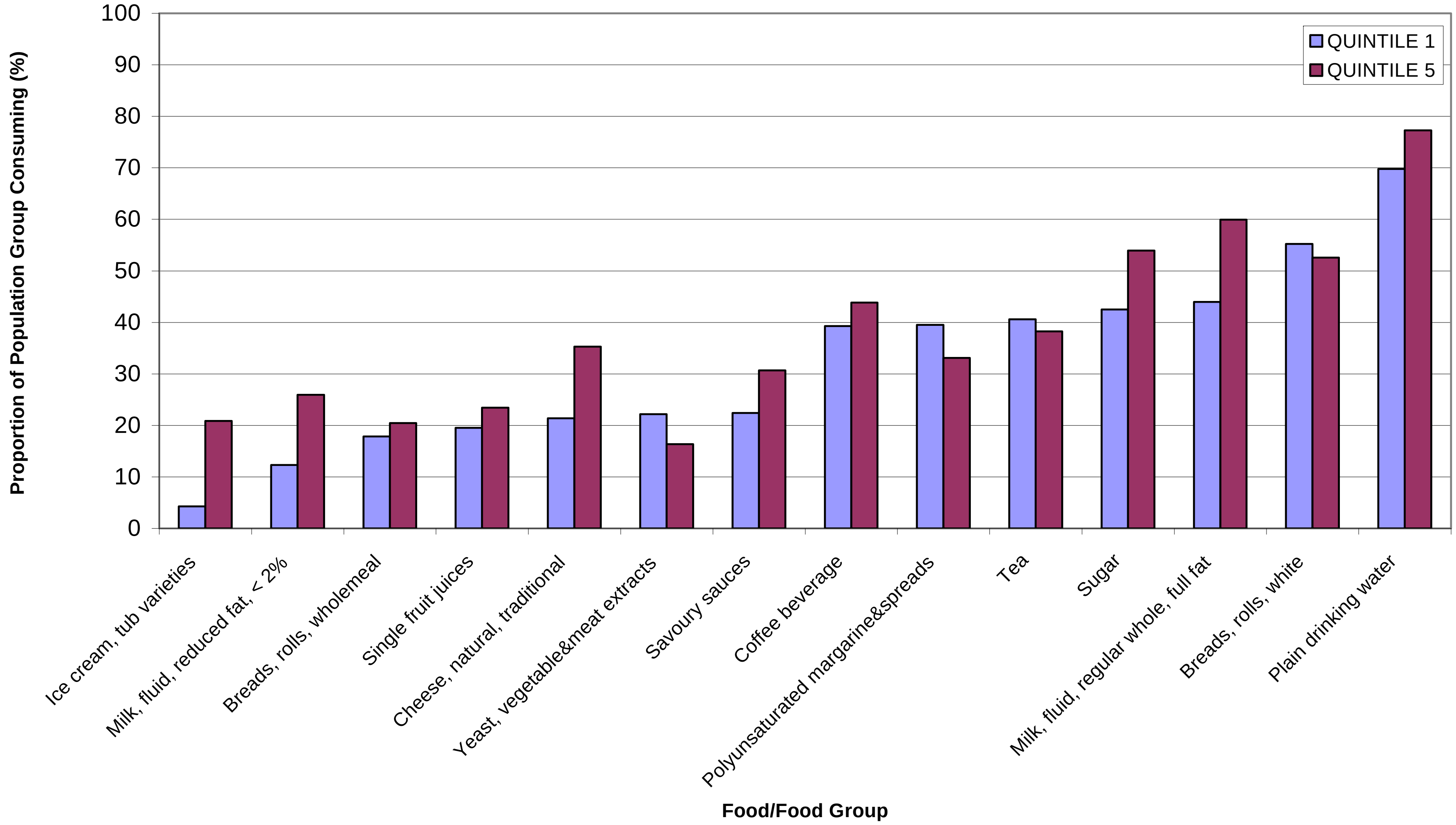


Figure 33: Proportion of Australians aged 2 years and above consuming various foods/ food groups

Summary

For all respondents with low and high iodine intakes in all population groups assessed, the introduction of mandatory fortification of breads (*Scenario 3 – Breads*) increased the mean intake of iodine from *Baseline.* The impact of a mandatory fortification program was much greater for the low iodine intake groups as their iodine intakes increased by a greater proportional amount. For the New Zealand population groups assessed, mandatory fortification of breads (Scenario 3 – *Breads*) had a bigger impact than that it did for the Australian population groups assessed. Those respondents in the low and high iodine intake groups in New Zealand showed a higher increase in estimated mean dietary iodine intakes in comparison to Australia.

There were differences in the food consumption patterns between those with low iodine intakes and those with high iodine intakes. Generally, higher proportions of New Zealanders from one or more of the target population groups with low iodine intakes consumed (1) soft drinks, (2) sauces, (3) sugar, (4) polyunsaturated margarine and (5) water than those with high iodine intakes.

Generally, higher proportions of Australians from one or more of the target population groups with low iodine intakes consumed (1) lollies and other confectionery, (2) fruit-flavoured drink base and cordial base, (3) fruit drinks, (4) savoury sauces, (5) yeast, vegetable and meat extracts, (6) sugar, (7) polyunsaturated margarines and spreads, (8) domestic water, (9) white breads and rolls, and (10) tea than those with high iodine intakes.

For Australian women aged 16-44 years and Australians aged 2 years and above with low iodine intakes, there were no foods or beverages eaten by ≥ 20% of the population group that were eaten in higher amounts than for those with high iodine intakes. This was the same pattern as found for New Zealanders aged 15 years and above. For Australian children aged 2-3 years and New Zealand women aged 16-44 years, there were several food groups eaten by ≥ 20% of the population group that were eaten in higher amounts than for those with high iodine intakes.

However, many of these food types identified for New Zealand or Australia are not considered to be appropriate food vehicles for mandatory fortification. White breads and rolls have already been considered for mandatory fortification. FSANZ is not responsible for the regulation of unpackaged water (e.g. tap water).

Estimates of iodine intakes for New Zealand children aged 5-14 years

Background, methodologies and scenarios assessed

FSANZ does not currently hold food consumption data from the 2002 National Children's Nutrition Survey (CNS) in the correct format to enable dietary iodine intake assessments to be conducted for New Zealand children aged 5-14 years. Therefore, the New Zealand Food Safety Authority (NZFSA) commissioned the University of Otago (LINZ Research group) to undertake a dietary intake assessment for iodine for children aged 5-14 years (Blakey *et al*., 2006; Blakey *et al*., 2007), based on data from the 2002 New Zealand CNS.

The estimated intakes of iodine for New Zealand children were compared in this section of the report to intakes for Australian children. The intake assessments for the two countries used slightly different methodologies. The main difference being the use of a single 24-hour recall of food consumption data for the New Zealand assessments and two 24-hour recalls of food consumption data for the Australian assessments. The results based on two different methodologies cannot be directly compared. Therefore, where possible, three sets of results are reported for each section: (1) New Zealand CNS single day unadjusted; (2) Australian single day unadjusted; and (3) Australian second day adjusted.

Including the single day unadjusted New Zealand results and the single day unadjusted Australian results enables direct comparison of results between New Zealand and Australian children. Including single day unadjusted Australian and second day adjusted Australian results shows the difference the adjustment makes and therefore the likely changes that may be expected were the New Zealand children intakes to be adjusted.

As discussed in Attachment 1, the use of a single day of food consumption data can result in a broader distribution of iodine intakes and, therefore, a different estimated proportion of the population group with (1) intakes below the EAR; or (2) above the UL. Adjusted nutrient intakes ('second-day adjusted nutrient intake methodology') better reflect 'usual' daily nutrient intakes and proportions of population groups above or below NRVs.

For these comparative assessments, the foods assumed to be fortified were similar; the dietary intake assessments for *Baseline* were performed using analytical food composition data, where available.

It is important to note that there are limitations in directly comparing the results from the FSANZ assessment and the LINZ assessment, in addition to the intake estimates being based on one and two day NNS consumption data. In the 2002 New Zealand CNS, there was over-sampling of the Maori and Pacific children. Population weighting was therefore used by the LINZ Research group in their assessment so that the survey sample better reflected the New Zealand children's population to enable conclusions to be drawn about New Zealand children in general. The 1995 Australian NNS did not require weighting in order to make comments about the iodine intakes of Australian children. The impact of weighting is unknown, but FSANZ has been advised by the NZFSA that weighting is not expected to be a major contributor to reported differences.

There is evidence from the dietary intake assessments conducted by FSANZ for adults, using the 1995 and 1997 NNSs, that New Zealand estimated dietary iodine intakes were lower at *Baseline* than those for Australia. This difference could be due to different food consumption patterns, seasonality of consumption and/or differing levels of iodine concentrations in foods (e.g. milk) between the two countries. It would be expected that similar food consumption patterns would be found for the younger children in New Zealand, however it is possible that changes in food consumption in the 7 year period from 1995 through to 2002 may account for some differences in the estimated iodine intakes. FSANZ will be in a position to use the 2002 CNS data in DIAMOND in 2008, so could potentially rerun these estimates at that time, enabling an adjusted intake to be estimated.

Scenarios for dietary iodine intake assessments

The NZFSA and University of Otago provided two reports on dietary iodine intake estimates for New Zealand children aged 5-14 years that included the scenarios outlined below (Blakey *et al*., 2006; Blakey *et al*., 2007). However, in this part of the report only the results from the Baseline and Breads scenarios are discussed. Results for the other scenarios are provided in Attachment 2.

Scenarios assessed for New Zealand children aged 5-14 years were as follows:

1. **NZ CNS *Baseline*** – where salt used in food manufacture of all processed food was non-iodised. The consumption of discretionary salt (1.0 gram per person) was also included. The iodine concentration in iodised discretionary salt was assumed to be 45 mg iodine per kg salt.
2. **NZ CNS *Scenario 1 – Processed foods*** – where non-iodised salt was replaced with salt containing 15 mg iodine per kg of salt in the manufacture of "processed" foods. The consumption of 1.0 gram of discretionary salt per person was also considered. The iodine concentration in iodised discretionary salt was assumed to be 20 mg iodine per kg salt.
3. **NZ CNS *Scenario 2 – Cereal-based foods*** – where non-iodised salt was replaced with salt containing 30 mg iodine per kg of salt in all commercially prepared "cereal-based" foods. The consumption of 1.0 gram of discretionary salt was also considered. The iodine concentration in iodised discretionary salt was assumed to be 20 mg iodine per kg salt.
4. **NZ CNS *Scenario 3 – Breads*** – where non-iodised salt was replaced with salt containing 45 mg iodine per kg of salt in the manufacture of commercial breads, with 40 mg iodine per kg salt remaining in the breads after processing and baking. The consumption of 1.0 gram of discretionary salt was also considered. The iodine concentration in iodised discretionary salt was assumed to be 45 mg iodine per kg salt.

For *NZ CNS Scenario 3 – Breads*, the iodine concentration in discretionary iodised salt was taken to be the midpoint of the range of 25-65 mg iodine per kg salt (45 mg iodine per kg salt) since it was determined that the use of salt iodised at 45 mg iodine per kg salt in the manufacture of breads (with 40 mg iodine per kg of salt remaining in the salt of bread after it is baked) was the most effective iodine concentration.

For the *Baseline* and *Scenario 3 Breads* assessments that used the NZ CNS and FSANZ data, two models were used where discretionary salt was included; one where all discretionary salt was non-iodised; and one where all discretionary salt was iodised to the level of 45 mg iodine per kg salt. In these calculations the market share of iodised salt in the New Zealand market (~60%) was not considered, unlike elsewhere in this report. The calculations on salt consumption were different for New Zealand and Australia as different data were available so care should be taken when directly comparing results for the two countries (see Attachment 1).

The dietary intake assessments did not take into account iodine from the use of iodine supplements or multi-vitamin supplements containing iodine. Additionally, potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. This will be captured in any future monitoring programs.

Methodologies for the iodine intake assessments

A summary of the methodologies used for the FSANZ and LINZ assessments for Australian and New Zealand children that are discussed in this section of the report are outlined in Table 5.

The age groups for Australian children's iodine intakes for the second day adjusted assessment were slightly different to those for the New Zealand CNS assessments. The youngest of the age groups for Australia is 4-8 years instead of 5-8 years for New Zealand and the oldest of the age groups is 14-18 years as opposed to 14 years.

A comparison with iodine intakes for Australian children based on a single day of food consumption data for *Scenario 3 – Breads* was not able to be conducted as this model could not be run for Australian children[10].

Table 5: Summary of the methodologies used for the FSANZ and LINZ comparative assessments of iodine intakes in children for New Zealand and Australia

Methodology	University of Otago (LINZ Research group)	FSANZ
	1. Single day un-adjusted model 2. Population weighted	1. Single day un-adjusted model **AND** second day adjusted model 2. Not population weighted
Iodine concentrations	Differences for some foods For example: • Milk contains approximately 8.9 µg iodine per 100 g. • Raw king prawns contain approximately 42 µg iodine per 100 g.	Differences for some foods For example: • Milk contains approximately 13.3 µg iodine per 100 g. • Raw king prawns contain approximately 30 µg iodine per 100 g.
Population groups assessed	5-14 years for New Zealand, 2002 CNS, broken down into NRV age groups.	5-14 years for Australia* for single day unadjusted intakes, 1995 NNS, broken down into NRV age groups. 4-18 years for Australia for second day adjusted intakes, 1995 NNS, broken down into NRV age groups.
Discretionary salt	One gram per day.	Various amounts per day depending on age of child, but all around one gram for second day adjusted assessments only.
Other differences	1. Similar foods assumed to be fortified but foods coded slightly differently in the 2002 CNS survey compared to the 1995 NNS. 2. Potentially different food consumption patterns between the two survey periods and/or countries.	

* Age groups within this range were examined for this assessment only to enable comparison with dietary intake assessment results from the 2002 NZ CNS.

[10] This is due to the way that DIAMOND is programmed for estimating single day nutrient intakes. There were more individual NNS foods that had a scenario nutrient concentration for the '*Breads* scenario than the single day model can accommodate (up to 100). The second day nutrient adjustment model can include up to 4600 scenario concentrations.

Estimated dietary iodine intakes

Estimated baseline dietary iodine intakes

Dietary intake assessments were provided for New Zealand children aged 5-14 years, broken down by NRV age groups. Results are shown in Table 6 with full results from each of the assessments are provided in Appendix 6.

When the use of non-iodised discretionary salt was considered, New Zealand children's mean baseline dietary iodine intakes (50 – 64 µg/day) were below Australian children's intakes for similar age groups (88 – 108 µg/day single day unadjusted, 91-114 µg/day second day adjusted). This may be due to the lower iodine content of milk reported for New Zealand compared to Australian milk.

New Zealand children also had much higher maximum iodine intakes (977 – 1,443 µg/day) than for Australian children (277 – 396 µg/day single day unadjusted, 256-441 µg/day second day adjusted). For example, New Zealand children aged 14 years had a maximum iodine intake of 1,443 µg per day as compared with Australian 14 year olds at 277 µg per day (single day unadjusted).

Food consumption data for each New Zealand respondent with the highest iodine intake in each age group were assessed for the single day unadjusted assessment, indicating that approximately 90% or more of these individual's iodine intakes were from the consumption of sushi, which is high in iodine content.

Food consumption data for each Australian respondent with the highest iodine intake in each age group were also assessed. The data show that oysters and milk accounted for approximately 90% of the iodine intake of the 5-8 year old child, milk and yoghurt for approximately 85% of the iodine intakes of the 9-13 year old child and 14 year old child. The 9-13 year old child and 14 year old child with the highest iodine intakes both consumed between 1,500 and 2,000 mL of milk for the day that they were surveyed.

Both sushi and shellfish are high in iodine and therefore have the potential to contribute significant quantities of iodine to the diet of individuals. Although milk is not as high in iodine, it is generally consumed in larger quantities than seafood, therefore also has the potential to contribute significant quantities of iodine.

Table 6: Estimated dietary iodine intakes for New Zealand and Australian children for *Baseline* with non-iodised discretionary salt

Country	Population Group	Method	Estimated *Baseline* dietary iodine intakes (µg/day)#	
			Mean	Maximum
New Zealand	5-8 years	Single day unadjusted	50	1,183
	9-13 years		54	977
	14 years		64	1,443
Australia	5-8 years	Single day unadjusted	88	360
	9-13 years		105	396
	14 years		108	277
Australia	4-8 years	Second day adjusted	91	256
	9-13 years		103	354
	14 -18 years		114	441

The mean iodine intakes when iodised discretionary salt consumption was included is shown for New Zealand children aged 5-14 years in Table A6.1 in Appendix 6.

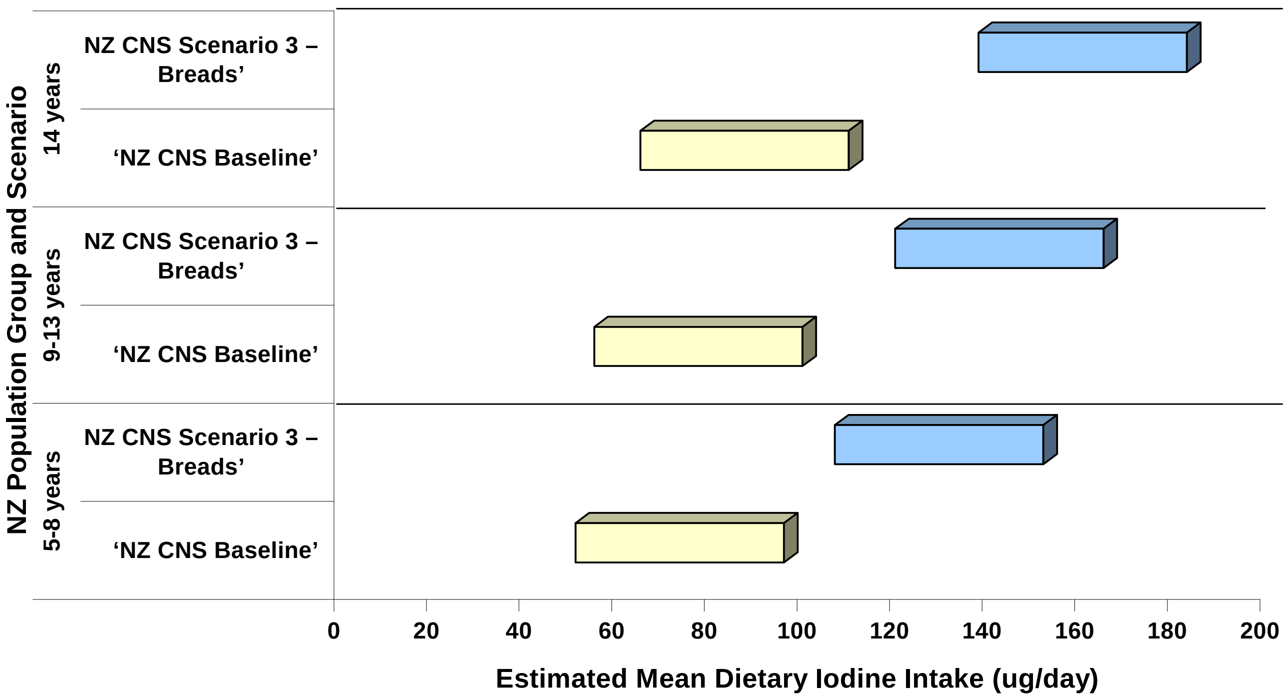
Estimated iodine intakes following fortification of bread

When non-iodised discretionary salt consumption was considered, the *NZ CNS Scenario 3 – Breads* mean dietary iodine intakes for New Zealand children aged 5-14 years were between 106 µg per day and 137 µg per day with maximum iodine intakes for this age group being between 977 µg per day and 1,660 µg per day, depending on the age group assessed (refer to Table 7). Whilst not directly comparable, the estimated mean dietary iodine intakes for Australian children of the same ages based on a second day adjusted assessment were higher, however, the maximum intakes were lower.

Table 7: Estimated dietary iodine intakes for New Zealand and Australian children for *Scenario 3 – Breads* with non-iodised discretionary salt

Country	Population Group	Method	Estimated *Scenario 3 – Breads* dietary iodine intakes (µg/day)#	
			Mean	Maximum
New Zealand	5-8 years	Single day unadjusted	106	1,203
	9-13 years		119	977
	14 years		137	1,660
Australia	4-8 years	Second day adjusted	135	327
	9-13 years		155	346
	14-18 years		172	764

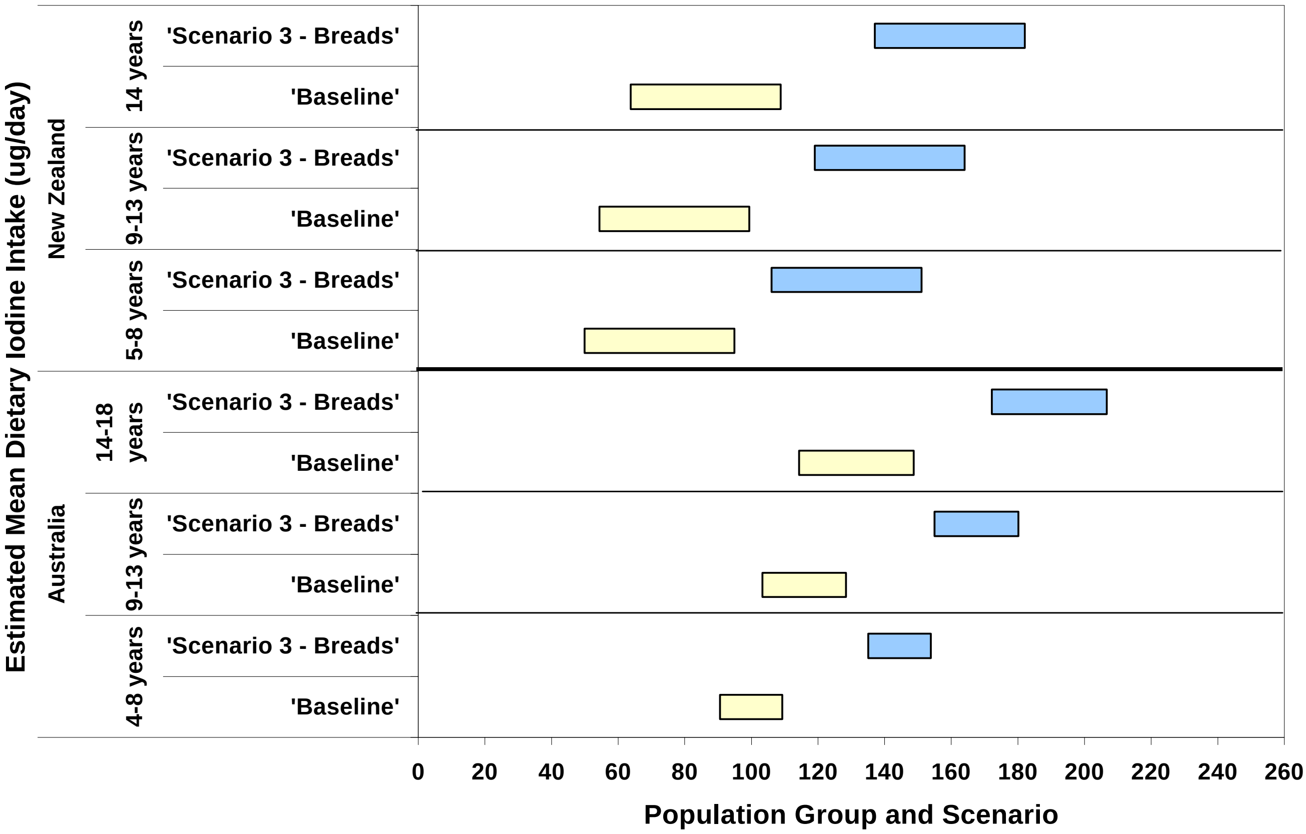
With the mandatory fortification of breads, mean dietary iodine intakes increased from *Baseline* for both New Zealand children aged 5-14 years and Australian children aged 4-18 years (Figure 34). Further details are available in Table A6.1 in Appendix 6. The lower end of each range is the mean dietary iodine intake when discretionary salt is non-iodised; the upper number in each range is the mean dietary iodine intake when it is assumed that all discretionary salt is iodised.



* The lower end of each bar is the mean dietary iodine intake when discretionary salt is non-iodised; the upper number of each bar is the mean dietary iodine intake when it is assumed that all discretionary salt is iodised.

Figure 34: Estimated range of mean dietary iodine intakes for New Zealand children aged 5-14 years, as derived from the 2002 NZ CNS for Baseline *and* Scenario 3 – Breads*

As shown in Figure 35, the estimated mean dietary iodine intakes for New Zealand children aged 5-14 years were lower at both *Baseline* and under the mandatory fortification of breads when compared to Australian children aged 4-18 years. The use of a 'single day unadjusted nutrient intake methodology' for New Zealand and a 'second day adjusted nutrient intake methodology' for Australia is unlikely to be the reason for this difference since the use of adjusted nutrient intakes has little or no impact on estimated mean nutrient intakes (refer to Attachment 1 for further details on methodology). Further details on estimated mean dietary iodine intakes are available in Table A6.5 in Appendix 6.



Δ Australian dietary iodine intakes were calculated using a 'second day adjustment nutrient intake methodology' whereas New Zealand dietary iodine intakes were calculated using a 'single day adjustment nutrient intake methodology', therefore are not able to be directly compared. The lower end of each bar is the mean dietary iodine intake when discretionary salt is non-iodised; the upper number of each bar is the mean dietary iodine intake when it is assumed that all discretionary salt is iodised.

Figure 35: Estimated mean dietary iodine intakes for Australian and New Zealand children for Baseline *and* Scenario 3 – Breads$^{\Delta}$

The maximum iodine intakes for New Zealand children aged 5-14 years were much higher at *Baseline* and for the mandatory fortification of breads than for Australian children aged 4-18 years (see Table A6.8 in Appendix 6). Some of this difference could be accounted for by the use of different methodologies in the calculation of dietary iodine intakes, but may also be due to higher sushi consumption.

As discussed in Attachment 1, the range of intakes from respondents is broader based on a single day of food consumption data than those derived using two day of food consumption data as the latter removes the variation in day to day intakes within each person and the variation between each person. Therefore it would be expected that there would be a smaller number of respondents exceeding the UL based on a second day adjusted assessment.

For example, comparing the maximum intakes for Australian children the one day unadjusted intakes resulted the maximum intake of 360 µg/day, and the second day adjusted intakes resulted in the maximum intake of 256 µg/day.

Estimated proportion of New Zealand children with inadequate iodine intakes

Full results outlining the proportion of New Zealand and Australian children with inadequate dietary iodine intakes is shown in Appendix 6, Tables A6.2 and A6.6.

Estimated proportion of children with inadequate intakes at Baseline

When non-iodised discretionary salt consumption was considered, a large proportion (79-85%) of New Zealand children aged 5-14 years were estimated to have inadequate dietary iodine intakes at *Baseline*. The results for New Zealand children indicate that much larger proportions of the population groups assessed were estimated to have inadequate dietary iodine intakes in comparison to Australian children (35-47% single day unadjusted, 22-41% second day adjusted) (see Table 8). This could potentially be attributed to the lower iodine concentration in milk in New Zealand in comparison to Australia.

The estimated proportion of New Zealand children with inadequate dietary iodine intakes was markedly lower (13-54%) when the use of iodised discretionary salt was considered (see Table 8). This was also the case for Australian children, and again the proportion of Australian children with inadequate intakes was lower. Figure 36 shows the ranges of estimated proportion of New Zealand population groups with inadequate dietary iodine intakes.

It should be noted that, if the New Zealand children's dietary iodine intakes had been able to be estimated using both days of the records from the CNS, a different proportion of each population group with inadequate dietary iodine intakes would be expected.

Table 8: Estimated proportion of New Zealand and Australian children with inadequate dietary iodine intakes for *Baseline*

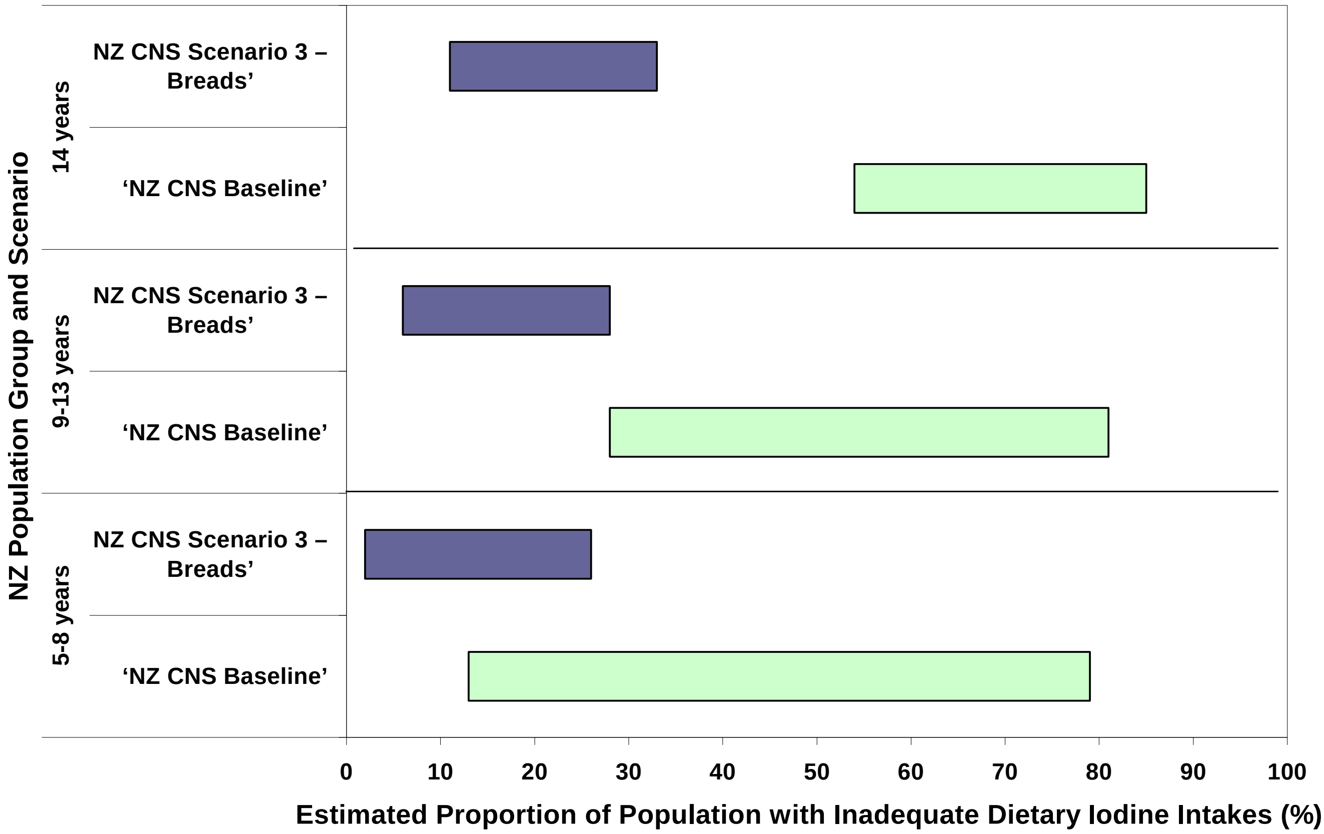
Country	Population Group	Method	EAR (µg/day)	Estimated proportion of the population with inadequate dietary iodine intakes (%) *Baseline*	
				Non-iodised discretionary salt	***Iodised discretionary salt***
New Zealand	5-8 years	Single day unadjusted	65	79	13
	9-13 years		75	81	28
	14 years		95	85	54
Australia	5-8 years	Single day unadjusted	65	35	NA
	9-13 years		75	35	NA
	14 years		95	47	NA
Australia	4-8 years	Second day adjusted	65	22	12
	9-13 years		75	29	14
	14-18 years		95	41	16

NA = Not assessed.

Estimated proportion of children with inadequate intakes following fortification of bread

As can be seen in Figure 36, mandatorily fortifying breads with iodine decreased the estimated proportion of the population group with inadequate dietary iodine intakes in comparison to *Baseline* for New Zealand children aged 5-14 years. The estimated proportion of New Zealand children with inadequate dietary iodine intakes for *NZ CNS Scenario 3 – Breads* (26-33%) was lower than for *NZ CNS Baseline* (79-85%) when discretionary salt was assumed to be non-iodised. When discretionary iodised salt was included in the dietary intake assessment for NZ CNS *Scenario 3 – Breads,* a smaller proportion of New Zealand children were estimated to have inadequate intakes (2-11%).

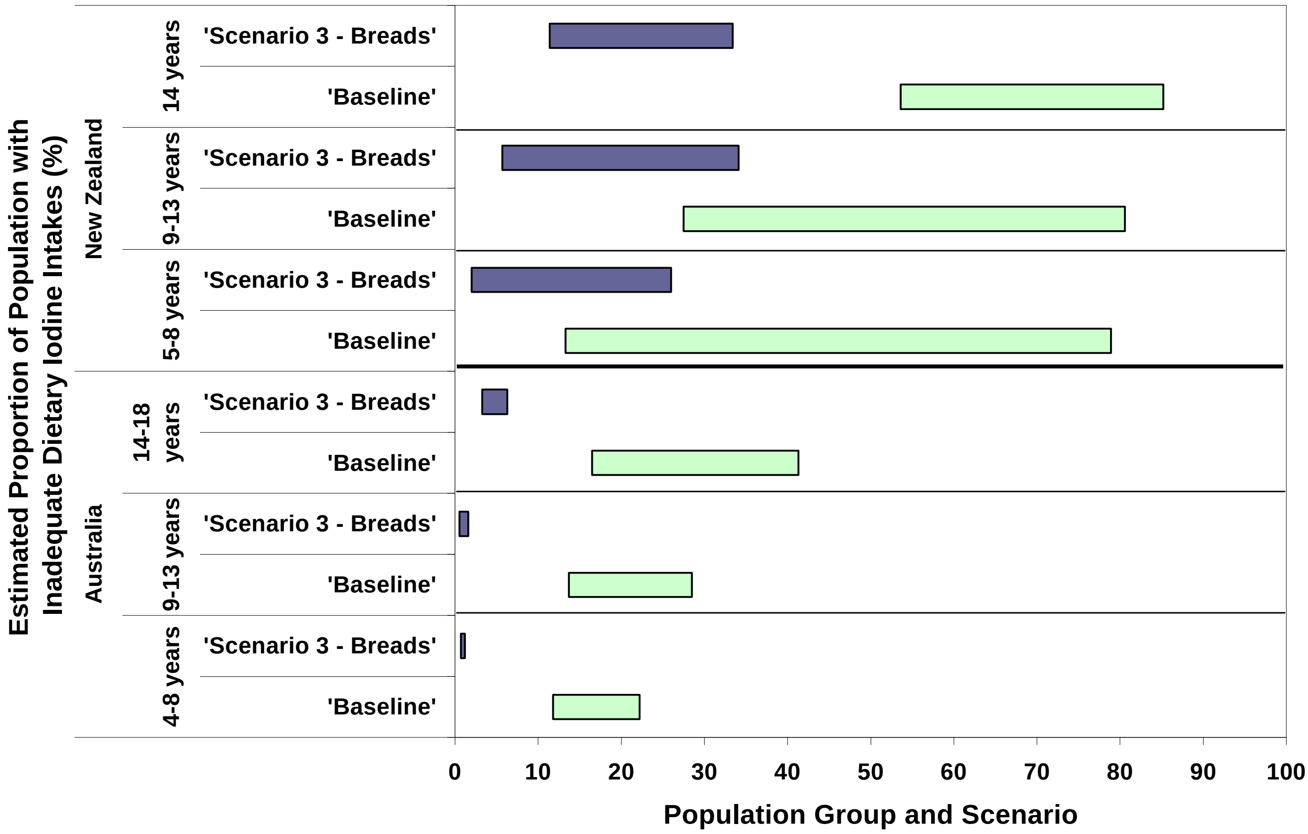
The lower end of the range is the estimated proportion of the population group with inadequate dietary iodine intakes when all discretionary salt is iodised; the upper number in the range is the estimated proportion of the population group with inadequate dietary iodine intakes when all discretionary salt is non-iodised.



* The lower end of each bar is the mean dietary iodine intake when discretionary salt is non-iodised; the upper number of each bar is the mean dietary iodine intake when it is assumed that all discretionary salt is iodised.

*Figure 36: Estimated proportion of the population with inadequate dietary iodine intakes for New Zealand children aged 5-14 years, for Baseline and the 'Breads scenario, as derived from the 2002 NZ CNS**

With the mandatory fortification of breads, the proportion of both Australian children aged 4-18 years and New Zealand children aged 5-14 years with inadequate dietary iodine intakes decreased from that at *Baseline*. As shown in Figure 37, the estimated proportions of New Zealand children aged 5-14 years with inadequate dietary iodine intakes were higher at both *Baseline* and under the mandatory fortification of breads when compared to Australian children. Some of this difference could be accounted for by the use of different methodologies in the calculation of dietary iodine intakes. As discussed in Attachment 1, the range of intakes from respondents is broader based on a single day of food consumption data than those derived using two days of food consumption data as the latter removes the variation in day to day intakes within each person and the variation between each person. For example, the estimated proportion of Australian children aged 9-13 years with inadequate intakes at *Baseline* was 35% based on the one day unadjusted assessment and lower at 29% for the second day adjusted assessment.



New Zealand dietary iodine intakes were calculated using a 'single day adjustment nutrient intake methodology' whereas Australian dietary iodine intakes were calculated using a 'second day adjustment nutrient intake methodology'. The lower end of each bar is the mean dietary iodine intake when discretionary salt is non-iodised; the upper number of each bar is the mean dietary iodine intake when it is assumed that all discretionary salt is iodised.

Figure 37: Estimated proportion of New Zealand and Australian children with inadequate dietary iodine intakes for Baseline *and* Scenario 3 – Breads#

New Zealand children's iodine intakes compared to the UL

Full results outlining the proportion of New Zealand and Australian children with dietary iodine intakes exceeding the UL are shown in Appendix 6, Tables A6.3 and A6.7.

Estimated proportion of children with iodine intakes exceeding the UL at Baseline

The proportion of New Zealand children exceeding the Upper Level (UL) at *Baseline* was low (see Table 9). Each age group assessed had less than one percent of the population group with dietary iodine intakes above the UL. Australian children also had low proportions with dietary iodine intakes above the UL, with children aged 9-13 years and 14 years having no respondents above the UL. When iodised discretionary salt was added to New Zealand children's intakes, proportions with iodine intakes above the UL remained the same as when non-iodised salt was included. The proportion of Australian children with dietary iodine intakes above the UL was also small (≤ 1% or zero depending on the method used).

It should be noted that the New Zealand intakes were not second day adjusted, which if undertaken, would be likely to result in a lower proportion of respondents with intakes exceeding the UL.

Table 9: Estimated proportion of New Zealand and Australian children with dietary iodine intakes above the Upper Level (UL) for *Baseline*, with non-iodised discretionary salt

Country	Population Group	Method	UL (µg/day)	Estimated proportion of the population with dietary iodine intakes >UL (%)
				Baseline
New Zealand	5-8 years	Single day unadjusted	300	<1
	9-13 years		600	<1
	14 years		900	<1
Australia	5-8 years	Single day unadjusted	300	<1
	9-13 years		600	0
	14 years		900	0
Australia	4-8 years	Second day adjusted	300	0
	9-13 years		600	0
	14-18 years		900	0

Estimated proportion of children with iodine intakes exceeding the UL following fortification of bread

The proportion of both New Zealand and Australian children with dietary iodine intakes above the UL following fortification of bread with iodised salt was slightly higher than baseline, however remained small (≤ 3%).

Assessing the impact of mandatory iodine fortification on areas with different water iodine concentrations

Data on the iodine concentration in urine collected for children aged 8-10 years old (see Section 2.1.1 of the P230 Draft Assessment Report) indicates that there may be some differences in iodine status by geographic location. One concern expressed in preliminary consultations undertaken by FSANZ is that a mandatory iodine program may increase the potential risk of exceeding the UL for iodine for people already consuming adequate iodine. Unfortunately, FSANZ is not in a position to assess this risk directly because no information is available on the factors that may be contributing to the reported differences in urinary iodine status.

In collating the iodine database for use in the dietary intake assessment, FSANZ has investigated whether there were differences by geographic location in the iodine concentration data available for food and water. Foods and beverages were collected from different States and Territories for the Australian Total Diet Study (ATDS). The iodine analyses for these foods and beverages showed no obvious trends by geographic location. Therefore, a national mean iodine concentration was derived from available analytical data for each food assigned an iodine value for dietary intake assessment purposes; a similar procedure was undertaken for the New Zealand assessment. There were a limited number of water samples for Australia with one or two samples available for each State or Territory, although each of those was a composite of water from three locations (except for South Australia, where all samples were collected in the capital city). Of these, three of the composite samples analysed had positive results (Western Australia one sample 3.8 µg/100 mL; Queensland 4.2 µg/100 mL and 4.3 µg/100 mL), with all other samples being non-detect results. As the small number of water samples were not representative of water available in each State or Territory, a nationally derived mean of 1.1 µg/100 mL for iodine concentration in water was used for the dietary intake assessments presented elsewhere, assuming that non-detect results were half the LOD (i.e. 0.5 µg/100 mL).

There is limited information on geographical variation in water iodine concentrations in New Zealand from the 2003/04 New Zealand TDS. However, it is specified in the report that due to the limited number of samples, comparisons between regions are not appropriate. Data from all water samples from the 2003/04 TDS show a mean water iodine concentration across all regions of 0.2 µg/100 mL and a maximum of 0.5 µg/100 mL. There seems to be less variation in New Zealand water compared to Australian water with a mean national concentration of 1.1 µg/100 mL and a higher values around 4 µg/100 mL.

Sensitivity analysis

To assess what difference the iodine level assigned to water may make to estimated iodine intakes, further dietary intake assessments were undertaken for the two age groups who appear to be at risk of exceeding the UL for iodine, namely, children aged 2-3 years and children aged 4-8 years. It is also important to note that, while FSANZ is not responsible for the regulation of unpackaged water (e.g. tap water), water has been included in the dietary intake assessments so that iodine intakes from both food and water have been taken into account. This analysis was undertaken for Australia only as the range in reported iodine levels in water was greater and individual dietary records were only available for Australian children.

Results are presented below for estimated iodine intakes assuming: (1) a zero concentration for iodine in water (i.e. a low water iodine area); (2) the mean level of 1.1 µg/100 mL; and (3) an upper level of 4 µg/100 mL (representing a higher iodine water area). The concentration of 4 µg/100 mL is a rounded average from the three water samples from the ATDS with detected iodine concentrations. It should be noted that the higher iodine intakes are indicative of potential intakes for children living in an area where the water is rich in iodine and cannot be related to location by State or Territory due to the non-representative nature of the water samples. It is assumed in these assessments that water iodine concentrations per 100 mL are equal to iodine concentrations per 100 g.

Data from a limited number of water authorities showed a 40-fold variation in the iodine content of water. Average reported values varied between 0.5 µg and 20 µg iodine per 100 mL of water. No data were available for some regions including Queensland and South Australia. There were insufficient data available to quantify the contribution of variations in water iodine content to regional differences in iodine deficiency. In the future FSANZ will track iodine content of the water supply across regions in consultation with relevant water authorities as a part of the proposed iodine monitoring system.

Results given in Table 10 and Table 11 indicate iodine intakes based on three different iodine levels in water, 0, 1.1 and 4 µg/100 mL. The results take into account that 20% of salt in Australia is iodised ('market weighted model') for both *Baseline* and *Scenario 3 – Breads*. The results for *Scenario 3 – Breads* indicate that the difference in iodine intake may be up to 16 µg per 2-3 year old child per day in a high iodine water area compared to an area with mean iodine water concentration; and may be up to 19 µg per child per day for 4-8 year old children. For 2-3 year olds the results depend on whether the baseline or fortification scenario is considered. For *Baseline* intakes the proportion of this population group exceeding the UL ranges from 0-2% as water concentration increases from 0 to 4 µg/100 mL. For the fortification scenario, the proportion exceeding the UL ranges from 3-14% as water iodine concentrations increase from 0-4 µg/100 mL. The maximum predicted iodine intake increases from 317 µg iodine/day to 353 µg iodine/day (11% increase). Living in an area with high iodine water appears to make very little difference to the proportion exceeding the UL for 4-8 year olds (0-1% exceeding the UL).

Table 10: Estimated dietary iodine intakes for 2-3 year old Australian children and the percentage of this population group with inadequate dietary iodine intakes and with dietary iodine intakes above the UL, when considering low, nationally representative and high iodine concentrations in water#

Scenario	Iodine Concentration in Water (µg/100 g)	Dietary Iodine Intake (µg/day)*		% Respondents with Inadequate Dietary Iodine Intakes	% Respondents > UL	Maximum Iodine Intake (µg/day)
		Mean	Median			
Baseline	0	88	83	23	0	199
	1.1 (Nationally representative)	95	90	16	<1	208
	4	112	107	8	2	235
Scenario 3 – Breads	0	127	121	2	3	317
	1.1 (Nationally representative)	133	127	1	6	328
	4	149	146	1	14	353

With market weighted discretionary iodised salt.
* Assuming water is consumed as tap water and is used in recipes, jelly, cordials etc (for these age groups the iodine content of tea and coffee has not been adjusted as few consume these items).

Table 11: Estimated dietary iodine intakes for 4-8 year old Australian children and the percentage of this population group with inadequate dietary iodine intakes and with dietary iodine intakes above the UL, when considering low, nationally representative and high iodine concentrations in water#

Scenario	Iodine Concentration in Water (µg/100 g)	Dietary Iodine Intake (µg/day)*		% Respondents with Inadequate Dietary Iodine Intakes	% Respondents > UL	Maximum Iodine Intake (µg/day)
		Mean	Median			
Baseline	0	87	80	26	0	235
	1.1 (Nationally representative)	94	86	18	0	256
	4	114	105	7	<1	337
Scenario 3 – Breads	0	132	125	1	<1	316
	1.1 (Nationally representative)	139	133	<1	<1	335
	4	158	153	<1	1	375

With market weighted discretionary iodised salt.
* Assuming water is consumed as tap water and is used in recipes, jelly, cordials etc (for these age groups the iodine content of tea and coffee has not been adjusted as few consume these items).

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Appendix 1

Complete information on dietary intake assessment results (Market Weighted Models)

Table A1.1: Market Weighted Model: Estimated mean dietary iodine intakes for New Zealand and Australian target population groups for *Baseline* and *Scenario 3 – Breads*

Country	Population Group	Estimated mean dietary iodine intake (µg/day)		Increase in mean dietary iodine intake from *Baseline* (µg/day)
		Baseline	***Scenario 3 – Breads***	***Scenario 3 – Breads***
New Zealand	15-18 years	106	193	+87
	19-29 years	106	190	+84
	30-49 years	109	195	+86
	50-69 years	103	185	+82
	70 years & above	95	173	+78
	15 years & above	105	189	+84
	16-44 years females	99	172	+73
Australia	2-3 years	95	133	+38
	4-8 years	94	139	+45
	9-13 years	108	160	+52
	14-18 years	121	179	+58
	19-29 years	119	177	+58
	30-49 years	110	166	+56
	50-69 years	105	158	+53
	70 years & above	96	147	+51
	2 years & above	108	162	+54
	16-44 years women	100	146	+46

Appendix 2

Complete information on dietary intake assessment results (Consumer Behaviour Models)

Table A2.1: Consumer Behaviour Models: Estimated mean and 95th percentile dietary iodine intakes, in µg/day, for New Zealand children aged 1-3 years for *Baseline* and *Scenario 3 – Breads*

Scenario	**Estimated dietary iodine intake (µg/day)**	
	Mean	**95th percentile**
Baseline	48 – 72	119 – 180
Scenario 3 – Breads	77 – 102	193 – 254

Note: In this table, the lower number in the range is the mean dietary iodine intake when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the mean dietary iodine intake when 1 serve/day of FSFYC is included in the diet.

Table A2.2: Consumer Behaviour Models: Estimated mean and 95th percentile dietary iodine intakes, in µg/day, for Australian children aged 1 year for *Baseline* and *Scenario 3 – Breads*

Scenario	**Estimated dietary iodine intake (µg/day)**	
	Mean	**95th percentile**
Baseline	79 – 92	198 – 230
Scenario 3 – Breads	95 – 107	238 – 268

Note: in this table, the lower number in the range is the mean dietary iodine intake when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the mean dietary iodine intake when 1 serve/day of FSFYC is included in the diet.

Table A2.3: Consumer Behaviour Model: Estimated mean dietary iodine intakes for New Zealand and Australian target population groups for *Baseline* and *Scenario 3 – Breads*

Country	Population Group	Estimated mean dietary iodine intake (µg/day)	
		Baseline	*Scenario 3 – Breads*
New Zealand	15-18 years	69 – 131	157 – 218
	16-44 years female	66 – 122	138 – 194
	19-29 years	72 – 129	155 – 213
	30-49 years	75 – 131	162 – 218
	50-69 years	72 – 123	154 – 206
	70 years & above	67 – 114	145 – 192
	15 years & above	72 – 127	157 – 211
Australia	2-3 years	93 – 105	130 – 143
	4-8 years	91 – 109	135 – 154
	9-13 years	103 – 128	155 – 180
	14-18 years	114 – 149	172 – 207
	16-44 years female	94 – 122	140 – 169
	19-29 years	113 – 145	171 – 203
	30-49 years	104 – 133	161 – 189
	50-69 years	98 – 129	152 – 182
	70 years & above	90 – 120	141 – 171
	2 years & above	102 – 131	156 – 185

Note: In this table, the lower number in the range is the mean dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and *Scenario 3 – Breads*.

Table A2.4: Major contributors (≥5%), excluding discretionary salt, to estimated iodine intakes for New Zealand children aged 1-3 years

Food Group Name	Major contributors to Iodine Intakes (% iodine intake)			
	Baseline		*Scenario 3 – Breads*	
	Without FSFYC	With FSFYC	Without FSFYC	With FSFYC
Milk, whole	**44**		**27**	
Formulated Supplementary Foods For Young Children (FSFYC)	0	**61**	0	**43**
Yoghurt	11	7	7	5
Egg	9	6	5	
Bread, white			25	19
Bread, wheatmeal			7	5

Notes:
[1] The numbers in **bold** indicate the major contributor to iodine intake for the population group for that scenario.
[2] The percent contribution is listed only if it is ≥ 5% - the shaded cells indicate that the food contributes to iodine intakes but that the contribution is < 5%.

Table A2.5: Major contributors (≥5%), excluding discretionary salt, to estimated iodine intakes for Australian children aged 1 year

Food Group Name	Major contributors to Iodine Intakes (% iodine intake)			
	Baseline		*Scenario 3 – Breads*	
	Without FSFYC	With FSFYC	Without FSFYC	With FSFYC
Milk, full fat	**75**	28	**62**	24
Bread, white			13	11
Formulated Supplementary Foods For Young Children (FSFYC)	0	**51**	0	**44**

Notes:
[1] The numbers in **bold** indicate the major contributor to iodine intake for the population group for that scenario.
[2] The percent contribution is listed only if it is ≥ 5% - the shaded cells indicate that the food contributes to iodine intakes but that the contribution is < 5%.

Table A2.6: Contributors, excluding discretionary salt, to estimated iodine intakes for New Zealand target population groups

Food Group Name	Contributors to Iodine Intakes (% iodine intake)			
	Females 16-44 years		15 years and above	
	Baseline	*Scenario 3*	*Baseline*	*Scenario 3*
Milk[1]	**33**	**17**	**31**	**14**
Fish/Seafood[2]	**13**	**7**	**16**	**8**
Eggs and egg dishes	**11**	**5**	**11**	**5**
Non-alcoholic beverages[3]	**6**	3	**5**	2
Grains and Pasta[4]	**7**	4	4	2
Bread (includes rolls and speciality breads)[5]	<1	**46**	<1	**48**
Bread based dishes	1	5	1	5
Breakfast cereals	<1	<1	<1	<1
Biscuits	<1	<1	<1	<1
Cakes and muffins	4	2	3	2
Puddings	1	<1	1	<1
Dairy products	3	2	3	1
Cheese	1	<1	1	<1
Butter and Margarine	<1	<1	<1	<1
Fats and oils	<1	<1	<1	<1
Beef and Veal	<1	<1	<1	<1
Lamb/Mutton	<1	<1	<1	<1
Pork	<1	<1	<1	<1
Poultry	<1	<1	<1	<1
Other meat	<1	<1	<1	<1
Sausages and processed meats	2	2	3	3
Pies and pasties	1	<1	1	<1
Vegetables	2	1	3	1
Potatoes and kumara	2	<1	2	<1
Snack foods	<1	<1	<1	<1
Fruit	1	<1	2	<1
Nuts and Seeds	<1	<1	<1	<1
Sugar/sweets	1	<1	<1	<1
Soups and stocks	<1	<1	<1	1
Sauces	1	<1	1	<1
Alcoholic beverages	2	<1	3	2
Dietary supplements	<1	<1	<1	<1
Herbs and spices	<1	<1	<1	<1

Note: The numbers in **bold** indicate the major contributors to iodine intake for the population group for that scenario

1. **Milk** includes cow's and goat's milks, evaporated milk, powdered milk, milkshakes, flavoured milk and soy beverages
2. **Fish/seafood** includes battered and crumbed fish, canned fish, plain cooked fish, smoked fish, shellfish, crustacean (plain cooked, battered, crumbed, canned, smoked) and dishes made from fish/seafood
3. **Non-alcoholic beverages** includes teas, coffees, hot chocolate drinks, fruit juices, cordials, fruit drinks, soft drinks, waters (tap, mineral) and sports drinks
4. **Grains and pasta** includes plain cooked rice, pasta, and noodles, filled pastas, savoury rice-based dishes, pasta-based dishes (e.g. lasagne, macaroni cheese), instant noodles, noodle-based dishes (e.g. chow mein), flours, bran and germ
5. **Bread** includes white, wholemeal, multigrain, rye, fruit bread, flat breads, topped breads (e.g. cheese topped), bagels, English-style muffins, crumpets and buns

Table A2.7: Contributors, excluding discretionary salt, to estimated iodine intakes for Australian target population groups

Food Group Name	Contributors to Iodine Intakes (% iodine intake)					
	2-3 years		Females 16-44 years		2 years and above	
	Baseline	*Scenario 3*	*Baseline*	*Scenario 3'*	*Baseline*	*Scenario 3*
Milk, milk products and dishes[1]	**71**	**52**	**41**	**28**	**45**	**30**
Non-alcoholic beverages[2]	**6**	4	**16**	**10**	**14**	**9**
Cereal-based products and dishes[3]	4	4	**7**	**6**	**7**	**5**
Cereals and cereal products[4]	4	**29**	**6**	**35**	**5**	**36**
Fish and seafood products and dishes[5]	1	1	**5**	3	**5**	3
Water	4	3	**10**	**7**	**8**	**5**
Fats and oils	<1	<1	<1	<1	<1	<1
Fruit products and dishes	1	<1	<1	<1	1	<1
Egg products and dishes	2	2	3	2	4	2
Meat, poultry and game products and dishes	2	2	3	2	3	2
Soup	<1	<1	1	<1	<1	<1
Seed and nut products and dishes	<1	<1	<1	<1	<1	<1
Savoury sauces and condiments	<1	<1	1	<1	<1	<1
Vegetable products and dishes	1	<1	3	2	2	2
Legume and pulse products and dishes	<1	<1	<1	<1	<1	<1
Snack foods	<1	<1	<1	<1	<1	<1
Sugar products and dishes	<1	<1	<1	<1	<1	<1
Confectionery and health bars	<1	<1	1	<1	<1	<1
Alcoholic beverages	<1	<1	1	<1	2	1
Special dietary foods	<1	<1	<1	<1	<1	<1
Miscellaneous	<1	<1	<1	<1	<1	<1
Infant formulae and foods	<1	<1	<1	<1	<1	<1

Note: The numbers in **bold** indicate the major contributors to iodine intake for the population group for that scenario

1. **Milk, milk products and dishes** includes milks (plain and flavoured), evaporated milk, condensed milk, milk powders, yoghurts (plain, flavoured and fruit), creams, cheeses, ice creams and ice confections (dairy and soy-based), frozen yoghurts, custards and other dairy-based desserts and soy-based beverages.
2. **Non-alcoholic beverages** includes teas, coffees, fruit and vegetable juices and drinks, cordials, soft drinks and mineral waters, electrolyte drinks, sports drinks, bottled water and tap water.
3. **Cereal-based products and dishes** includes biscuits (sweet and savoury), cakes, buns, muffins (cake style), scones, slices, 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, pancakes, crepes, pikelets and doughnuts.
4. **Cereals and cereal products** includes grains, cereal flours and starch powders, breads and rolls, breakfast cereals, English-style muffins, crumpets, tortillas, pastas, noodles and rice.
5. **Fish and seafood products and dishes** includes fresh, frozen, smoked, canned, crumbed and battered fish, molluscs and crustacea, fish fingers, fish cakes and mixed dishes containing fish or other seafood.

Appendix 3

Complete information on risk characterisation (Market Weighted Models)

Table A3.1: Market Weighted Model: Estimated proportion of New Zealand and Australian population groups with dietary iodine intakes below the Estimated Average Requirement (EAR) for *Baseline* and *Scenario 3 – Breads*

Country	Population Group	EAR (µg/day)	Estimated proportion of the population with inadequate dietary iodine intakes (%)	
			Baseline	***Scenario 3 – Breads***
New Zealand	15-18 years	95	27	0
	16-44 years female (non-pregnant)	95/100*	68	0
	16-44 years female (pregnancy EAR)	160	97	45
	16-44 years female (lactation EAR)	190	99	77
	19-29 years	100	49	0
	30-49 years	100	46	0
	50-69 years	100	54	0
	70 years & above	100	72	0
	15 years & above	*	51	0
Australia	2-3 years	65	16	1
	4-8 years	65	18	1
	9-13 years	75	21	<1
	14-18 years	95	35	4
	16-44 years female (non-pregnant)	95/100*	59	9
	16-44 years female (pregnancy EAR)	160	93	71
	16-44 years female (lactation EAR)	190	97	88
	19-29 years	100	41	6
	30-49 years	100	47	5
	50-69 years	100	53	5
	70 years & above	100	63	6
	2 years & above	*	43	5

* The appropriate EAR for each age group was used for each individual respondent.

Table A3.2: Market Weighted Model: Estimated proportion of New Zealand and Australian population groups with dietary iodine intakes above the Upper Level (UL) for *Baseline*, and *Scenario 3 – Breads*

Country	Population Group	UL (µg/day)	Estimated proportion of the population with dietary iodine intakes > UL (%)	
			Baseline	***Scenario 3 – Breads***
New Zealand	15-18 years	900	0	0
	16-44 years female	900/1,100*	0	0
	19-29 years	1,100	0	0
	30-49 years	1,100	0	0
	50-69 years	1,100	0	0
	70 years & above	1,100	0	0
	15 years & above	*	0	0
Australia	2-3 years	200	<1	6
	4-8 years	300	0	<1
	9-13 years	600	0	0
	14-18 years	900	0	0
	16-44 years female	900/1,100*	0	0
	19-29 years	1,100	0	0
	30-49 years	1,100	0	0
	50-69 years	1,100	0	0
	70 years & above	1,100	0	0
	2 years & above	*	<1	<1

* The appropriate UL for each age group was used for each individual respondent.

Appendix 4

Complete information on risk characterisation (Consumer Behaviour Models)

Table A4.1: Estimated mean dietary iodine intakes, as a percentage of the EAR, for New Zealand children aged 1-3 years for *Baseline* and *Scenario 3 – Breads*

Scenario	**EAR (µg/day)**	**Estimated mean dietary iodine intake (%EAR)**
Baseline	65	75 – 110
Scenario 3 – Breads	65	120 – 160

Note: In this table, the lower number in the range is the percentage of the EAR when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the EAR when 1 serve/day of FSFYC is included in the diet.

Table A4.2: Estimated mean dietary iodine intakes, as a percentage of the EAR, for Australian children aged 1 year for *Baseline* and *Scenario 3 – Breads*

Scenario	**EAR (µg/day)**	**Estimated mean dietary iodine intake (%EAR)**
Baseline	65	120 – 140
Scenario 3 – Breads	65	150 – 170

Note: In this table, the lower number in the range is the percentage of the EAR when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the EAR when 1 serve/day of FSFYC is included in the diet.

Table A4.3: Consumer Behaviour Models: Estimated proportion of New Zealand and Australian population groups with inadequate dietary iodine intakes for *Baseline* and *Scenario 3 – Breads*

Country	Population Group	EAR (µg/day)	Estimated proportion of the population with inadequate dietary iodine intakes	
			Baseline	*Scenario 3 – Breads*
New Zealand	15-18 years	95	0 – 91	0 – 6
	16-44 years female (non-pregnant)	95/100*	1 – 95	0 – 14
	16-44 years female (pregnancy EAR)	160	95 – 99	17 – 80
	16-44 years female (lactation EAR)	190	98 – 99	55 – 91
	19-29 years	100	<1 – 91	0 – 10
	30-49 years	100	<1 – 90	0 – 8
	50-69 years	100	8 – 92	0 – 7
	70 years & above	100	22 – 96	0 – 6
	15 years & above	*	5 – 91	0 – 8
Australia	2-3 years	65	12 – 18	<1 – 2
	4-8 years	65	12 – 22	<1 – 1
	9-13 years	75	14 – 29	<1 – 2
	14-18 years	95	16 – 41	3 – 6
	16-44 years female (non-pregnant)	95/100*	31 – 65	6 – 13
	16-44 years female (pregnancy EAR)	160	82 – 95	45 – 75
	16-44 years female (lactation EAR)	190	93 – 98	71 – 90
	19-29 years	100	22 – 47	4 – 9
	30-49 years	100	23 – 54	3 – 8
	50-69 years	100	22 – 61	2 – 8
	70 years & above	100	26 – 72	2 – 9
	2 years & above	*	21 – 50	3 – 7

Note: In this table, the lower number in the range is the percentage of the population group with inadequate dietary iodine intakes when all discretionary salt is iodised; the upper number in the range is the percentage of the population inadequate dietary iodine intakes when discretionary salt is non-iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for *Scenario 3 – Breads*.

Table A4.4: Estimated mean and 95th percentile dietary iodine intakes, as a percentage of the UL, for New Zealand children aged 1-3 years for *Baseline* and *Scenario 3 – Breads*

Scenario	UL (µg/day)	Estimated dietary iodine intake (%UL)	
		Mean	95th percentile
Baseline	200	25 – 35	60 – 90
Scenario 3 – Breads	200	40 – 50	95 – 130

Note: In this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

Table A4.5: Estimated mean and 95th percentile dietary iodine intakes, as a percentage of the UL, for Australian children aged 1 year for *Baseline* and *Scenario 3 – Breads*

Scenario	UL (µg/day)	Estimated dietary iodine intake (%UL)	
		Mean	95th percentile
Baseline	200	40 – 45	100 – 120
Scenario 3 – Breads	200	50 – 55	120 – 130

Note: In this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

Table A4.6: Consumer Behaviour Models: Estimated proportion of New Zealand and Australian population groups with dietary iodine intakes above the Upper Level (UL) for *Baseline*, and *Scenario 3 – Breads*

Country	Population Group	UL (µg/day)	Estimated proportion of the population with dietary iodine intakes > UL (%)	
			Baseline	***Scenario 3 – Breads***
New Zealand	15-18 years	900	0 – 0	0 – 0
	16-44 years female	900/1,100*	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 & above	1,100	0 – 0	0 – 0
	15 years & above	*	0 – 0	0 – 0
Australia	2-3 years	200	<1 – 2	5 – 10
	4-8 years	300	0 – 0	<1 – <1
	9-13 years	600	0 – 0	0 – 0
	14-18 years	900	0 – 0	0 – 0
	16-44 years female	900/1,100*	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 & above	1,100	0 – 0	0 – 0
	2 years & above	*	<1 – <1	<1 – <1

* The appropriate UL for each age group was used for each individual respondent.
Note: In this table, the lower number in the range is the estimated proportion of the population with dietary iodine intakes >UL when discretionary salt is non-iodised; the upper number in the range is the estimated proportion of the population with dietary iodine intakes >UL when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and *Scenario 3 – Breads*.

Appendix 5

Complete information on results for respondents with low and high quintile intakes of iodine

Table A5.1: Estimated mean dietary iodine intakes for New Zealand and Australian women aged 16-44 years for low (Quintile 1) and high (Quintile 5) consumers of iodine

Country	Population Group	Mean Iodine Intake (µg/day)			
		Quintile 1		Quintile 5	
		Baseline	*Scenario 3 – Breads* **mandatory fortification**	*Baseline*	*Scenario 3 – Breads* **mandatory fortification**
New Zealand	16-44 years female	40	138	118	196
	15 years and above	44	129	100	176
Australia	2-3 years	54	91	143	183
	16-44 years female	53	105	153	190
	2 years and above	58	109	167	223

Table A5.2: Increase in estimated mean dietary iodine intakes for New Zealand and Australian population groups for low (Quintile 1) and high (Quintile 5) consumers of iodine

Country	Population Group	Increase in Mean Dietary Iodine Intakes (µg/day)		Increase in Mean Dietary Iodine Intakes (%)	
		Quintile 1	Quintile 5	Quintile 1	Quintile 5
New Zealand	16-44 years female	+98	+78	250	65
	15 years and above	+85	+76	190	75
Australia	2-3 years	+37	+40	70	30
	16-44 years female	+52	+37	100	25
	2 years and above	+51	+56	90	35

Table A5.3: Contributors to iodine intakes for New Zealand groups with low and high intakes of iodine

Food Group Name	Contributors to Iodine Intakes (% iodine intake)							
	Females 16-44 years				15 years and above			
	Baseline		*Scenario 3'*		*Baseline*		*Scenario 3'*	
	Q1	Q5	Q1	Q5	Q1	Q5	Q1	Q5
Milk Products and Dishes[1]	**39**	**36**	**18**	**25**	**40**	**31**	**16**	**19**
Cereals and Cereal Products[2]	**12**	**7**	**53**	**32**	**10**	**6**	**57**	**35**
Fish and Seafood Products and Dishes[3]	**11**	**24**	**5**	**17**	**9**	**28**	4	**18**
Eggs and Egg Dishes[4]	**10**	**13**	**5**	**9**	**9**	**12**	4	**8**
Cereal Based Products and Dishes[5]	**6**	4	**8**	4	**6**	3	**7**	**5**
Meat, Poultry and Game Dishes[6]	**5**	2	4	2	**6**	3	4	4
Vegetable Products and Dishes[7]	3	**9**	1	**6**	4	**6**	2	4
Water[8]	4	2	2	1	4	1	2	1
Non-Alcoholic Beverages	3	<1	1	<1	3	1	1	<1
Soups, Stocks and Sauces	2	1	2	1	2	1	2	1
Alcoholic Beverages	2	<1	<1	<1	2	3	<1	2
Fruit Products and Dishes	1	<1	<1	<1	1	2	<1	1
Sugar Products and Dishes	1	<1	<1	<1	1	<1	<1	<1
Fats and Oils	<1	<1	<1	<1	<1	<1	<1	<1
Seed and Nut Products and Dishes	<1	<1	<1	<1	<1	<1	<1	<1
Snack Foods	<1	<1	<1	<1	<1	<1	<1	<1
Special Dietary Foods	<1	0	<1	0	<1	<1	<1	<1
Miscellaneous	<1	0	<1	0	<1	<1	<1	<1

Note: The numbers in **bold** indicate the major contributors to iodine intake for the population group for that scenario

1. **Milk products and dishes** includes cow's and goat's milks, evaporated milk, powdered milk, milkshakes, flavoured milk, soy beverages, milk puddings, cream, sour cream, ice cream, frozen yoghurts, yoghurt (regular, reduced fat and low fat), cheese (high, medium and low fat).
2. **Cereals and cereal products** includes rice, flour, pasta, bran and germs, grains, bread (white, wholemeal, multigrain, rye, fruit bread, flat breads), speciality breads (garlic or cheese topping), bagels, muffins, crumpets, sweet yeast buns, muesli, porridge and cooked cereals and other breakfast cereals, pastries and pies (pies).
3. **Fish and seafood products and dishes** includes battered and crumbed fish, canned fish, plain cooked fish, smoked fish, shellfish, crustacean (plain cooked, battered, crumbed, canned, smoked) and dishes made from fish/seafood.
4. **Egg and egg dishes** includes poached, boiled and fried eggs, omelettes and quiches.
5. **Cereal based products and dishes** includes biscuits (sweet and savoury), muesli bars, cakes and muffins (sweet and savoury), scones, pikelets, doughnuts, pastry and tarts.
6. **Meat, poultry and game products and dishes** includes beef, lamb and mutton, pork, bacon, ham, veal, rabbit, venison, chicken, turkey, duck, quail, liver, heart, kidney, tongue, other organ meats and offal, sausage and processed meats.
7. **Vegetable products and dishes** includes leafy greens (e.g. silverbeet or lettuce), beans, peas and corn, tomatoes, onion, garlic and leek, other vegetables, stir-fry and stuffed vegetables, legumes and pulses, tofu, potatoes and kumara.
8. **Water** includes mineral and soda water, tap and filtered water.

Table A5.4: Contributors to iodine intakes for Australian population groups with low and high intakes of iodine

Food Group Name	**Contributors to Iodine Intakes (% iodine intake)**											
	2-3 years				**Females 16-44 years**				**2 years and above**			
	Baseline		***Scenario 3***		***Baseline***		***Scenario 3***		***Baseline***		***Scenario 3***	
	Q1	**Q5**	**Q1**	**Q5**	**Q1**	**Q5**	**Q1**	**Q5**	**Q1**	**Q5**	**Q1**	**Q5**
Milk products and dishes[1]	**45**	**81**	**25**	**65**	**20**	**50**	**10**	**39**	**25**	**53**	**12**	**40**
Non-Alcoholic Beverages[2]	**16**	3	**9**	2	**27**	**10**	**13**	**8**	**24**	**9**	**12**	**7**
Cereals and cereal products[3]	**8**	2	**48**	**21**	**7**	**5**	**51**	**26**	**7**	**4**	**52**	**27**
Water[4]	**7**	3	4	2	**16**	**7**	**8**	**5**	**13**	**6**	**6**	4
Cereal based products and dishes[5]	**7**	3	**5**	2	**9**	**6**	**7**	**6**	**8**	**6**	**5**	**6**
Meat, poultry and game products and dishes[6]	3	1	2	<1	**5**	2	3	2	**5**	2	3	2
Soup, Stocks and Sauces	3	<1	2	<1	3	2	1	1	3	1	2	1
Sugar products and dishes	2	<1	1	<1	2	1	<1	<1	2	<1	<1	<1
Fruit products and dishes	2	<1	1	<1	1	<1	<1	<1	2	<1	<1	<1
Vegetable products and dishes[7]	2	1	1	<1	**5**	2	2	1	5	2	2	1
Fish and seafood products and dishes[8]	1	2	1	2	1	**8**	<1	**6**	2	**8**	1	**6**
Snack foods	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Egg products and dishes	<1	2	<1	2	2	4	<1	3	2	4	1	3
Miscellaneous	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Seed and nut products and dishes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fats and oils	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Alcoholic beverages	0	0	0	0	2	<1	<1	<1	2	1	1	1
Special dietary foods	0	0	0	0	0	<1	0	<1	0	<1	0	<1
Infant formulae and foods	0	0	0	0	0	0	0	0	0	0	0	0

Note: The numbers in **bold** indicate the major contributors to iodine intake for the population group for that scenario

1. **Milk, milk products and dishes** includes milks (plain and flavoured), evaporated milk, condensed milk, milk powders, yoghurts (plain, flavoured and fruit), creams, cheeses, ice creams and ice confections (dairy and soy-based), frozen yoghurts, custards and other dairy-based desserts and soy-based beverages.
2. **Non-alcoholic beverages** includes teas, coffees, fruit and vegetable juices and drinks, cordials, soft drinks and mineral waters, electrolyte drinks, sports drinks, bottled water and tap water.
3. **Cereals and cereal products** includes grains, cereal flours and starch powders, breads and rolls, breakfast cereals, English-style muffins, crumpets, tortillas, pastas, noodles and rice.
4. **Water** includes plain drinking water.
5. **Cereal-based products and dishes** includes biscuits (sweet and savoury), cakes, buns, muffins (cake style), scones, slices, 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, pancakes, crepes, pikelets and doughnuts.
6. **Meat, poultry and game products and dishes** includes beef, lamb, pork, bacon, ham, veal, kangaroo, rabbit, venison, chicken, turkey, duck, quail, emu, liver, heart, kidney, tongue, other organ meats and offal, sausage and processed meats.
7. **Vegetable products and dishes** includes potatoes, cabbage, cauliflower, leaf and stalk vegetables, carrot and similar root vegetables, peas and beans, tomatoes, other fruiting vegetables, onion, garlic and leek.
8. **Fish and seafood products and dishes** includes fresh, frozen, smoked, canned, crumbed and battered fish, molluscs and crustacea, fish fingers, fish cakes and mixed dishes containing fish or other seafood.

Table A5.5: Food groups consumed by ≥ 20% of New Zealand women aged 16-44 years and the mean amounts eaten by consumers of these foods

Food Group	Proportion of Population Group Consuming (%)		Mean consumer amount (g/day)	
	Quintile 1	Quintile 5	Quintile 1	Quintile 5
Potato chips/wedges/croquette/ hash browns	21	21	131	126
Jam/marmalade/honey	21	29	18	19
Regular soft drinks	28	15	528	371
Additional sauces incl. tomato, ketchup	30	25	28	18
Tea incl. black, herbal, green	48	59	661	896
Coffee and coffee substitutes	48	63	86	116
Sugar	59	56	20	23
Water incl. mineral, soda, tap, filtered	84	87	1,080	1,319

Table A5.6: Food groups consumed by ≥ 20% of New Zealanders aged 15 years and above and the mean amounts eaten by consumers of these foods

Food Group	Proportion of Population Group Consuming (%)		Mean consumer amount (g/day)	
	Quintile 1	Quintile 5	Quintile 1	Quintile 5
Beer	4	24	1,174	1,828
Wheat based biscuits & shredded wheat	11	20	33	45
Potato chips/wedges/croquette/hash browns	16	24	129	164
Regular soft drinks	23	21	489	623
High fat cheese (>30g fat/100g)	24	24	33	44
Milk, trim (green)	26	32	153	338
Additional sauces incl. tomato, ketchup	26	29	25	33
Jam/marmalade/honey	29	34	17	25
Butter	38	44	18	24
Polyunsaturated margarine	39	38	18	26
Bread & rolls, white	44	48	108	128
Coffee and coffee substitutes	51	58	80	105
Milk, homogenised fluid (blue)	53	54	211	361
Sugar	54	67	17	26
Tea incl. black, herbal, green	56	58	668	821
Water incl. mineral, soda, tap, filtered	84	81	1,021	1,070

Table A5.7: Food groups consumed by ≥ 20% of Australian children aged 2-3 years and the mean amounts eaten by consumers of these foods

Food Group	Proportion of Population Group Consuming (%)		Mean consumer consumption amount (g/day)	
	Quintile 1	Quintile 5	Quintile 1	Quintile 5
Other dry beverage flavourings	4	21	4	10
Cheese, processed	12	21	16	37
Fortified dry beverage flavourings	12	21	2	7
Peanuts & peanut products	16	22	11	14
Jams & conserves	16	21	8	11
Breakfast cereal, wheat-based biscuits & shredded wheat	22	26	22	26
Fruit-based or flavoured cordials & drinks	24	29	446	360
Lollies & other confectionery	24	13	21	13
Fruit-flavoured drink base & cordial base	26	11	78	50
Fruit drinks	28	12	299	489
Single fruit juices	29	36	273	243
Savoury sauces	30	24	11	23
Yeast, vegetable & meat extracts	33	30	3	3
Sugar	34	26	3	4
Polyunsaturated margarine & spreads	42	36	6	11
Domestic water	46	32	321	291
Plain drinking water	51	67	492	559
Breads, rolls, white	58	58	69	82
Milk, fluid, regular whole, full fat	61	91	118	800

Table A5.8: Food groups consumed by ≥ 20% of Australian women aged 16-44 years and the mean amounts eaten by consumers of these foods

Food Group	Proportion of Population Group Consuming (%)		Mean consumer consumption amount (g/day)	
	Quintile 1	Quintile 5	Quintile 1	Quintile 5
Milk, fluid, reduced fat, < 2% fat	13	32	46	354
Single fruit juices	20	24	308	304
Yeast, vegetable & meat extracts	22	16	5	5
Savoury sauces	22	27	21	33
Cheese, natural, traditional	24	36	23	42
Polyunsaturated margarine & spreads	36	30	11	13
Tea	41	47	558	804
Coffee beverage	42	46	632	826
Sugar	44	51	14	18
Milk, fluid, regular whole, full fat	46	59	58	404
Breads, rolls, white	54	51	85	100
Plain drinking water	68	84	889	1,246

Table A5.9: Food groups consumed by ≥ 20% of Australians aged 2 years and above and the mean amounts eaten by consumers of these foods

Food Group	Proportion of Population Group Consuming (%)		Mean consumer consumption amount (g/day)	
	Quintile 1	Quintile 5	Quintile 1	Quintile 5
Ice cream, tub varieties	4	21	52	162
Milk, fluid, reduced fat, < 2% fat	12	26	62	430
Breads, rolls, wholemeal	18	20	77	103
Single fruit juices	20	23	266	320
Cheese, natural, traditional	21	35	22	44
Yeast, vegetable & meat extracts	22	16	5	6
Savoury sauces	22	31	20	34
Coffee beverage	39	44	603	839
Polyunsaturated margarine & spreads	40	33	12	16
Tea	41	38	633	824
Sugar	43	54	13	21
Milk, fluid, regular whole, full fat	44	60	83	498
Breads, rolls, white	55	53	89	119
Plain drinking water	70	77	735	1,247
Ice cream, tub varieties	4	21	52	162
Milk, fluid, reduced fat, < 2% fat	12	26	62	430
Breads, rolls, wholemeal	18	20	77	103
Single fruit juices	20	23	266	320

Appendix 6

Complete information on the dietary intake assessments for New Zealand children aged 5-14 years, as derived from the 2002 New Zealand Children's Nutrition Survey

Table A6.1: Estimated (single day, unadjusted) mean dietary iodine intakes for New Zealand children aged 5-14 years, as derived from the 2002 NZ CNS

Age Group	Estimated Mean Dietary Iodine Intake (µg/day)	
	NZ CNS Baseline	*NZ CNS Scenario 3 – Breads*
5-8 years	50 – 95	106 – 151
9-13 years	54 – 99	119 – 164
14 years	64 – 109	137 – 182

Note: In this table, the lower number in the range is the mean dietary iodine intake of the population when discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake of the population group when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads*.

Table A6.2: Estimated proportion of New Zealand children aged 5-14 years with inadequate dietary iodine intakes, as derived from the 2002 NZ CNS (single day, unadjusted)

Age Group	Estimated Proportion of the Population with Inadequate Dietary Iodine Intakes	
	NZ CNS Baseline	*NZ CNS Scenario 3 – Breads*
5-8 years	13 – 79	2 – 26
9-13 years	28 – 81	6 – 28
14 years	54 – 85	11 – 33

Note: In this table, the lower number in the range is the estimated proportion of the population with inadequate dietary iodine intakes when all discretionary salt is iodised; the upper number in the range is the estimated proportion of the population with inadequate dietary iodine intakes when discretionary salt is non-iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads*.

Table A6.3: Estimated proportion of New Zealand children aged 5-14 years with dietary iodine intakes above the UL, as derived from the 2002 NZ CNS (single day, unadjusted)

Age Group	Estimated Proportion of the Population with Dietary Iodine Intakes > UL	
	NZ CNS Baseline	*NZ CNS Scenario 3 – Breads*
5-8 years	<1 – <1	1 – 3
9-13 years	<1 – <1	<1 – <1
14 years	<1 – <1	<1 – <1

Note: In this table, the lower number in the range is the estimated proportion of the population with dietary iodine intakes >UL when discretionary salt is non-iodised; the upper number in the range is the estimated proportion of the population with dietary iodine intakes >UL when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads*.

Table A6.4: Estimated maximum dietary iodine intakes for New Zealand children aged 5-14 years, as derived from the 2002 NZ CNS (single day, unadjusted)

Age Group	Estimated Maximum Dietary Iodine Intake (µg/day)	
	NZ CNS Baseline	***NZ CNS Scenario 3 – Breads***
5-8 years	1,183 – 1,228	1,203 – 1,248
9-13 years	977 – 1022	977 – 1,022
14 years	1,443 – 1,488	1,660 – 1,705

Note: In this table, the lower number in the range is the maximum dietary iodine intake of the population when discretionary salt is non-iodised; the upper number in the range is the maximum dietary iodine intake of the population group when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads*.

Table A6.5: Estimated mean dietary iodine intakes for New Zealand and Australian children aged 5-14 years at *Baseline* and under the mandatory fortification of breads

Country	Age Group	Estimated Mean Dietary Iodine Intake (µg/day)	
		Baseline	**Mandatory fortification of breads**
New Zealand*	5-8 years	50 – 95	106 – 151
	9-13 years	54 – 99	119 – 164
	14 years	64 – 109	137 – 182
Australia**	4-8 years	91 – 109	135 – 154
	9-13 years	103 – 128	155 – 180
	14-18 years	114 – 149	172 – 207

Note: In this table, the lower number in the range is the mean dietary iodine intake of the population when discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake of the population group when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for the mandatory fortification of breads.
* Based on single day, unadjusted assessment.
** Based on second day adjusted assessment.

Table A6.6: Estimated proportion of New Zealand and Australian children aged 5-14 years with inadequate dietary iodine intakes at *Baseline* and under the mandatory fortification of breads

Country	Age Group	Estimated Proportion of the Population with Inadequate Dietary Iodine Intakes (%)	
		Baseline	**Mandatory fortification of breads**
New Zealand*	5-8 years	13 – 79	2 – 26
	9-13 years	28 – 81	6 – 28
	14 years	54 – 85	11 – 33
Australia**	4-8 years	12 – 22	<1 – 1
	9-13 years	14 – 29	<1 – 2
	14-18 years	16 – 41	3 – 6

Note: In this table, the lower number in the range is the estimated proportion of the population with inadequate dietary iodine intakes when all discretionary salt is iodised; the upper number in the range is the estimated proportion of the population with inadequate dietary iodine intakes when discretionary salt is non-iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg at *Baseline* and for the mandatory fortification of breads.
* Based on single day, unadjusted assessment.
** Based on second day adjusted assessment.

Table A6.7: Estimated proportion of New Zealand and Australian children aged 5-14 years with dietary iodine intakes above the UL at *Baseline* and under the mandatory fortification of breads

Country	Age Group	Estimated Proportion of the Population with Dietary Iodine Intakes exceeding the UL (%)	
		Baseline	**Mandatory fortification of breads**
New Zealand*	5-8 years	<1 – <1	1 – 3
	9-13 years	<1 – <1	<1 – <1
	14 years	<1 – <1	<1 – <1
Australia**	4-8 years	0 – 0	<1 – <1
	9-13 years	0 – 0	0 – 0
	14-18 years	0 – 0	0 – 0

Note: In this table, the lower number in the range is the estimated proportion of the population with dietary iodine intakes >UL when discretionary salt is non-iodised; the upper number in the range is the estimated proportion of the population with dietary iodine intakes >UL when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for the mandatory fortification of breads.
* Based on single day, unadjusted assessment.
** Based on second day adjusted assessment.

Table A6.8: Estimated maximum dietary iodine intakes for New Zealand and Australian children aged 5-14 years at *Baseline* and under the mandatory fortification of breads.

Country	Age Group	Estimated Maximum Dietary Iodine Intake (µg/day)	
		Baseline	**Mandatory fortification of breads**
New Zealand*	5-8 years	1,183 – 1,228	1,203 – 1,248
	9-13 years	977 – 1,022	977 – 1,022
	14 years	1,443 – 1,488	1,660 – 1,705
Australia**	4-8 years	256 – 279	335 – 366
	9-13 years	354 – 371	436 – 436
	14-18 years	441 – 496	764 – 818

Note: In this table, the lower number in the range is the maximum dietary iodine intake of the population when discretionary salt is non-iodised; the upper number in the range is the maximum dietary iodine intake of the population group when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and for the mandatory fortification of breads.

* Based on single day, unadjusted assessment.

** Based on second day adjusted assessment.

Attachment 1

Dietary Intake Assessment Report – Methodology

What is dietary modelling?

Dietary modelling is a tool used to estimate dietary exposure to food chemicals, including nutrient intakes, from the diet as part of the FSANZ risk assessment process. To estimate dietary exposure to food chemicals, records of what foods people have eaten are needed along with reports of how much of the food chemical of interest is in each food. The accuracy of these dietary exposure estimates depends on the quality of the data used in the dietary models. Sometimes, all of the data needed are not available or their accuracy is uncertain so assumptions have to be made, either about the foods eaten or about chemical levels, based on previous knowledge and experience. The models are generally set up according to international conventions for food chemical dietary exposure estimates. However, each modelling process requires decisions to be made about how to set the model parameters and what assumptions to make. Different decisions may result in different answers. Therefore, FSANZ documents clearly all such decisions, model assumptions and data limitations to enable the results to be understood in the context of the data available and so that FSANZ risk managers can make informed decisions.

Population groups assessed

Iodine is used in the production of hormones essential in the brain development of the foetus and young child. This is reflected in a substantially elevated requirement for iodine during pregnancy and lactation. Children, especially those up to 3 years of age, are still experiencing substantial brain and nervous system developments. This makes them a particularly vulnerable group to iodine deficiency. Consequently, the primary target groups for iodine fortification were identified as:

1. children aged up to 3 years; and
2. women aged 16-44 years, who were taken to represent the target group of women of child-bearing age when estimating dietary iodine intakes.

All ages within a population were also identified as a target group, therefore, based on National Nutrition Survey (NNS) age groups available for dietary intake assessments, this equates to the Australian population aged 2 years and above and the New Zealand population aged 15 years and above. Consequently, iodine intakes were estimated for these population groups in order for potential public health and safety risks to be assessed.

The dietary intake assessments were conducted separately for both the Australian and New Zealand populations and target sub-population groups.

Dietary modelling approach

The dietary intake assessments discussed in this attachment were conducted using FSANZ's dietary modelling computer program, DIAMOND.

Dietary Intake = nutrient concentration x food consumption amount

Iodine intakes were estimated by combining usual patterns of food consumption, as derived from NNS data, with current concentrations of iodine in food and the proposed levels of use of iodine in salt.

Dietary survey data

DIAMOND contains dietary survey data for both Australia and New Zealand which were used for the dietary intake assessments. The 1995 NNS from Australia surveyed 13,858 people aged 2 years and above, and the 1997 New Zealand NNS surveyed 4,636 people aged 15 years and above.

Both of these surveys used a 24-hour food recall methodology. A second 24-hour recall was also conducted on a subset of respondents in both surveys for a non-consecutive day. Standard methodologies were used to estimate nutrient intake based on consumption data from the first 24 hour recall (day one), which were then adjusted to estimate 'usual intake' by using consumption information from the second 24 hour recall (day two). The second day adjustment nutrient intake methodology is discussed in detail in the section below titled 'Calculating adjusted intakes'.

It is recognised that these survey data have several limitations. These are discussed in the section below titled 'Limitations of the dietary modelling'.

FSANZ does not currently hold food consumption data from the 2002 National Children's Nutrition Survey (CNS) in the correct format to enable dietary iodine intake assessments to be conducted for New Zealand children aged 5-14 years. Therefore, the New Zealand Food Safety Authority (NZFSA) commissioned the University of Otago (LINZ Research group) to undertake a dietary intake assessment for iodine for children aged 5-14 years (Blakey *et al*., 2006; Blakey *et al*., 2007), based on data from the 2002 New Zealand CNS.

Dietary intake assessments for New Zealand children aged 5-14 years were undertaken using the New Zealand 2002 National Children's Nutrition Survey data. Estimated iodine intakes for young children aged 1-3 years were based on food consumption data from a constructed model diet that was used in the analysis of the New Zealand Total Diet Survey (NZ TDS) (Vannoort and Thomson, 2005e). For Australia, dietary iodine intakes were assessed for 1 year old children using a theoretical diet that was based on consumption data for a 2 year old Australian child from the NNS and modified for consumption patterns for infants. See the section of this attachment below titled 'How were the dietary iodine intakes calculated?' for more details on the infant diets.

Additional food consumption data or other relevant data

Discretionary salt consumption data

The iodine fortification of salt is currently voluntary and not all salt available on the retail market is iodised. Salt is currently permitted to contain 25 – 65 mg iodine per kg salt. The consumption of discretionary salt used in cooking and/or at the table is a potentially significant source of iodine where people are consuming iodised salt.

Limited data on the consumption of discretionary salt were available from the 1995 Australian NNS. Data on the consumption of discretionary salt were not available for the

1997 New Zealand NNS. The Australian NNS asked two questions: (1) “How often do you add salt to food during cooking?”; and (2) “How often do you add salt to your food after it is cooked?” (McLennan and Podger, 1998).

Possible responses were: “never/rarely, sometimes or usually”. If respondents answered either “sometimes” or “usually”, they were regarded as being consumers of discretionary salt for the purposes of this assessment.

In response to these questions, it was determined that approximately 62% of Australians aged 2 years and above use discretionary salt. Further details on the proportion of Australian population groups who consume discretionary salt can be found in Table 1.

Table 1: Percentage of Australian population groups who consume discretionary salt, as reported in the 1995 NNS

Australian population group	Proportion of Australian population groups consuming discretionary salt (%)
2-3 years	36
4-8 years	48
9-13 years	55
14-18 years	63
19-29 years	59
30-49 years	60
50-69 years	70
70 years and above	75
Females 16-44 years	56
2 years and above	62

Calculation of discretionary salt amount at Draft Assessment for P230

Since the data from the NNSs did not include extensive quantitative consumption amounts of discretionary salt, at Draft Assessment for P230 an estimate of the amount of salt consumed was derived from grocery market share data for salt. The amount of salt consumed by respondents identified as salt consumers was derived as follows:

$$\text{Consumer salt consumption amount} = \frac{\text{Salt sales (grams/year)}}{\text{365 days/year x number of people consuming salt in the population}}$$

The Australian data were derived from a number of sources (Retail World Pty Ltd, 2001; Flanagan, 2002; Flanagan, 2004; Flanagan, 2005; Flanagan, 2006), and were based on grocery sales of salt over a 12 month period. Using data on the volume of salt sold during a 1 year period, it was determined that, for Australian consumers of discretionary salt, the consumption was 2.7 grams per person per day, based on 62% of the population consuming discretionary salt. This salt consumption figure was then matched to each respondent from the 1995 NNS who reported consuming discretionary salt for the Food Related Questions.

The New Zealand data were based on supermarket sales of salt (iodised and non-iodised) over a 12-month period. The calculation did not include salt sold through other outlets such as Asian supermarkets etc.

Therefore, the consumption of discretionary salt by New Zealanders was likely to be an underestimate. Using these data, it was determined that, across the New Zealand population, 1.0 gram of discretionary salt was consumed per person per day. This salt consumption figure was then matched to every respondent (15 years and above) from the 1997 NNS.

<u>Calculation of discretionary salt amount at Final Assessment for P230</u>

Following comments in submission and during consultations on P230 that the amount of discretionary salt assumed to be consumed per person reporting its use was higher than expected for the Australian population, FSANZ assessed alternative approaches to estimating the amount of discretionary salt used that were based on NNS data and not sales data.

In 1991, Mattes and Donnelly (Mattes and Donnelly, 1991) published information on the relative contributions of dietary <u>sodium</u> sources. These authors found that 77% of sodium intake was from sodium added during processing, 11.6% from sodium found naturally in foods, 6.2% from salt added at the table, and 5.1% from salt added in cooking. Using these data, it was determined that 87% of salt (sodium chloride) was from processed foods and 13% of salt was from discretionary uses.

The Food Safety Authority of Ireland (Food Safety Authority of Ireland, 2005) estimated that 65-70% of dietary sodium intake was from manufactured foods, 15% from sodium found naturally in foods, and 15-20% from discretionary salt. Using these data, it was determined that 76-82% of salt (sodium chloride) was from processed foods and 18-24% of salt was from discretionary uses.

At Final Assessment for P230, the data from the abovementioned studies was used to determine a ratio of sodium that comes from processed foods to discretionary salt. It was determined that overall, around 15% of sodium intakes were from discretionary uses of salt and 70% was from processed foods. It was assumed that this ratio was also the case for both Australians and New Zealanders, assuming 15% of the sodium intake was from natural sources. Therefore, a total of 85% of dietary sodium is from added sources (i.e. 15% from discretionary salt and 70% from processed foods). The proportion of added salt that comes from discretionary salt versus processed foods was then determined. Approximately 82% of salt intake (sodium chloride) was from processed foods and approximately 18% of salt was from discretionary uses (i.e. for discretionary salt, 15% of the 85% added sodium, or 15/85*100).

Total intakes of salt (sodium chloride) were estimated from processed foods using a salt database in DIAMOND. Total salt intakes from processed foods as derived from DIAMOND were then assumed to be 82% of the total salt intake, so a calculation was done to obtain the amount of salt consumed from discretionary uses.

Based on this and using the above mentioned ratio, in general, the new approach predicted discretionary salt use of approximately 1g/day, with some variation around this value for different age/gender groups. This was similar to the amount of discretionary salt used in the intake assessments at DAR for P230 for the New Zealand population, but considerably lower than that used previously for the Australian salt users (2.7 g/day).

The methodology used to determine the quantities of discretionary salt consumed by Australians and New Zealanders is outlined in Figure 1, with the results being shown in Figure 2 and Figure 3 and in Table A1.1 in Appendix 1.

The higher salt intakes estimated for the New Zealand population compared to the Australian population are likely to be due to the higher salt content of bread sold in New Zealand.

Determine proportion of salt intake from: (1) Processed foods; and (2) Discretionary salt

↓ 82% salt from processed foods
18% salt from discretionary sources

Determine mean intake of salt from processed foods for all NRV age groups using DIAMOND

↓

Calculate mean intake of discretionary salt for each NRV age group, based on mean intake of salt from processed foods:

$$\text{Mean intake of discretionary salt} = \frac{\text{Mean intake of salt from processed foods x } 0.18}{0.82}$$

↓

Determine total mean intake of salt from both processed foods and discretionary salt for each NRV age group

Figure 1: Methodology for estimating discretionary salt quantities for Australian and New Zealand population groups

As the calculation of the amount of salt consumed was different for the Australian and New Zealand populations, the data in Figures 2 and 3 need to be interpreted carefully. The salt intakes for New Zealand in Figure 3 are the sum of the salt intakes for discretionary salt and salt from processed foods as given in Figure 2, as discretionary salt intakes were assigned to all NNS respondents for the New Zealand calculations. The salt intake from processed foods from Australia was based on all respondents in the NNS, for which the salt intake from discretionary salt was derived (Figure 2). This amount of discretionary salt was then only added to the records of NNS respondents who reported consuming salt in the NNS (62% respondents). Salt intake distributions for all Australian NNS respondents were then derived from the data set (Figure 3).

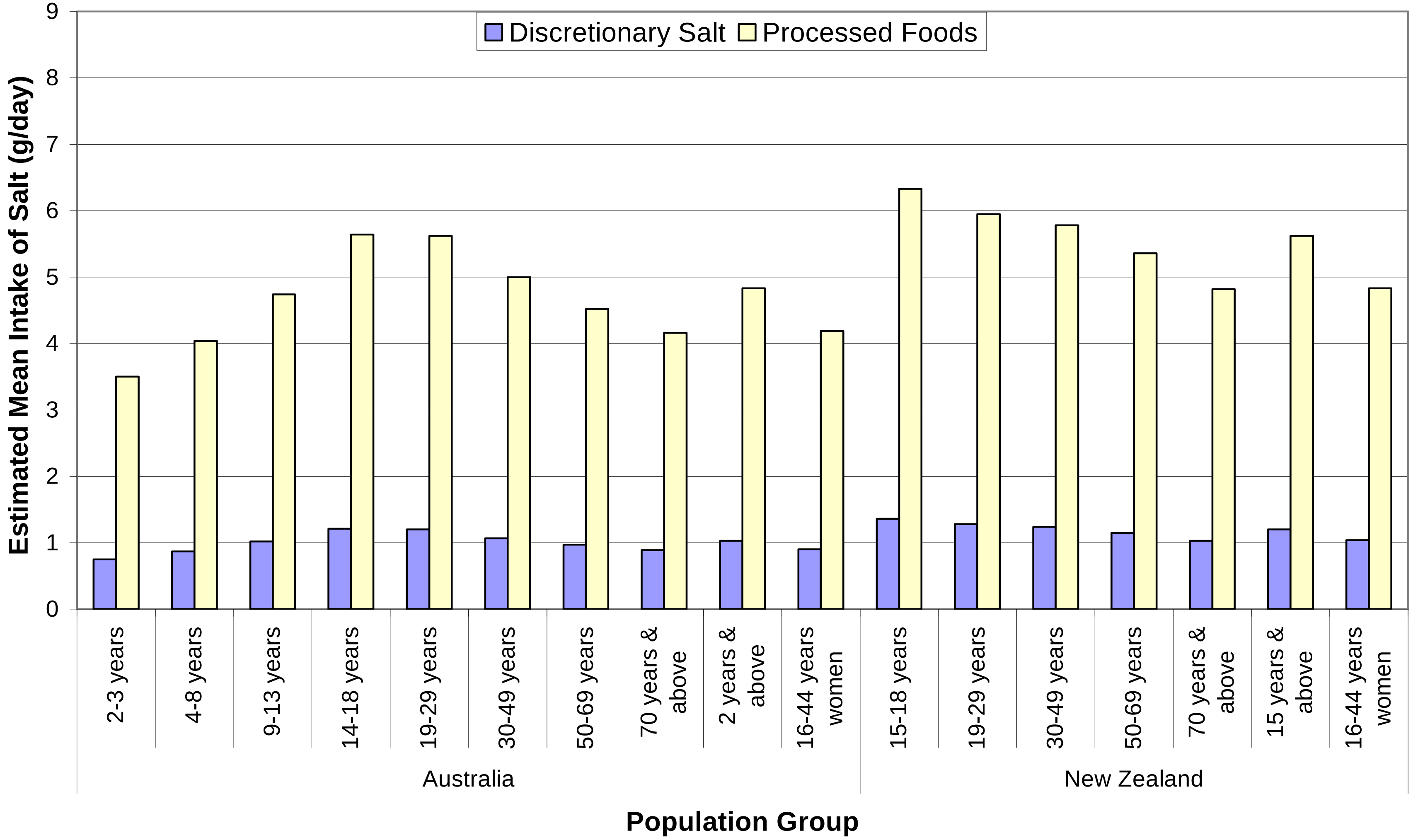

Figure 2: Estimated mean dietary intake of salt (sodium chloride) from processed foods and mean discretionary salt intake for Australian and New Zealand population groups

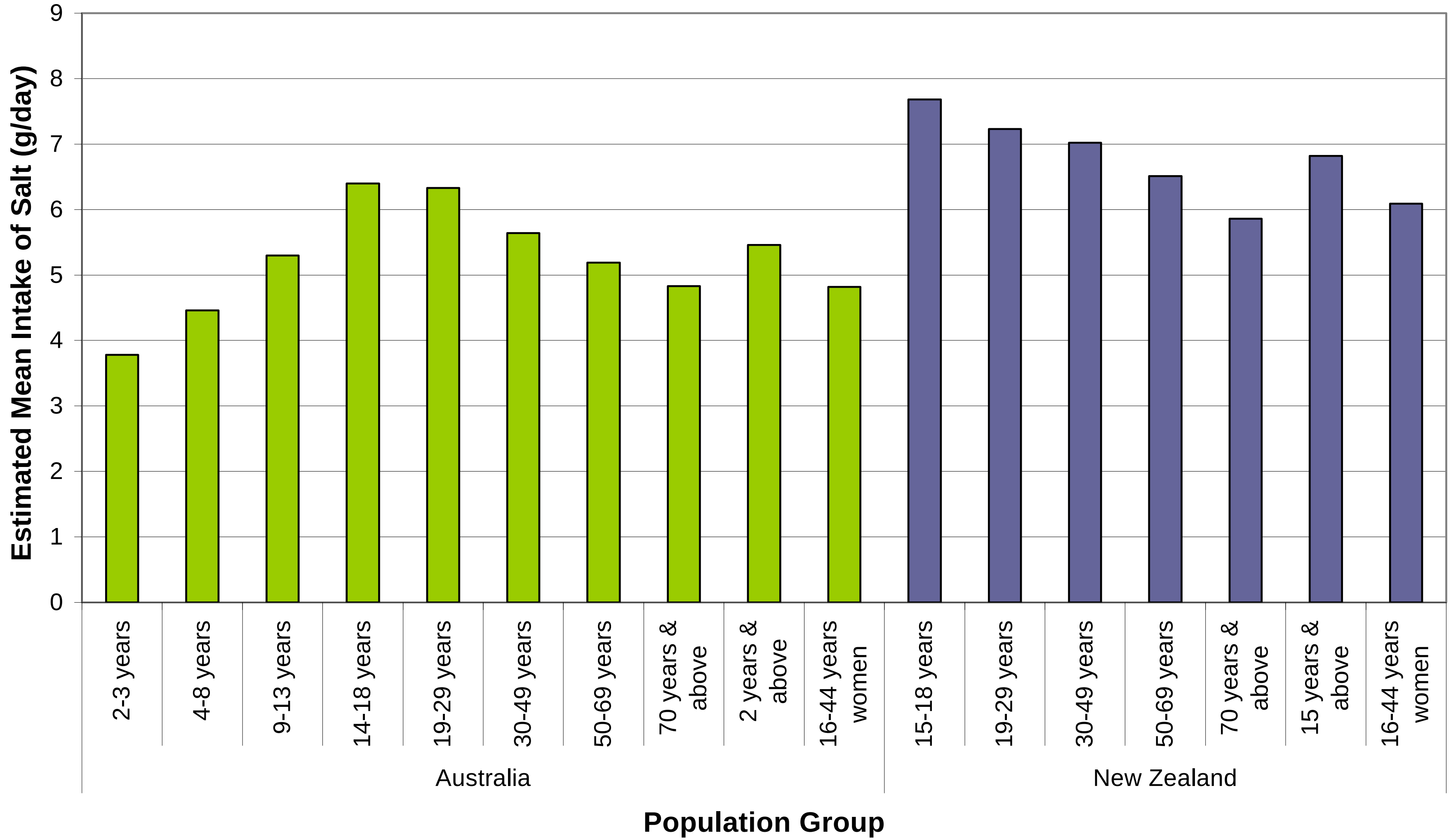

Figure 3: Estimated mean dietary intake of salt (sodium chloride) from all food sources for Australian and New Zealand population groups

Iodine and salt concentration data

Iodine concentration data

Baseline iodine concentrations for foods were derived from four major sources:

1. Total diet studies for Australia and New Zealand (Food Standards Australia New Zealand, 2005; Vannoort and Thomson, 2005c; Vannoort and Thomson, 2005d) provided information on around 90 and 120 foods respectively that are commonly consumed foods. As well as providing information on iodine levels in these foods, the results of the studies also identified major contributing food groups (such as dairy) for which more detailed information on iodine levels was necessary.

2. Analytical data for foods sampled in both countries from around 2000 to 2005. Many of these foods were dairy and seafood. Where the same foods were available in both countries (for example, foods manufactured in one country and sold in both, such as breakfast cereals), the same data were able to be used in the modelling for both countries.

3. Overseas analytical data were used when no relevant Australian or New Zealand data were identified and a food is known to be imported into both countries (for example, canned fish or European cheeses). Data from the UK (Food Standards Agency, 2002) and Denmark (Møller *et al*., 2006) were major information sources.

4. Recipe calculations were used to derive iodine levels in mixed foods (e.g. spaghetti Bolognese) for which analytical data were not available.

Information from these four sources was matched against the 1995 Australian and 1997 New Zealand NNS food codes, assigning an iodine value to virtually all individual food codes.

In 2006 FSANZ commissioned an analytical program (the 'Key Foods Program') aimed at generating up-to-date nutrient data for the major foods consumed by Australian children to support the 2007 National Children's Nutrition and Physical Activity Survey ('Kids Eat Kids Play' Survey). Results for levels of iodine in milk samples collected in winter 2006 for all States and Territories indicate substantially higher iodine levels than found in the 22nd Australian Total Diet Survey, which collected samples in five States and Territories in late 2004. Due to the importance of milk in children's diets and the high contribution that milk makes to total iodine intakes for this group, FSANZ initiated a second round of sampling and analysis of milks in summer 2007 in order to determine if the apparent increase in iodine levels in milk is likely to be ongoing or not and to gain further information on the variability of iodine levels in milk. Results of these most recent samples indicate iodine levels within the range of the two previous sets of data.

FSANZ has had discussions with the dairy industry to try to ascertain possible reasons for the variation in iodine content of milk. It was noted that seasonal variation is one factor. The most notable reason discussed was that due to the drought, dairy cattle feeding practices have changed over the past four years with feeding sources becoming many and varied with feeds even sourced from overseas. Also, due to less feed in paddocks cattle are eating closer to the ground and therefore more soil is consumed, therefore the iodine content of the soil would also have an influence on milk concentration.

One practice that was discounted as having effects on milk iodine concentrations was teat washes containing iodine. These are generally applied post-milking and iodine residues would have decreased before the next milking.

Compilation of the salt database

In order to predict the impact of mandatory iodine fortification of salt used in processed foods, it was necessary to first generate a database of the level of salt in processed foods.

Salt (sodium chloride) is not measured as such in food analysis. Instead, levels of either sodium or chloride can be used to estimate sodium chloride, although neither on its own gives a completely accurate measure of salt content. Both sodium and chloride occur naturally in foods, at varying levels. Sodium may also be present in foods through the use of leavening agents (such as sodium bicarbonate) and other food additives (including sodium metabisulphite, sodium nitrite and sodium ascorbate/erythorbate).

The proportion of salt in foods was estimated based on analytical information from Australian and New Zealand food composition tables and from product labels. The techniques used to estimate salt levels in this dietary intake assessment were as follows:

- Processed foods (all foods manufactured commercially, including cereals and cereal-based foods; meat and meat products; poultry and game products and dishes; milk, milk products and dishes; snack foods; and savoury sauces and condiments) that contained negligible quantities of salt were not included in the salt database because mandatory iodine fortification would not change their iodine content.

- For other processed foods known to contain salt, except breads, the salt content was derived from analysed sodium values, adjusting for natural sources of sodium or additive use where known.

- In the case of Australian breads, chloride levels were available for these foods and were used to estimate salt content as it was assumed there would be no significant sources of added chloride other than salt, whereas sodium may be present not only from natural sources and from salt, but also from the use of sodium-containing additives. These chloride levels were measured in 2005 in white, wholemeal and multigrain breads (two bread samples collected in each of five states). Using this technique, salt contents were estimated at 1.36% in white and wholemeal breads and 1.24% in multigrain bread. These figures were used respectively for all other white, wholemeal and grain breads and rolls.

- For Australian rye breads, where chloride data were not available, salt content was estimated by assuming that 90% of measured sodium was derived from sodium chloride, resulting in an estimated sodium content of 1.21% in light rye bread.

- For New Zealand breads, where data on chloride levels were not available to FSANZ, salt content was estimated by assuming that 90% of measured sodium in a wide range of breads was derived from sodium chloride. Using this technique, salt levels were estimated at between 0.7 and 2.0%.

- For breakfast cereals, salt content was assumed to be 90% of the measured sodium content, except where products were known to be unsalted. Data held in food composition tables for sodium in breakfast cereals were cross-checked against 2006 label data for these products to identify where significant reductions in salt content may have occurred.

Iodine concentrations used in the baseline and fortification scenarios

Baseline model

This model represents current estimated iodine intakes for each population group, assessed in the current regulatory environment (i.e. before approval of any mandatory iodine fortification permissions being given in Australia and New Zealand).

This model only considered where voluntary iodine permissions outlined in Standard 1.3.2 of the Code have been taken up by industry, as evidenced by products available on the supermarket shelves or by analytical data. It did not include foods or food groups where voluntary fortification of iodine is permitted in the Code but has not been taken up by industry. Besides iodised salt, no foods were identified as being iodine fortified. The model took into account naturally occurring iodine in food. It did not take into account iodine intakes from the use of iodine supplements or multi-vitamin supplements containing iodine.

Scenario models

Once the salt database was developed, a second calculation then determined how much iodine in the salt would contribute to the iodine content of the food, depending on the assumptions made for each scenario. The iodine contribution from the salt was then added to the natural *Baseline* iodine concentration of that food.

The resulting iodine concentrations for each food were then used in the dietary intake assessments for each scenario. For example, the *Scenario 1 - Breads, breakfast cereals and biscuits* iodine concentration for white bread was calculated as outlined in Figure 4.

Iodine concentration in bread (non-iodised salt):	1.37 µg/100 g
Proportion of salt in white bread:	1.36%
Concentration of iodine in salt:	30 mg/kg salt

Iodine concentration in white bread (using iodised salt):
1.37 µg I/100 g bread + (0.00136 kg salt/100 g bread x 30,000 µg I/kg salt)
= 1.37 µg I/100 g bread + 40.8 µg I/100 g bread
= 42.2 µg iodine /100 g white bread

Figure 4: Example of method for calculating iodine concentration in salt-containing foods for Scenario 1 – Breads, breakfast cereals and biscuits *for dietary intake assessment purposes*

In addition it was proposed that the level of iodisation in table salt should be assumed to be the same as the mandatory level assumed for salt in the foods that were relevant to the scenario being assessed, for ease of implementation by the food industry were mandatory fortification to be approved.

For example, for *Scenario 1 – Breads, breakfast cereals and biscuits* the impact of using salt iodised at 30 mg iodine per kg salt in the manufacture of breads, breakfast cereals and biscuits and reducing voluntary discretionary salt iodisation to 30 mg iodine per kg salt was assessed. For *Scenario 2 – Breads and breakfast cereals*, equivalent levels were set at 40 mg iodine per kg salt. For *Scenario 3 – Breads*, the iodine concentration in discretionary iodised salt was not reduced from 45 mg iodine per kg salt since the most effective iodine concentration for salt used in the manufacture of breads was determined as being 45 mg iodine per kg salt (the mid-point of the current voluntary fortification range of 25-65 mg iodine per kg salt). For the universal salt iodisation (USI) option, the level of iodisation of all salt was 15 mg iodine per kg salt.

Since *Scenario 1- Breads, breakfast cereals and biscuits* and USI were for comparative purposes against the dietary intake assessments performed for the P230 Draft Assessment, the dietary intake estimates for these scenarios did not take into account potential losses of iodine during production and storage.

However, the two other scenarios investigated for Final Assessment for P230 (*Scenario 2 – Breads and breakfast cereals* and *Scenario 3 – Breads*) took into account a 10% loss in the iodine concentration of the iodised salt present in breads and breakfast cereals on baking/processing. Data derived from the Tasmanian fortification program showed iodine losses of approximately 10% in baked bread. Minimal loss of iodine has also been reported in iodised salt subjected to heating (Bhatnagar, 1997). On the basis of the information available, FSANZ has estimated that an average loss of 10% should be accommodated in the fortification range to account for any expected losses in processing.

Food vehicle

Salt was identified as the food vehicle for iodine fortification of the food supply. In evaluating potential food groups for fortification with iodine via iodised salt, the major contributors to salt intake from processed foods were determined. For the Australian population groups of children aged 2-3 years, women aged 16-44 years and the population aged 2 years and above, the major contributor (≥ 5%) to salt intake from processed foods was cereals and cereal products. Other important contributors included cereal-based products and dishes; meat, poultry and game products and dishes; milk, milk products and dishes; and savoury sauces and condiments. For New Zealand population groups of women aged 16-44 years and the population aged 15 years and above, bread (including rolls and specialty breads) was the major contributor to salt intake from processed foods. Sauces, bread-based dishes, pork, grains and pasta, sausages and processed meats, and pies and pasties were other important contributors to salt intake from processed foods for one or more of the target New Zealand population groups. See Table A1.2a and b of Appendix 1 for further details.

Since cereals and cereal products were the major contributor to salt intake from processed foods for Australia and breads were the major contributor for New Zealand, two broad options for iodine fortification were investigated at Draft Assessment for P230: (1) replacing non-iodised salt with iodised salt in commercially-prepared cereal based foods; and (2) replacing non-iodised salt with iodised salt in processed foods.

Following Draft Assessment for P230 and taking account of comments in submissions and at consultation, it was proposed that the foods to be mandatorily fortified within the cereal and cereal based food group would be restricted to foods that had the potential to make a contribution to iodine intakes, with three options assessed and presented at Final Assessment for P230: breads, breakfast cereals and biscuits; breads and breakfast cereals; and breads only. Breads were major contributors to iodine intakes for all the various fortification scenarios considered at Final Assessment for P230 as were breakfast cereals in scenarios 1 and 2. The USI option presented at Final Assessment for P230 is similar to the P230 Draft Assessment Option (2), except that all discretionary salt is iodised on a mandatory rather than a voluntary basis. The section titled 'Bread consumption patterns' discusses how the bread consumption data derived from the 1995 and 1997 NNSs were compared with more recent data on food consumption patterns to determine if they were valid data to use in the current proposal.

How were the estimated dietary iodine intakes calculated?

For all population groups ***except*** *Australian children aged 1 year and New Zealand children aged 1-3 years*

Iodine intakes were calculated for each individual in the NNSs using their individual food consumption records from the dietary survey. The DIAMOND program multiplies the specified concentration of iodine for an individual food by the amount of the food that an individual consumed in order to estimate the intake of iodine from each food. Once this has been completed for all of the foods specified to contain iodine, the total amount of iodine consumed from all foods is summed for each individual. Adjusted nutrient intakes are first calculated (see below) and population statistics (such as mean intakes) are then derived from the individuals' ranked intakes.

Adjusted nutrient intakes, which better reflect 'usual' daily nutrient intakes, were calculated because NRVs, such as the EAR and UL, are based on usual or long term intakes and it is therefore more appropriate to compare adjusted or 'usual' nutrient intakes with NRVs.

Calculating adjusted intakes

To calculate usual daily nutrient intakes, more than one day of food consumption data is required. Information for a second (non-consecutive) day of food consumption was collected from approximately 10% of Australian NNS respondents and 15% of New Zealand NNS respondents. In order to calculate an estimate of more usual nutrient intakes using both days of food consumption data, an adjustment was made to each respondent's iodine intake based on the first day of food consumption data from the NNS. The adjustment took into account several pieces of data, including each person's day one nutrient intake, the mean nutrient intake from the group on day one, the standard deviation from the day one sample and the between person standard deviation from the day two sample. This calculation is described in Figure 5. For more information on the methodology of adjusting for second day intakes, see the Technical Paper on the National Nutrition Survey: Confidentialised Unit Record File (Australian Bureau of Statistics, 1998).

$$\text{Adjusted value} = x + (x_1 - x) * (S_b/S_{obs})$$

Where: x is the group mean for the Day 1 sample
x_1 is the individual's day 1 intake
S_b is the between person standard deviation; and
S_{obs} is the group standard deviation for the Day 1 sample

Source: (Australian Bureau of Statistics, 1998)

Figure 5: Calculating adjusted nutrient intakes

The age-gender groups used to calculate the second day adjusted iodine intakes were as outlined in Table 2. The age groups used for adjusting nutrient intakes are different to those used for reporting nutrient intakes. This is because there needs to be a certain number of people with a second day of food consumption data to enable a correct adjustment to be made. Reporting however, can be broken down into the age/gender groups as required.

Table 2: Age-gender groups used to calculate second day adjusted iodine intakes

Country	Age Group	Gender	
		Male	Female
Australia	2-13 years	✓	✓
	14-34 years	✓	✓
	35 years and above	✓	✓
New Zealand	15 years and above	✓	✓

Comparison of one day and usual intake distributions

The range of intakes from respondents is broader based on a single day of food consumption data than the range of usual intakes (Figure 6) as the latter removes the variation in day to day intakes within each person and the variation between each person.

Using adjusted intakes provides better information for risk characterisation purposes. Use of adjusted (or usual) nutrient intakes will have little or no impact on estimated mean nutrient intakes, but would result in an estimated 95th percentile intake, for example, that is lower than the 95th percentile intake from a single day only, or a 5th percentile intake that is higher than the 5th percentile intake based on day one intakes only.

FSANZ received estimated iodine intakes for New Zealand children aged 5-14 years from the New Zealand Food Safety Authority (NZFSA) using the 2002 New Zealand Children's Nutrition Survey data for some scenarios at Final Assessment for P230. These estimated intakes were calculated slightly differently from the FSANZ intakes in that they were not adjusted for second day intakes and therefore cannot be directly compared to the Australian data for the same age group. Comparative estimates between New Zealand and Australian children can be found in Attachment 2.

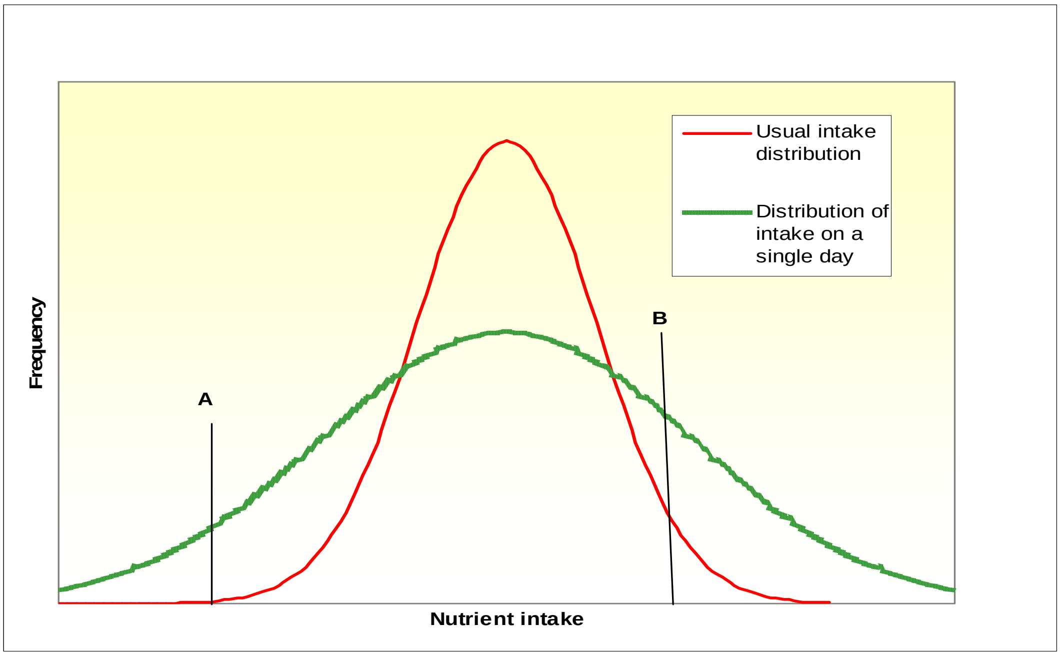

Figure 6: Comparison of one day and usual intake distributions

Comparison of intakes with NRVs

The range of intakes from respondents is broader based on a single day of food consumption data than those derived using two days of food consumption data as the latter removes the variation in the day to day intakes within each person and the variation between each person. Comparison of intakes, based on a single day of food consumption data, with NRVs such as EARs or ULs would therefore result in a different proportion of the population having intakes below or above a specified level (e.g. Figure 6, point A or B). Whether the proportion above or below is under- or overestimated based on a day 1 assessment depends on the NRV being used and where the NRV lies in relation to median of the intake distribution.

Note that where the proportion of each population group is expressed as having inadequate intakes (proportion below the EAR) or exceeding the UL, each individual's total adjusted intake (μg/day) was compared to the EAR or UL for their corresponding age and gender and a percentage was calculated based on the total number of respondents in the population group being assessed.

Assessment of dietary inadequacy

The prevalence of inadequate nutrient intake can best be assessed by applying the Probability Method to the distribution of usual intakes in the population (NRC, 1986). Using this approach involves: (1) determining the probability of inadequacy for each intake level in the group; and (2) calculating the average of those individual probabilities. To use the probability method, the requirement distribution must be known (so the probability of inadequacy associated with each intake level can be determined), and nutrient requirements and intakes must be independent (Health Canada, 2006)[11]. This method essentially compares

[11] A more detailed description of the Probability Approach for calculating nutrient inadequacy can be found here: http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/cchs_guide_escc_a3_e.html

the distribution of intakes for a nutrient with the distribution of requirements to yield an estimate of the proportion of the population that has an inadequate intake.

An alternative method of assessing inadequate intakes in the population is the EAR Cut-Point Method. This method involves simply calculating the proportion of the population with intakes below the EAR. It is a good estimator of the results of the more complex full Probability Method, if certain conditions are met, for the following reasons (Health Canada, 2006):

1. Although the probability of inadequacy exceeds 50% when usual intakes are below the EAR, not everyone with an intake below the EAR fails to meet their own requirement. Some individuals with lower-than-average requirements will have adequate intakes (their usual intake, although below the EAR, exceeds their own requirement).

2. Similarly, although the probability of inadequacy is less than 50% when usual intakes are above the EAR, not everyone with intakes above the EAR meets their own requirement. Some individuals with higher-than-average requirements will have inadequate intakes (their usual intake, although above the EAR, is below their own requirement).

3. When the requirement distribution is symmetrical, when intakes are more variable than requirements, and when intakes and requirements are independent, the proportion of the group described in (1) above cancels out the proportion described in (2) above. The prevalence of inadequacy in the group can thus be approximated by the proportion with usual intakes below the EAR.

The EAR Cut-Point Method has been used to estimate the prevalence of inadequate intakes in the current document.

The Recommended Dietary Intake (RDI) was not used to assess dietary inadequacy because it should not be used to assess intakes of populations (NHMRC, 2006).

The EARs used in this assessment were from the NRVs released in 2006 for Australia and New Zealand (National Health and Medical Research Council 2006).

How were the percent contributors calculated?

Percentage contributions of each food group to total estimated iodine intakes were calculated by summing the intakes for a food group from each individual in the population group who consumed a food from that group and dividing this by the sum of the intakes of all individuals from all food groups containing iodine, and multiplying this by 100. These calculations were done using the day one 24-hour recall data.

Iodine intakes for Australian children aged 1 year and New Zealand children aged 1-3 years

As there were no data available from the 1995 Australian NNS for children aged < 2 years, theoretical diets were constructed to estimate dietary iodine intake for the target group of children aged 1 year. Similarly, as there are no data available from the 1997 New Zealand NNS or 2002 New Zealand children's NNS for children aged < 5 years, theoretical diets were used to estimate dietary iodine intake for the target group of New Zealand children aged 1-3 years.

A number of theoretical diets were used to account for the fact that some young children may consume Formulated Supplementary Foods for Young Children (FSFYC), or 'toddler milks', as a partial alternative to milk. These theoretical diets were considered for young children with and without the consumption of one serve of FSFYC, assuming FSFYC replaced some of the cow's milk consumed. A range of dietary iodine intakes were presented; the lower number in the range represents where no FSFYC were consumed; the upper number in the range represents where 1 serve (226 g) of FSFYC was consumed per day.

Since the theoretical diets were based on mean food consumption amounts only, individual records were not available to derive a distribution of food consumption amounts and hence a distribution of nutrient intakes. The proportion of these population groups with dietary iodine intakes below the EAR or above the UL could therefore not be calculated. As an alternative, the 95th percentile dietary iodine intake was estimated and then compared to the UL, using the internationally accepted formula (WHO, 1985) of:

95th percentile intake = mean intake x 2.5

Discretionary salt (either non-iodised or iodised) was not considered in the iodine intakes for infants aged 1-3 years because low sodium diets are strongly recommended for infants (NHMRC, 2003). This is because at birth, infant kidneys are underdeveloped and do not fully develop until several months later. Therefore excretion of excess sodium in the diet is difficult and may be of a health concern.

<u>Australian children aged 1 year</u>

The theoretical diet for Australian children aged 1 year was based on information on recommended energy intakes, mean body weight and the proportion of milk and solid foods in the diet for a 12 month old child, and data from the 1995 NNS on foods consumed by a 2 year old child.

The recommended energy intake for a twelve-month-old boy (FAO, 2004) at the 50th percentile weight was used as the basis for the theoretical diet. Boys' weights were used because boys tend to be heavier than girls at the same age and therefore have higher energy and food requirements. Between Draft Assessment and Final Assessment for P230, the World Health Organisation (WHO) released its updated child growth standards (WHO, 2007). The body weight of a 50th percentile one year old boy that was used in the calculation of the theoretical diet for 1 year was revised (reduced from 10.2 kg used at Draft Assessment to 9.6 kg at Final Assessment for P230) to reflect the new WHO figures.

It was assumed that 35 per cent of energy intake was derived from milk and 65 per cent from solids (Hitchcock *et al*., 1986). The patterns of consumption of a two-year-old child were taken from the 1995 NNS and the amounts of foods scaled down to determine the solid portion of the 1 year old's diet. Certain foods such as nuts (excluding peanut butter), coffee and alcohol were removed from the diet since nuts can be a choking risk (National Health and Medical Research Council, 2001) and coffee and alcohol are unsuitable foods for infants (ACT Community Care, 2000).

<u>New Zealand children aged 1-3 years</u>
As there were no data available from the 1997 or 2002 New Zealand NNS for children aged < 5 years, a theoretical diet was used to estimate dietary iodine intake for New Zealand children aged 1-3 years. The Simulated Diet for 1-3 year old toddlers that was used in the analysis of the 2003/04 New Zealand Total Diet Survey (NZ TDS) was used to estimate the mean dietary iodine intake in this assessment (Vannoort and Thomson, 2005b). The Simulated Diet was based on a 14-day diet constructed to represent average consumers and was derived from regional studies, rather than national studies of food and nutrient consumption (Vannoort and Thomson, 2005a).

Assumptions used in the dietary modelling

The aim of the dietary intake assessment was to make as realistic an estimate of dietary iodine intake as possible. However, where significant uncertainties in the data existed, conservative assumptions were generally used to ensure that the dietary intake assessment did not underestimate intake.

The assumptions made in the dietary modelling are listed below, broken down into several categories.

Consumer behaviour

- Consumption of foods as recorded in the NNSs represent current food consumption amounts;
- the dietary patterns for females aged 16-44 years are representative of the dietary patterns for pregnant women and for lactating women;
- consumers select products that, on average, contain iodine at the concentrations specified;
- consumers do not alter their food consumption habits upon iodine fortified products becoming more available on the market.;
- since data were not available to allow the identification of respondents in the 1997 New Zealand NNS who consume discretionary salt, it was assumed that all New Zealanders aged 15 years and above consumed discretionary salt;
- Australian children aged 1 year do not consume discretionary salt; and
- New Zealand children aged 1-3 years do not consume discretionary salt.

Concentration Data

- Non-iodised salt has an iodine concentration of zero;
- where there were no Australian iodine concentration data for specific foods, it was assumed that New Zealand data were representative of these food groups, and vice

versa for New Zealand;
- where a food was not included in the intake assessment, it was assumed to contain a zero concentration of iodine;
- there is no contribution to iodine intakes through the use of complementary medicines (Australia) or dietary supplements (New Zealand): and
- for the purpose of determining the amount of discretionary salt consumed by Australians and New Zealanders, all sodium from processed foods is from sodium chloride. This is likely to result in overestimate of the amount of discretionary salt.

Food Vehicles

- Salt was assumed to be used as an ingredient in breads (plain, sweet and savoury), some breakfast cereals (those currently containing salt), sweet biscuits and crackers/savoury biscuits where each of these food groups was included in the various scenarios. All processed foods containing salt were included in the USI scenario.

General

- The additional iodine from mandatory fortification is absorbed into the body at a similar rate to the iodine from the general food supply;
- with the exception of breads and breakfast cereals in Scenarios 2 and 3, there are no reductions in the iodine concentrations in iodised salt from cooking and storage; and
- for the purpose of this assessment, it is assumed that 1 millilitre is equal to 1 gram for all liquid and semi-liquid foods (e.g. orange juice).

Limitations of the dietary modelling

FSANZ always ensures the data and methodologies used for dietary modelling are the most up to date and the best available. FSANZ evaluates all data sets prior to dietary modelling for any project and has been proactive in obtaining and using other data and methodologies where applicable and undertaking validations processes where required. FSANZ notes any limitations associated with the dietary modelling so that the results can be interpreted correctly.

Dietary modelling based on 1995 or 1997 NNS food consumption data provides the best estimate of actual consumption of a food for individuals and the resulting estimated dietary intake of a nutrient for the population. FSANZ has undertaken an assessment of changing food consumption patterns across the diet over time and concluded that 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 1995/1997 (Cook *et al*., 2001a; Cook *et al*., 2001b).

Bread consumption patterns

Potential changes in bread consumption since 1995 and 1997 were important to assess since 'bread' was the selected food vehicle for mandatory fortification as there is potential uncertainty associated with the consumption of foods that may have changed in consumption since 1995/1997, or that have been introduced to the market since 1995/1997.

FSANZ undertook research as part of the folic acid fortification proposal (P295 – Consideration of Mandatory Fortification with Folic Acid) to find more recent food consumption data to validate the NNS data, in particular on the proportion of the population who currently consume bread. It is recognised while the overall amount of bread people consume may not change over time, the type of bread being consumed may have changed. For example, more focaccia may be consumed now than in the 1995 and 1997 NNS. However, despite these changes within the food category, the overall consumption of bread appears to have remained the same. It should be noted that caution is needed when comparing the data from all sources given the different survey methodologies used, differences in the ways that breads were defined between the different surveys, age groups, foods included in the assessments etc.

Broad trends in sales by volume and value of bread and other food categories are tracked by the use of industry publications such as the annual *Retail World's Australasia Grocery Guide*. However these data indicate food sold at a national level only and not food consumed, so are of limited use to estimate changes at an individual level that can then be used to estimate nutrient intake changes.

More recent food consumption data for individual consumers were available from Roy Morgan research (Single Source and Young Australian data) (Roy Morgan, 2006a; Roy Morgan, 2006b) the Australian Dairy Corporation (ADC) (Australian Dairy Corporation, 2003), a Newspoll survey in Australia (George Weston Submission, 2006) and a UMR survey from New Zealand (NZFSA submission, 2006). Summary data derived from the 1995 Australian NNS and 1997 New Zealand NNS have been included below for comparative purposes.

Roy Morgan has produced 'Single Source' data, reporting the proportion of various population groups who consumed particular commodities in the last seven days (weekly consumer) (Roy Morgan, 2006a). The 1995 and 1997 NNS surveys reported consumption in two ways; the proportion of survey participants who consumed particular commodities in the 24-hour recall (daily consumer); and the frequency of consumption during the previous 12 months (weekly consumer data available). Frequency data were available for the population aged 12 years and above and 19 years and above. In many instances, the surveyed commodities were restricted to single varieties only i.e. white bread, toast or rolls rather than total bread intake that combines all varieties.

Additional data on bread consumption were available from Dairy Australia, who commissioned Roy Morgan Research to undertake a food consumption survey via a 7-day self-completed diary. These data outline the proportion of women aged 16-34 years who consume bread.

Australia

Proportion of target population groups consuming bread

Details on the proportion of women who consume bread on a weekly or daily basis in various yearly periods and studies are presented in Table 3.

Table 3: Proportion of Australian women of various age groups who consume bread on a weekly/daily basis

Age (years)	Year	Survey	Sample size	Proportion consuming bread (%)
16-44	1995	NNS (24-hour)[1]	3,178	85
16-44	2001	Roy Morgan[2]	7,088	81
16-44	2006	Roy Morgan[2]	2,881	80
16-34	1995	NNS (24-hour)[1]	2,061	85
16-34	2001	Roy Morgan[2]	3,937	81
16-34	2002-03	Dairy Aust (Roy Morgan)[3]	1,518	79
16-34	2006	Roy Morgan[2]	2,408	74
19+	1995	NNS (FFQ)[4]	8332	68
19+	1995	NNS (FFQ)[5]	8332	70
20+	2001	Roy Morgan[2]	14,156	79
20+	2006	Roy Morgan[2]	6,901	77

[1] fresh and toasted breads and rolls; bagels; croutons; flat bread; pizza base; English muffins, savoury bread and rolls; focaccia; fruit buns; sandwiches; filled rolls and hamburgers; and crumbed products
[2] bread/rolls, toast and bagels
[3] fresh and toast breads and rolls; focaccia; bagels; flat bread; Lebanese bread; crumpets; English muffins; pancakes; and crepes
[4] white bread, toast and rolls
[5] wholemeal/wholegrain bread, toast and rolls

The proportion of women aged 16-44 years who consume bread reduced slightly from 85% in 1995 to 80% in 2006. For women aged 16-34 years, data from Dairy Australia revealed that 97% consumed bread on a weekly basis. This is much higher than results from Roy Morgan for 2001 (81%) and 2006 (79%) as well as the NNS (24-hour) (85%). Based on the food frequency questionnaire (FFQ) component of the NNS, 68% of women aged 19 years and above consumed white bread, toast and rolls and 70% wholemeal/wholegrain bread, toast and rolls on a weekly basis. Data from Roy Morgan for women aged 20 years and above, that combined both white, wholemeal and grain breads and rolls, revealed a consumption of 77% in 2006. It is difficult to compare these data since the NNS FFQ investigated consumption of white breads and wholemeal breads separately.

Amount of bread consumed by target population groups

Additional and more recent data on bread consumption was available from Dairy Australia via Roy Morgan Research. These data outline the amount of bread consumed by women aged 16-34 years. Data were collected via a 7-day self-completed diary.

Details of the amount of bread consumed by women of various age groups in various yearly periods and studies are presented in Table 4.

Table 4: Amount of bread consumed by Australian women of various age groups

Age (years)	Year	Survey	Sample size	Consumer mean intake	
				Grams/ week	Slices/day*
16-34	1995	NNS (24-hour)[1]	2,061	896	4.3
16-34	2002-2003	Dairy Aust (Roy Morgan)[2]	180	933	4.4
16-44	1995	NNS (24-hour)[1]	1,509	861	4.1

[1] fresh and toasted breads and rolls; bagels; croutons; flat bread; pizza base; English muffins, savoury bread and rolls; focaccia; fruit buns; sandwiches; filled rolls and hamburgers; and crumbed products
[2] fresh and toast breads and rolls; focaccia; bagels; flat bread; Lebanese bread; crumpets; English muffins; pancakes; and crepes
* 1 slice was assumed to be 30 grams

As data from the NNS was for one day only, these figures may not be reflective of longer term consumption. However, as bread is a commonly consumed food by the Australian population, the daily consumption over a longer period of time would not be expected to be significantly lower. The mean number of slices of bread consumed per day remained fairly constant from 1995 to 2003 (4.3 slices versus 4.4).

New Zealand

Proportion of target population groups consuming bread
Details on the proportion of women aged 16-44 years who consumed bread on a weekly or daily basis in various yearly periods and studies are presented in Table 5.

Table 5: Proportion of New Zealand women aged 16-44 years who consumed bread on a weekly/daily basis

Age (years)	Year	Survey	Sample size	Proportion consuming bread (%)
16-44	1995	NNS (24-hour)[1]	1,509	83
	2001	Roy Morgan[2]	3,614	85
	2006	Roy Morgan[2]	1,606	85

[1] fresh and toasted bread and rolls; pita bread; bagels; croutons; pizza base; savoury bread and rolls; English muffins; fruit bread; cream buns; sandwiches; burgers; filled rolls; and filled croissants
[2] bread/rolls, toast and bagels

The proportion of New Zealand women aged 16-44 years who consume bread remained steady at around 85% between 1995 and 2006. It is important to note that the NNS (24-hour) and Roy Morgan data measure the proportion of the 16-44 year old women consuming different types of breads (as described in the footnotes to the Table 5) and the data were collected for differing time periods (24-hour versus weekly consumption).

Amount of bread consumed by target population groups
The data from the FFQ component of the NNS assessed bread consumption in terms of number of slices per week and therefore cannot be compared to the Roy Morgan data.

Summary

It is difficult to directly compare the data from all sources given the different survey methodologies used, age groups included, foods included in the assessments etc. It is expected that reported levels for the proportion of the population consuming breads from a 7 day survey would be higher than that for a survey reporting a single day's consumption, as it is more likely that the consumers who do not eat bread every day will be picked up in a seven day study.

Generally, the assessment shows that the consumption data for breads, as recorded in the 1995 and 1997 NNSs, are still relevant for Australia and New Zealand, particularly for the target population group.

Changes in consumption patterns for non-fortified foods

Concern was expressed in submissions to the Draft Assessment for P230 or at consultations that the relative contribution of seafood and other foods to iodine intakes may have changed since 1995/97 due to changed food consumption patterns e.g. increase in seafood and sushi consumption, foods which can have a relatively high iodine content. Seafood was not the highest contributor to iodine intakes at baseline and there were records of sushi consumption in both the 1995 and 1997 NNSs. As seafood and sushi are likely to be occasionally consumed foods for most people in the population, an increase in consumption of these foods may not have a large impact on estimated baseline iodine intakes at a population level. Such changes in consumption patterns of non-fortified foods would however be assessed as part of an ongoing iodine monitoring program that in the future is expected to have access to more up to date information on food consumption patterns, such as that from the 2007 Australian children's NNS and the planned 2008 New Zealand adults NNS.

Other limitations

Over time, there may be changes to the ways in which manufacturers and retailers make and present foods for sale. Since the data were collected for the Australian and New Zealand NNSs, there have been significant changes to the Food Standards Code to allow more innovation in the food industry. As a consequence, a limitation of the dietary modelling is that some of the foods that are currently available in the food supply were either not available or were not as commonly available in 1995/1997. Additionally, since the data were collected for the NNSs, there has been an increase in the range of products that are fortified with nutrients. FSANZ does update the food composition database through analytical programs, and scans of the market place. However, with the market place continually changing it is difficult to account for all fortified products at a given point in time.

There are a number of limitations associated with the iodine concentration data. Analytical values used may not fully reflect actual levels due to variation in iodine concentrations in foods due to seasonal and geographic location. For scenario concentrations, a major limitation relates to the assumptions about the proportion of salt used in the manufacture of different foods (e.g. in different brands of breads).

A limitation of estimating dietary intake over a period time using information from a recall method is that people may over- or under-report food consumption, particularly for certain types of foods.

Over- and under-reporting of food consumption has not been accounted for in this dietary intake assessment. However, adjusting intakes based on two days of food consumption data accounts for some variation both within individuals and between individuals.

Since the 1995 Australian NNS does not report on respondents aged below 2 years, the 1997 New Zealand NNS does not report on respondent aged below 15 years and the 2002 New Zealand National Children's Nutrition Survey (CNS) does not report on respondents aged below 5 years, theoretical diets were used to estimate dietary iodine intakes for children in the target group of up to 3 years. Theoretical diets for Australian children aged 1 year and New Zealand children aged 1-3 years were used in this assessment. Mean food consumption amounts in the theoretical dies are used to represent food consumption patterns for an age group as a whole and may not be as accurate as the data derived for other population groups from the NNSs that use food consumption data of individuals. FSANZ received estimated iodine intakes for New Zealand children aged 5-14 years from NZFSA using the 2002 New Zealand Children's Nutrition Survey data. The estimated intakes were calculated slightly differently from the FSANZ intakes for other population groups, however, the submitted estimates provide an indication of the impact that the introduction of mandatory fortification of salt used in the manufacture of breads with iodine might have.

Although some data on the use of complementary medicines (Australia) or dietary supplements (New Zealand) were collected in the NNSs, data were either not in a robust enough format to include in DIAMOND or have simply not been included in the DIAMOND program to date. Consequently, intakes of substances consumed via complementary medicines or dietary supplements could not be included directly in the dietary intake assessment conducted using DIAMOND.

While the results of national nutrition surveys can be used to describe the usual intake of groups of people, they cannot be used to describe the usual intake of an individual (Rutishauser, 2000). In addition, they cannot be used to predict how consumers will change their eating patterns as a result of an external influence such as the availability of a new type of food.

FSANZ does not apply statistical population weights to each individual in the NNSs which make the data representative of the actual population as a whole. Maori and Pacific peoples were over-sampled in the 1997 New Zealand NNS so that statistically valid assessments could be made for these population groups. As a result, there may be bias towards these population groups in the dietary intake assessment because population weights were not used.

The NNS food consumption data were not 'updated' for dietary modelling as it is not possible to modify the actual NNS data for use in DIAMOND. FSANZ did a lot of investigation to assess current bread consumption patterns. This was compared to the NNS data and it was determined that consumption patterns had not changed significantly and that dietary modelling based on NNS data would still provide robust results to enable reliable risk management decisions to be made.

Iodine intakes were calculated for each individual in the NNSs using their individual food consumption records from the dietary survey. The amount of bread reported as being consumed by each individual was used in the calculation of dietary iodine intakes. Average bread consumption amounts were not used.

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Appendix 1

Information on risk assessment

Table A1.1: Estimated mean dietary intake of salt (sodium chloride) from processed foods and mean discretionary salt intake for Australian and New Zealand population groups

Country	Population Group	Estimated Mean Salt Intakes from Processed Foods (g/day)	Estimated Mean Discretionary Salt Intake (g/day)	Estimated Total Mean Intake of Salt (g/day)
Australia	2-3 yrs	3.50	0.75	3.78
	4-8 yrs	4.04	0.87	4.46
	9-13 yrs	4.74	1.02	5.30
	14-18 yrs	5.64	1.21	6.40
	19-29 yrs	5.62	1.20	6.33
	30-49 yrs	5.00	1.07	5.64
	50-69 yrs	4.52	0.97	5.19
	70 years & above	4.16	0.89	4.83
	2 yrs & above	4.83	1.03	5.46
	16-44 yr women	4.19	0.90	4.82
New Zealand	15-18 yrs	6.33	1.36	7.68
	19-29 yrs	5.95	1.28	7.23
	30-49 yrs	5.78	1.24	7.02
	50-69 yrs	5.36	1.15	6.51
	70 years & above	4.82	1.03	5.86
	15 yrs & above	5.62	1.20	6.82
	16-44 yr women	4.83	1.04	6.09

Table A1.2: Contribution of foods to salt intakes from processed foods at *Baseline* for Australian and New Zealand target population groups

a. Australia

Food Category	% Contribution to Salt Intake From Processed foods		
	2-3 yrs	16-44 yrs	2 years & above
	All	Female	All
Cereals and cereal products[1]	35	31	32
Cereal-based products and dishes[2]	17	18	17
Meat, poultry and game products and dishes[3]	17	18	21
Milk products and dishes[4]	8	6	5
Savoury sauces and condiments[5]	5	9	8
All other foods	18	18	17

Note:

1. **Cereals and cereal products** includes grains, cereal flours and starch powders, breads and rolls, breakfast cereals, English-style muffins, crumpets, tortillas, pastas, noodles and rice.
2. **Cereal-based products and dishes** includes biscuits (sweet and savoury), cakes, buns, muffins (cake style), scones, slices, 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, pancakes, crepes, pikelets and doughnuts.
3. **Meat, poultry and game products and dishes** includes plain beef, lamb, pork, veal, poultry, game meats, offal, ham, bacon, sausages, frankfurts, processed meats, and mixed dishes made from these meats.
4. **Milk products and dishes** includes milks (plain and flavoured), evaporated milk, condensed milk, milk powders, yoghurts (plain, flavoured and fruit), creams, cheeses, ice creams and ice confections (dairy and soy-based), frozen yoghurts, custards and other dairy-based desserts and soy-based beverages.
5. **Savoury sauces and condiments** includes gravies, savoury sauces (including dry mixes, simmer sauces, pasta sauces etc.), pickles, chutneys, relishes, salad dressings, mayonnaises, and stuffings.

b. New Zealand

Food Category	% Contribution to Salt Intake From Processed foods	
	16-44 yrs	15 years & above
	Female	All
Bread (includes rolls and speciality breads)	33	33
Sauces	9	8
Bread based dishes[1]	6	6
Pork[2]	<5	6
Grains and Pasta[3]	6	<5
Sausages and processed meats	5	6
Pies and pasties	5	5
All other foods	35	35

Note:

1. **Bread based dishes** includes pizzas, sandwiches, filled rolls and hamburgers, taco and tortilla-based dishes, dim sims, spring rolls, wontons and stuffings
2. **Pork** includes plain pork, pork stir-fries, stews and casseroles, ham and bacon.
3. **Grains and pasta** includes plain cooked rice, pasta, and noodles, filled pastas, savoury rice-based dishes, pasta-based dishes (e.g. lasagne, macaroni cheese), instant noodles, noodle-based dishes (e.g. chow mein), flours, bran and germ

Table A1.3: Proportion of Australian and New Zealand population groups who consume breads, breakfast cereals and biscuits

Country	Population Group	Number of Respondents	Proportion of Respondents Consuming (%)				
			Breads	Breakfast cereals	Biscuits	Breads and/ or breakfast cereals	Breads and/ or, breakfast cereals and/ or biscuits
Australia	2-3 years	383	88	67	51	97	99
	Females 16-44 yrs	3,178	85	33	36	91	94
	2 years and above	13,858	88	44	41	93	96
New Zealand	Females 16-44 yrs	1,509	83	29	37	88	92
	15 years and above	4,636	87	36	40	91	94

Notes:

1. It was assumed, for the purpose of calculating the 'percentage of respondents consuming', that all breads, biscuits and breakfast cereals contain salt and are commercially prepared;
2. Cooked oats and unprocessed brans were excluded; and
3. A NNS respondent is counted as a consumer if they consumed at least one of the foods listed above or a mixed food that contains a food listed above, irrespective of the amount of the food eaten (e.g. if a person ate a chocolate crackle that contains breakfast cereal, they are counted as a consumer of breakfast cereal).

Attachment 2

Dietary Intake Assessment Report – Summary of Fortification Scenarios Considered

SUMMARY

Dietary intake assessments were conducted for various scenarios in order to assess the potential impact the introduction of mandatory fortification of food with iodine (via iodised salt) in New Zealand and Australia would have on iodine intakes among the target groups of children aged up to 3 years, women of child-bearing age (assumed to be 16-44 years) and the population in general (New Zealand – 15 years and above; Australia – 2 years and above). The aim was to determine a level of fortification that maximised iodine intakes for the target groups while minimising the estimated proportion of the population with inadequate dietary iodine intakes and dietary iodine intakes above the Upper Level of Intake (UL). Numerous scenarios were assessed at Final Assessment for P230, each producing similar outcomes to those scenarios presented at Draft Assessment for P230.

National Nutrition Survey (NNS) food consumption data were used for the intake assessments. Dietary intake assessments undertaken by the New Zealand Food Safety Authority (NZFSA) and the LINZ Research group at the University of Otago using the New Zealand 2002 National Children's Nutrition Survey data (children 5-14 years) were conducted. Where relevant, these were compared with similar dietary intake assessments conducted by FSANZ. Estimated iodine intakes for young children aged 1-3 years were based on food consumption data from a constructed 'theoretical diet'.

At Draft assessment for P230, three scenarios were presented:

1. ***Baseline*** to estimate current iodine intakes from food alone, based on current naturally occurring iodine concentrations in foods and iodine concentrations in foods resulting from permitted uses of iodine in the Code. The consumption of discretionary salt (salt used in cooking and at the table) was also considered. The iodine concentration in iodised discretionary salt was assumed to be 45 milligrams (mg) iodine per kg salt for dietary intake assessment purposes and was based on industry-supplied data, noting that it is also the midpoint of the range of currently permitted iodine fortification of salt (25 – 65 mg iodine per kg salt).

2. ***P230 DAR – Cereal based foods*** – non-iodised salt was replaced with iodised salt containing 30 mg iodine per kg of salt in cereal-based foods. The voluntary permission for iodine fortification of discretionary salt was reduced from 25-65 mg iodine per kg salt to 20 mg iodine per kg salt.

3. ***P230 DAR – Processed foods*** – non-iodised salt was replaced with iodised salt containing 15 mg iodine per kg of salt in processed foods. The permission for iodine fortification of discretionary salt remained voluntary and was reduced from 25-65 mg iodine per kg salt to 20 mg iodine per kg salt.

Between the Draft and Final Assessment reports, following consultation and consideration of submissions for P230, a number of changes were made to the dietary intake assessments for both New Zealand and Australia. These changes were:

1. **Revision of the amount of discretionary salt** assumed to be consumed by New Zealand and Australian population groups.
2. **Inclusion of information on the proportion of discretionary salt that is iodised** in New Zealand and Australia, which was then incorporated in dietary intake assessments for a 'market weighted assessment.
3. **Change in the focus of the assessments** from:

    a. all cereal based foods to three scenarios with different cereal based foods (breads, breakfast cereals and biscuits; breads and breakfast cereals; breads only); and
    b. all processed foods to universal salt iodisation (i.e. a mandatory fortification permission for iodised table salt).

This resulted in the following four scenarios being considered and presented at Final Assessment for P230 and compared to the established baseline (see Figure 1):

1. **Scenario 1 –** ***Breads, breakfast cereals and biscuits*** – non-iodised salt was replaced with iodised salt containing 30 mg iodine per kg of salt in breads, breakfast cereals and biscuits. The voluntary permission for iodine fortification of discretionary salt was reduced from 25-65 mg iodine/kg salt to 30 mg iodine/kg salt.

2. **Scenario 2 –** ***Breads and breakfast cereals*** – non-iodised salt was replaced with iodised salt containing 40 mg iodine per kg of salt in breads and breakfast cereals, with 35 mg iodine per kg salt remaining in the salt of fortified breads and breakfast cereals after baking/processing. The voluntary permission for iodine fortification of discretionary salt was reduced from 25-65 mg iodine per kg salt to 40 mg iodine per kg salt.

3. **Scenario 3 –** ***Breads*** – non-iodised salt was replaced with iodised salt containing 45 mg iodine per kg of salt in breads, with 40 mg of iodine per kg of salt remaining in the salt of iodine-fortified bread after baking. The iodine concentration in iodised discretionary salt was assumed to be 45 mg iodine per kg salt for dietary intake assessment purposes and was based on industry-supplied data, noting that it is also the midpoint of the range of currently permitted iodine fortification of salt (25 – 65 mg iodine per kg salt).

4. ***Universal salt iodisation*** – non-iodised salt was replaced with iodised salt containing 15 mg iodine per kg of salt in processed foods. The voluntary permission for iodine fortification of discretionary salt was made mandatory and was reduced from 25-65 mg iodine per kg salt to 15 mg iodine per kg salt.

In addition, food consumption patterns were assessed for groups in both countries with low and high intakes of iodine with the aim of identifying other food vehicles preferentially consumed by people with low iodine intakes that could potentially more effectively target the appropriate population groups.

Through submissions, two alternative fortification options were proposed and their potential impact on iodine intakes considered:

1. **A restricted breads only mandatory fortification scheme** where heavy grain breads are excluded from mandatory fortification.

2. **A voluntary fortification scheme**, as proposed by the food industry, where food manufacturers would sign on to a 'Memorandum of Understanding (MOU)' to fortify certain brands of breads, breakfast cereals and biscuits foods with iodine (**MOU *Scenario – Market weighted***). This scenario assumed that non-iodised salt would be replaced with iodised salt containing 45 mg iodine per kg of salt in approximately 30% of breads, 15% of breakfast cereals and 15% of biscuits on a voluntary basis. Assuming that there would be a 10% loss of iodine from the salt during baking/ cooking/ extruding, iodised salt was deemed to contain 40 mg iodine per kg salt for dietary intake assessment purposes. A market weighted intake estimate represented the likely impact of a voluntary iodine fortification scheme across the population over a period of time. The use of discretionary iodised salt was not considered for this assessment.

Although some data on the use of dietary supplements (New Zealand) or complementary medicines (Australia) were collected in the NNSs, data were either not in a robust enough format to include in DIAMOND or have simply not been included in the DIAMOND program to date. Therefore the dietary intake assessments did not take into account iodine from the use of iodine supplements or multi-vitamin supplements containing iodine.

Additionally, potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. Any changes would however be captured in the future in ongoing monitoring programs.

A complete set of information for the above scenarios has been provided to allow Ministers to determine the most appropriate iodine fortification approach.

The results of the dietary intake assessments undertaken at Final Assessment for P230 indicated:

Comparison with P230 Draft Assessment scenarios

- In general, estimated mean iodine intakes and the proportions of target populations with inadequate dietary iodine intakes and intakes above the UL were similar for all mandatory fortification scenarios considered at Draft Assessment and at Final Assessment for P230. This was expected as the level of salt iodisation assumed to be mandatory in each scenario had been adjusted to obtain a similar public health and safety outcome in relation to these parameters.

Estimated dietary iodine intakes at Final Assessment for P230

- Estimated mean dietary iodine intakes increased from *Baseline* under the mandatory fortification options assessed.
- New Zealand has lower *Baseline* iodine intakes than Australia, possibly due to the lower iodine concentration in milk. Milk is a major contributor to iodine intakes.
- When discretionary iodised salt consumption is considered, New Zealand women of child-bearing age have a larger incremental increase in iodine intakes for *Scenario 3 – Breads* in comparison to the same population group for Australia.

This is potentially due to the higher intakes of salt from mandatorily fortified bread by New Zealand population groups in comparison to Australians due to a higher salt content in New Zealand breads.

- When discretionary iodised salt consumption is considered, Australian population groups showed a larger incremental increase in mean dietary iodine intakes for *Universal salt iodisation* in comparison to New Zealanders. This may be due to the lower proportion of discretionary salt that is iodised at *Baseline* for Australia.

- For New Zealand children aged 1-3 years, the increase in mean dietary iodine intakes from *Baseline* was highest for *Scenario 1 – Breads, breakfast cereals & biscuits* (90-115 µg/day) and lowest for *Scenario 3– Breads* (77-102 µg/day), as assessed using a theoretical diet.

- For Australian children aged 1 year, the increase in mean dietary iodine intakes from *Baseline* was similar for all mandatory fortification scenarios considered at Draft and Final Assessments for P230, as assessed using a theoretical diet.

- The population reach for *Scenario 2 – Breads and breakfast cereals* is better than for *Scenario 3 – Breads* (i.e. higher proportion of people consuming fortified foods), therefore this is a viable option for the future, but for technical reasons is not possible for industry to implement at the current time (see Figure 3 in this attachment).

- The alternative mandatory fortification option (all breads minus heavy grain breads) did not result in as high a proportion of the target population group consuming mandatorily fortified foods in comparison to 'all Breads, albeit by a small percentage.

- The exclusion of heavy grain breads from mandatory fortification would make the alternative mandatory fortification option inconsistent with the 'Dietary Guidelines for Australian Adults', in particular '1.2 – Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain' and reduces the proportion of the target population groups consuming fortified breads. The consumption of heavy grain breads increases with age (mostly for females), and older Australians have a higher proportion of their population groups with inadequate dietary iodine intakes.

- Estimated mean dietary iodine intakes increased minimally from *Baseline* for the industry proposed voluntary fortification scheme in comparison to the mandatory fortification scenarios.

Food Consumption Patterns

- There does not appear to be a single food or food group that is consumed preferentially and by a significant proportion of women of child bearing age, children aged 2-3 years or the population as whole, in the low iodine intake group that could be fortified to more effectively target these groups.

Comparison of estimated iodine intakes with reference health values in risk characterisation indicates that:

- When discretionary iodised salt consumption is considered, the *Universal salt iodisation* scenario produced a higher mean dietary iodine intake and lower proportion of respondents with inadequate dietary iodine intakes but a higher proportion of respondents with intakes above the UL in comparison to *Scenario 3 – Breads* for Australian population groups. For New Zealand, the reverse was true, whereby *Scenario 3 – Breads* produced a higher mean dietary iodine intake and lower proportion of respondents with inadequate dietary iodine intakes but a higher proportion of respondents with intakes above the UL in comparison to *Universal salt iodisation*.

- For New Zealanders aged 15 years and above and all Australian population sub-groups aged 4 years and above, less than 1% of respondents had dietary iodine intakes above the UL for *Scenario 3 – Breads* and *Universal Salt Iodisation*.

- For Australian children aged 2-3 years, 6% of the population group had intakes above the UL for *Scenario 3 – Breads* and 11% for *Universal Salt Iodisation*.

- Of all of the population groups assessed, women aged 16-44 years had the highest proportions of the population group with inadequate dietary iodine intakes, particularly when intakes were compared with the Estimated Average Requirements (EARs) for pregnancy and lactation.

- For New Zealand high consumers of iodine (95^{th} percentile) aged 1-3 years, *Baseline* iodine intakes were estimated at 60-90% of the UL. Under the mandatory fortification scenarios, this rose slightly to approximately 95-140% of the UL.

- For Australian high consumers of iodine (95^{th} percentile) aged 1 year, *Baseline* iodine intakes were estimated at 100-120% of the UL. Under the mandatory fortification scenarios, this rose slightly to 120-130% of the UL.

Dietary iodine intakes derived using New Zealand 2002 Children's Nutrition Survey data

- The scenarios investigated between the P230 DAR and FAR were *Baseline*, *Processed foods*, *Cereal based foods* and *Breads*.

- The highest mean iodine intakes (where discretionary salt was not included) were for the *Cereal based foods* scenario, however the *Processed foods* scenario had only slight lower results, and the *Breads* scenario had the lowest mean intakes.

- The scenario that resulted in the highest proportion with inadequate dietary intakes when discretionary salt was not included was the *Breads* scenario, followed by the *Cereal based foods* scenario and *Processed foods* which were similar. When discretionary iodised salt was included, the proportion with inadequate intakes for all scenarios was lower.

- When discretionary salt was not included, the *Cereal based foods* scenario and the *Processed foods* scenario had similar proportions of the population exceeding the UL (<1 to 2%), which were higher than for the *Breads* scenario (<1 to 1%). When discretionary iodised salt was included, the proportion exceeding the UL was slightly higher for all scenarios (<1 to 3).

- The results for New Zealand children 5-14 years were not second day adjusted, therefore the estimated proportions of each population group with inadequate intakes or the proportion exceeding the UL would be slightly different were a second day adjustment made.

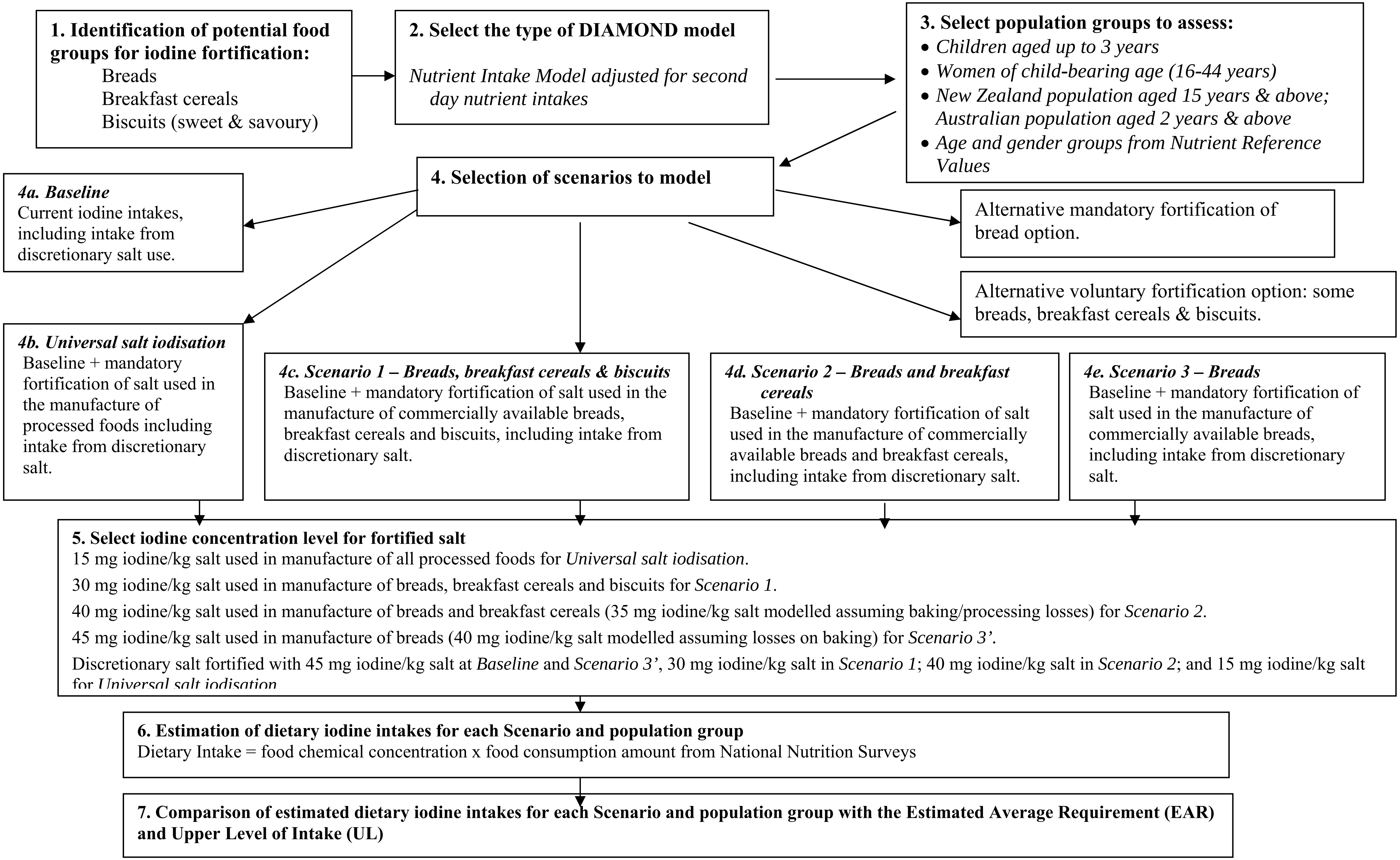

Figure 1: Dietary intake assessment approach used for assessing iodine intakes for New Zealand and Australia

Dietary intake assessment approach

The intake assessments were conducted for the target groups of children aged up to 3 years, women of child-bearing age (assumed to be 16-44 years) and the population in general (New Zealand – 15 years and above; Australia – 2 years and above).

The methodology used to assess dietary iodine intakes, the population groups assessed and the limitations and assumptions used in the assessments are discussed in Attachment 1.

Scenario models

For the current (*Baseline*) and mandatory fortification scenarios (scenarios 1-3) modelled for the purpose of this Proposal, two different model types were assessed:

a) Market share model; and
b) Consumer behaviour model.

A summary of the scenarios and model types conducted for the P230 Final Assessment can be found in Table 1. The market share and consumer behaviour model types are discussed in detail in the main dietary intake assessment report.

Table 1: Summary of scenarios examined for the P230 Final Assessment

	Scenario Name	Market Share Model	Consumer Behaviour Model	
			Always chooses non-iodised discretionary salt	Chooses iodised discretionary salt
Current situation	*Baseline*	✓	✓	✓
Mandatory fortification	*Scenario 1 – Breads, breakfast cereals and biscuits*	-	✓	-
	Scenario 2 – Breads and breakfast cereals	✓	✓	✓
	Scenario 3 – Breads	✓	✓	✓
	*Universal salt iodisation **	✓	NA	NA
	'Alternative – Breads minus heavy grain Breads	-	-	-
Voluntary fortification	MOU *Scenario – Market weighted*	✓ (discretionary salt not included)	NA	NA

* Each of the models types (i.e. market share and consumer behaviour) produces the same dietary iodine intakes since mandating salt iodisation under *Universal salt iodisation* means that there is no choice but to have iodised discretionary salt.
NA = Not Applicable

Baseline

The *Baseline* represents current estimated iodine intakes for each population group assessed for the current regulatory environment (i.e. with no mandatory iodine fortification permissions in New Zealand and Australia). This scenario only considered where voluntary iodine permissions outlined in Standard 1.3.2 of the Code have been taken up by the food industry, as evidenced by products available on the supermarket shelves or by analytical data; the only food voluntarily fortified with iodine was discretionary salt. *Baseline* took into account naturally occurring iodine in food but did not take into account iodine intakes from the use of iodine supplements or multi-vitamin supplements containing iodine.

Scenarios

For each of the scenarios it was assumed that the intake assessment included *Baseline* iodine concentrations for all foods other than those specified to be fortified in each particular scenario, e.g. salt-containing breads and breakfast cereals for scenario 2 and discretionary salt. As for *Baseline*, the dietary intake assessments did not take into account iodine intakes from the use of iodine supplements or multi-vitamin supplements containing iodine.

The level of iodisation of salt in the food vehicle specified in each scenario considered was assumed to be the same as that for discretionary salt, following comments in submissions that it would be easier for the industry to have one level of iodisation for all uses of salt. In cases where the food was subsequently baked or otherwise processed, a 10% loss of iodine was assumed in the final product (Scenarios 2 and 3 only).

Each of the scenarios considered at Final Assessment for P230 are discussed in more detail in the Dietary Intake Assessment – Main Report for *Baseline* and *Scenario 3 – Breads* and Attachment 3 for *Baseline* and *Scenario 2 – Breads and breakfast cereals*. Attachment 4 discusses the *Universal salt iodisation* scenario and Attachment 5 discusses the alternative mandatory approach for breads and the industry proposed voluntary fortification approach, noting that the alternative mandatory approach was assessed using a different methodology to that for other scenarios.

Comparison of concentration data used in different models

The iodine concentrations in discretionary salt were weighted for the 'market share' model to take into account current market share of iodised versus non-iodised salt. For the 'consumer behaviour' models, two different iodine concentrations were used: option (a) where it is assumed that individuals always select non-iodised discretionary salt; and option (b) where it is assumed that individuals always select iodised discretionary salt. Figure 2 outlines how the iodine concentrations for discretionary salt were calculated for the 'market share' and 'consumer behaviour' models.

Market share model iodine concentration – Australia:

Currently, 60% of the New Zealand discretionary salt market is iodised and 20% of the Australian discretionary salt market is iodised. Discretionary iodised salt contains an average of 45 mg iodine per kg salt.

Iodine concentration (NZ)	= iodine concentration in iodised salt x market share
	= 45 mg iodine/kg salt x 60%
	= 27 mg iodine per kg salt
	= 27 µg iodine per gram of salt

Consumer behaviour model iodine concentrations –New Zealand and Australia:

a) Consumer selects **non-iodised** discretionary salt
Iodine concentration in discretionary salt = 0 mg iodine per kg salt (0 µg/gram)

b) Consumer selects **iodised** discretionary salt
Iodine concentration in discretionary salt = 45 mg iodine per kg salt (45 µg/gram)

Figure 2: Derivation of 'market share model' and 'consumer behaviour model' iodine concentrations in discretionary salt

The derivation of iodine concentration data for all other foods is discussed in detail in Attachment 1. The determination of the amount of discretionary salt consumed is given in Attachment 1, as this was not recorded quantitatively in the NNSs.

Food vehicle

At Draft Assessment for P230, the preferred regulatory option was the iodine fortification of breads, breakfast cereals and biscuits. It was proposed that salt iodised at 30 mg iodine/kg salt would be used in the manufacture of breads, breakfast cereals and biscuits and the iodine concentration in voluntary discretionary salt iodisation would be reduced to 30 mg iodine/kg salt. However, following submissions to the P230 DAR and further consultation, the issue of removing biscuits from mandatory iodine fortification was raised for consideration at Final Assessment for P230 (see main report for more information). Additionally, technical difficulties were raised by the food industry regarding the addition of salt to breakfast cereals. These technical difficulties were investigated at Final Assessment for P230 (see P230 main report for more information).

To determine whether removing biscuits or biscuits and breakfast cereals from mandatory iodine fortification would result in a substantial reduction in the proportion of people consuming mandatorily iodine fortified foods, the proportion of the target population groups consuming these foods was investigated. It was concluded that the removal of biscuits would result in a small drop in the proportion of the target group consuming mandatorily iodine fortified foods. The removal of both breakfast cereals and biscuits from mandatory iodine fortification would result in a further reduction, with an estimated 83-88% of the New Zealand and Australian populations consuming breads (refer to Figure 3 and Table A1.1 for further details on the proportion consuming fortified foods for the various mandatory fortification scenarios).

This information was considered in conjunction with other issues (e.g. trade impact, technical issues) and it was concluded that breads would be considered for mandatory fortification with iodine at Final Assessment for P230. Consequently, dietary intake assessments were conducted to investigate the impact of using salt iodised at 45 mg iodine per kg salt in the manufacture of breads and the impact of voluntary discretionary salt iodisation remaining at 45 mg iodine per kg salt.

Data derived from the Tasmanian fortification program showed iodine losses of approximately 10% in baked bread. Minimal loss of iodine has also been reported in iodised salt subjected to heating (Bhatnagar, 1997). On the basis of the information available, FSANZ has estimated that an average loss of 10% should be accommodated in the fortification range to account for any expected losses in processing. Taking into account this 10% loss in the iodine content of iodised salt on baking, it was deemed that the salt present in breads would contain 40 mg iodine per kg salt after baking/processing, for dietary intake assessment purposes for *Scenario 3 – Breads*; and breads and breakfast cereals would contain 35 mg iodine per kg salt for *Scenario 2 – Breads and breakfast cereals*.

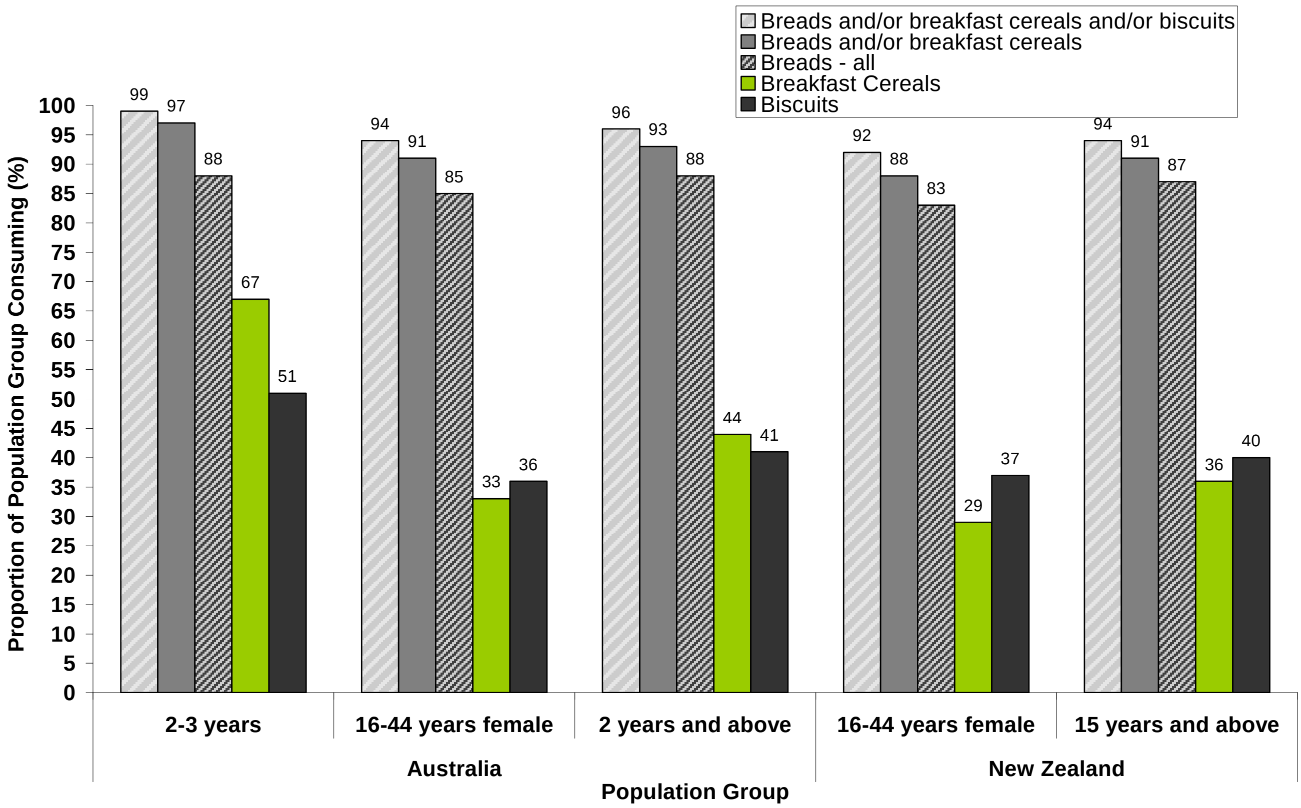

Figure 3: Proportion of New Zealand and Australian population groups consuming breads and/or breakfast cereals and/or biscuits

Comparison between fortification scenarios at Draft and Final Assessments for P230

Estimated mean dietary iodine intakes

For *Baseline*, each of the two scenarios at Draft Assessment, and each of the five scenarios at Final Assessment for P230, dietary iodine intakes were estimated for the target population groups of Australian children aged 2-3 years, New Zealand and Australian women aged 16-44 years, New Zealanders aged 15 years and above and Australians aged 2 years and above. A comparison was made between the estimated mean dietary iodine intakes for all scenarios. A comparison with the voluntary MOU scenario was also made. The comparisons between mean dietary iodine intakes assume that no discretionary salt is consumed.

For the New Zealand population groups assessed, the *Universal salt iodisation*, P230 *DAR – Processed foods*' and *Scenario 3– Breads* scenarios produced the highest mean dietary iodine intakes. All other scenarios produced slightly lower mean intakes which were similar to each other. For the Australian population groups assessed, the *Universal salt iodisation* and P230 *DAR – Processed foods*' scenarios produced the highest mean dietary iodine intakes. All other scenarios produced slightly lower mean intakes which were similar to each other. The voluntary MOU scenario resulted in lower iodine intakes for both New Zealand and Australia compared to the mandatory fortification scenarios. These results are shown in Figure 4 and Figure 5 and in Table A1.2a and b in Appendix 1.

Results New Zealand children aged 5-14 years, using the 2002 Children's National Nutrition Survey (CNS)

For New Zealand children aged 5-14 years the estimated dietary intakes were undertaken by the New Zealand Food Safety Authority (NZFSA) and the LINZ Research group at the University of Otago using the New Zealand 2002 National Children's Nutrition Survey data. The scenarios investigated between DAR and FAR for P230 were Baseline, 'Processed foods', 'Cereal based foods and 'Breads. The highest mean iodine intakes (where discretionary salt was not included) were for the 'Cereal based foods scenario, however the 'Processed foods' scenario had only slight lower results, and the 'Breads scenario had the lowest results.

See Table A2.1 in Appendix 2 for full results.

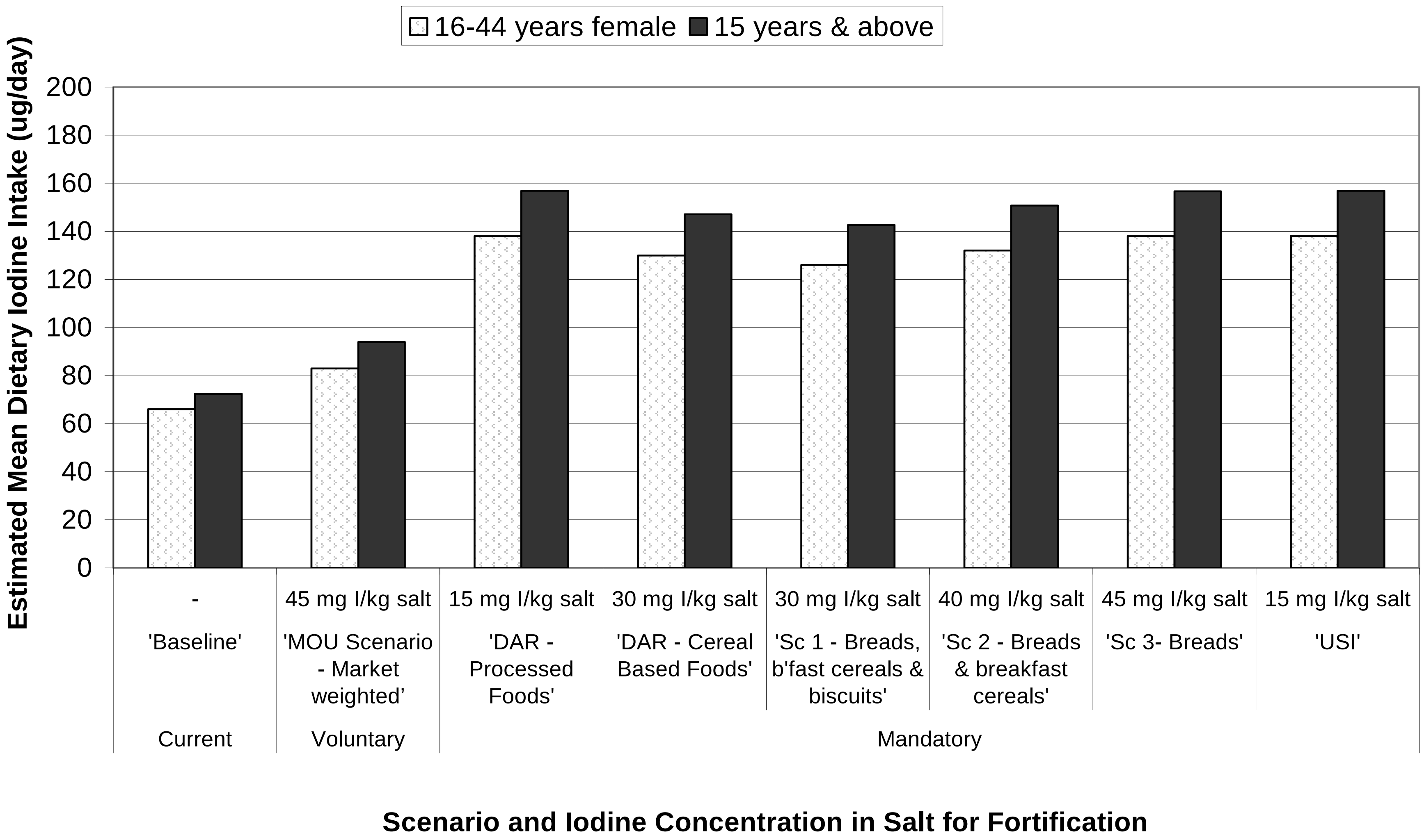

Figure 4: Comparison between estimated mean dietary iodine intakes for New Zealand population groups from Draft Assessment and Final Assessment for P230

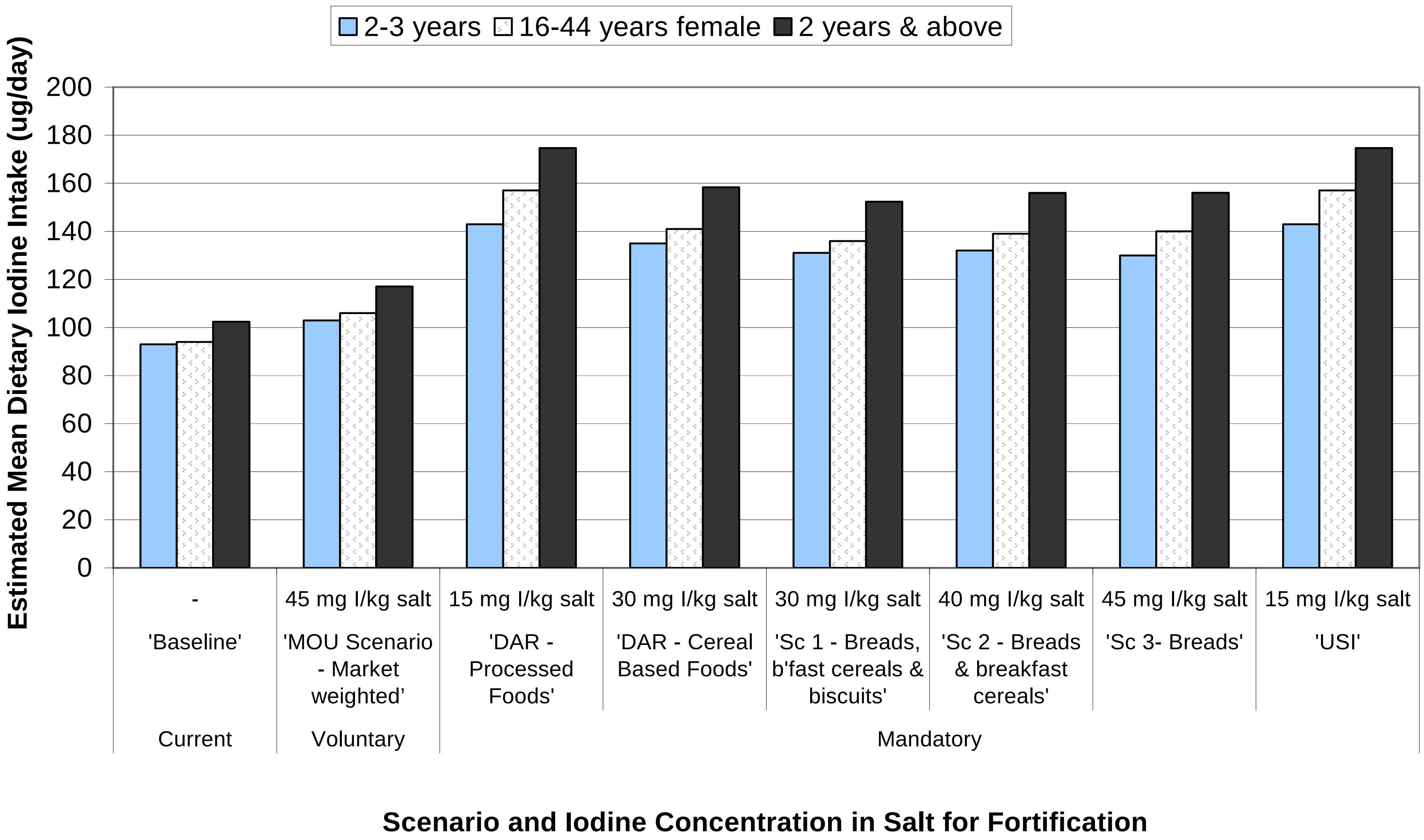

Figure 5: Comparison between estimated mean dietary iodine intakes for Australian population groups from Draft Assessment and Final Assessment for P230

Estimated proportion of target population groups with inadequate dietary iodine intakes

Estimated dietary iodine intakes were compared with the Estimated Average Requirement (EAR) for iodine for each age and gender group. The EARs used in this assessment are shown in Appendix 3 of the Dietary Intake Assessment Main Report, noting that the EARs for women who are pregnant and lactating are much higher than for other women of the same age. When certain conditions are met, the proportion of the population group with intakes below the EAR can be used to estimate the prevalence of inadequacy (Health Canada, 2006a). For each of the DAR and FAR scenarios for P230, the proportions of the population groups with dietary iodine intakes below the EAR were assessed and used as an estimation of the prevalence of inadequate iodine intakes.

For New Zealand women aged 16-44 years, the *Universal salt iodisation* and P230 *DAR – Processed foods*' scenarios produced the lowest estimated proportions of respondents with inadequate dietary iodine intakes. All other scenarios produced higher proportions, which were similar to each other. A similar pattern was found for New Zealanders aged 15 years and above.

For Australian children aged 2-3 years, all of the mandatory fortification scenarios resulted in a low estimated proportion of respondents with inadequate dietary iodine intakes. However, a higher proportion (>10%) of the group were estimated to have inadequate dietary iodine intakes under the voluntary MOU fortification scenario. For Australian women aged 16-44 years, the *Universal salt iodisation* and P230 *DAR – Processed foods*' scenarios produced the lowest estimated proportions of respondents with inadequate dietary iodine intakes. All other mandatory fortification scenarios produced higher proportions, which were similar to each other. A similar pattern was found for Australians aged 2 years and above.

These results are shown in Figure 6 and Figure 7 and in Table A1.3 in Appendix 1.

Results New Zealand children aged 5-14 years, using the 2002 Children's National Nutrition Survey (CNS)

The scenario that resulted in the highest proportion of New Zealand Children with inadequate dietary intakes when discretionary salt was not included was the 'Breads scenario (26-33% depending on the age group), followed by the 'Cereal based foods scenario (16-24%) and 'Processed foods' (14-23%) which were similar. When discretionary iodised salt was included, the proportion with inadequate intakes for all scenarios was lower (2-15% depending on the scenario and age group). See Table A2.2 in Appendix 2 for full results. The results for New Zealand children 5-14 years were not second day adjusted, therefore the estimated proportions of each population group with inadequate intakes may be slightly different if a second day adjustment had been able to be made.

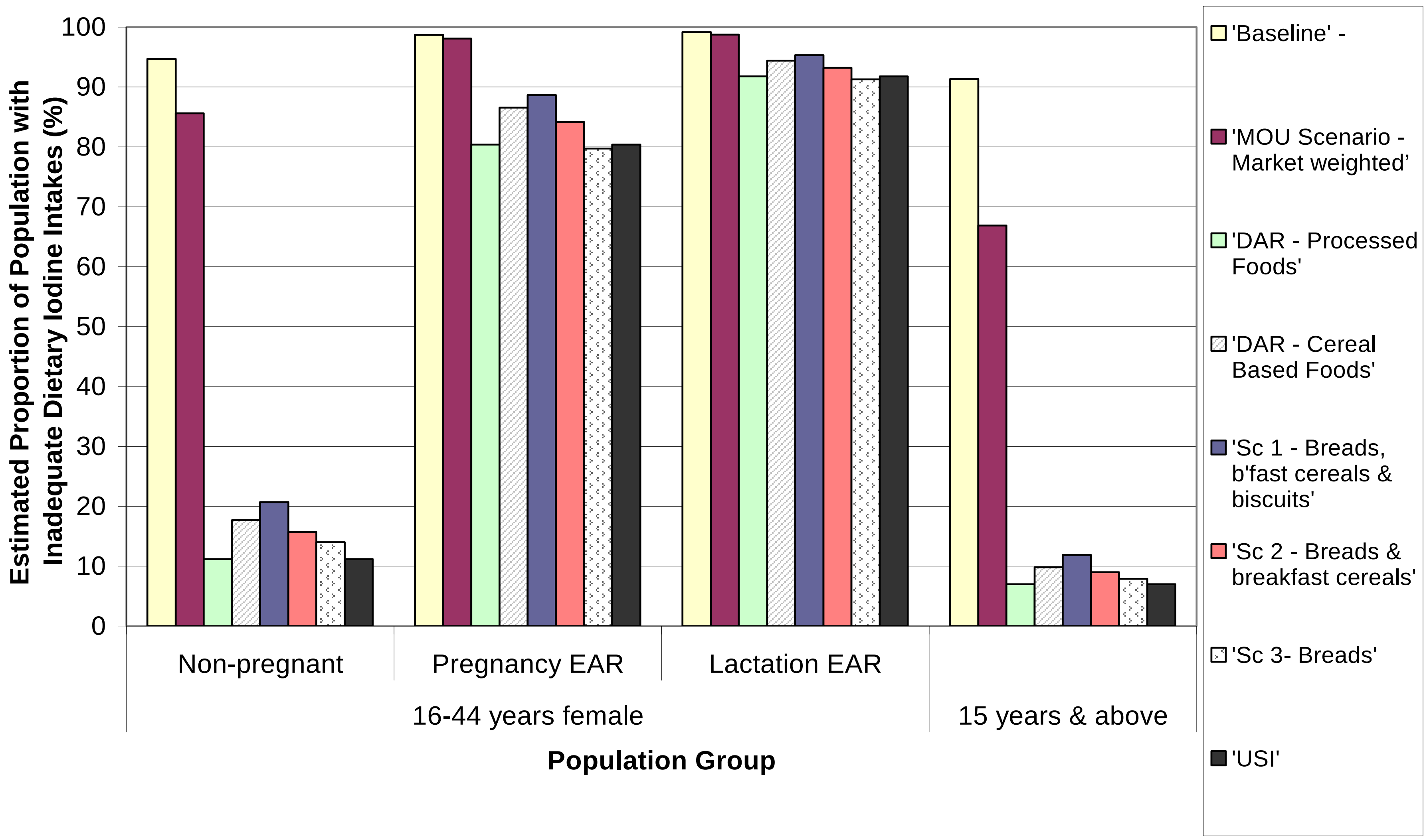

Figure 6: Estimated proportion of New Zealand target groups with inadequate dietary iodine intakes

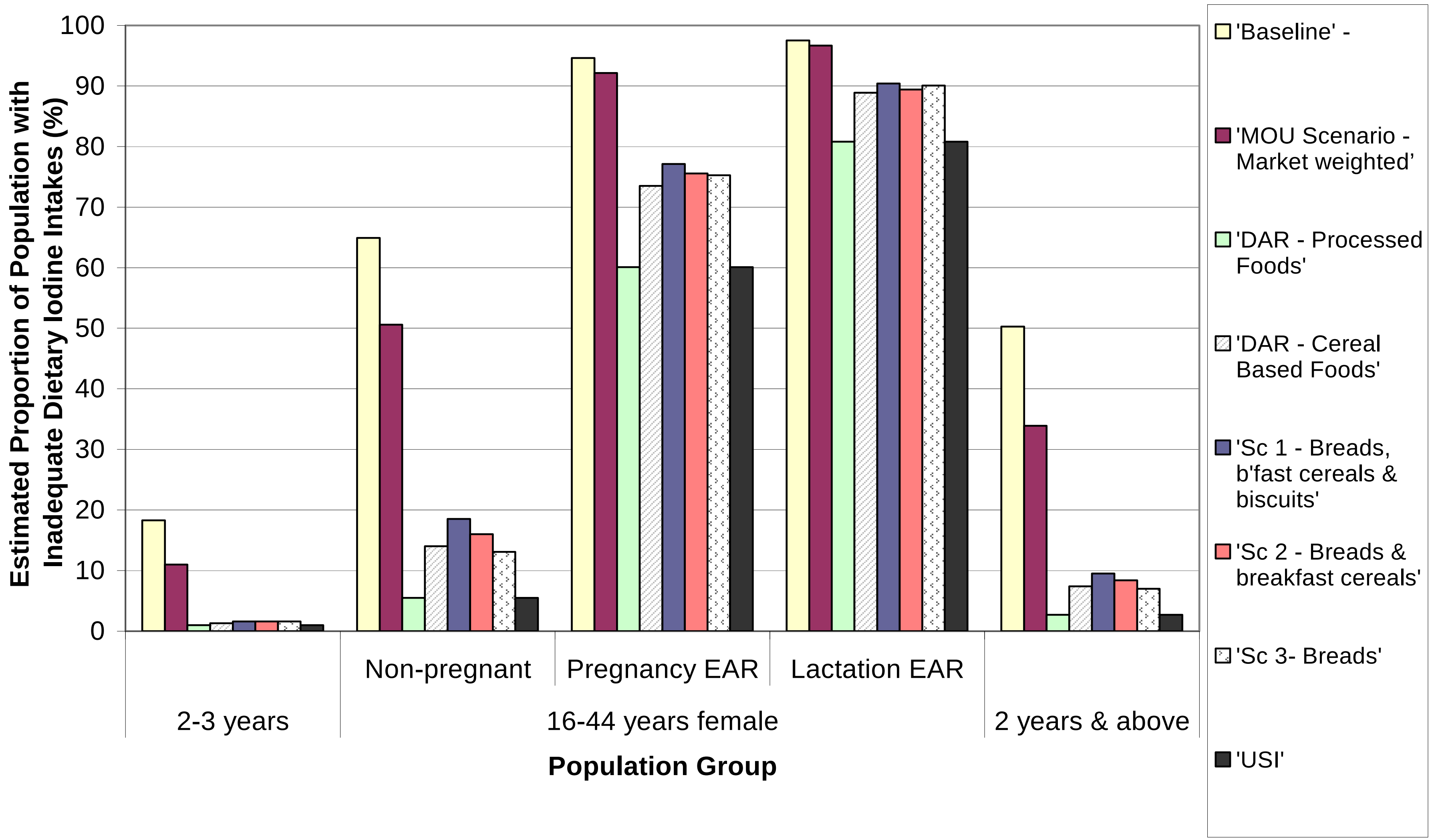

Figure 7: Estimated proportion of Australian target groups with inadequate dietary iodine intakes

Results for New Zealand children aged 1-3 years and Australian children aged 1 year, using theoretical diets

As dietary iodine intakes for New Zealand children aged 1-3 years and for Australian children aged 1 year were calculated using a 'theoretical diet', the proportion of these population groups with dietary iodine intakes below the EAR, and therefore with inadequate dietary iodine intakes, could not be determined. The mean intake was simply compared to the EAR and expressed as a percentage of the EAR. For New Zealand children aged 1-3 years, the estimated *Baseline* mean dietary iodine intake was below the EAR when formulated supplementary foods for young children (FSFYC) were not considered. For both *Baseline* and the mandatory fortification scenarios, estimated mean dietary iodine intakes were above the EAR for Australian children aged 1 year. Estimated mean dietary iodine intakes were above the EAR for all mandatory fortification scenarios. For additional information, refer to Table A1.4a and b in Appendix 1.

Estimated proportion of target population groups with dietary iodine intakes above the UL

Estimated dietary iodine intakes were compared with the UL. The ULs used in this assessment are shown in Appendix 3 of the Dietary Intake Assessment Main Report. For all voluntary and mandatory fortification scenarios considered at Draft and Final Assessment for P230, no New Zealand or Australian women aged 16-44 years or New Zealander aged 15 years and above had dietary iodine intakes that exceeded the UL.

For all mandatory fortification scenarios examined, with the exception of *Universal salt iodisation* and P230 *DAR – Processed foods'*, the proportions of Australian children aged 2-3 years estimated to have dietary iodine intakes above the UL were similar (5-7% of the population group). For the *Universal salt iodisation* and P230 *DAR – Processed foods'* scenarios, a greater proportion of 2-3 year old children were estimated to have dietary iodine intakes in excess of the UL (10%). These results are detailed in Figure 8 and in Table A1.5 in Appendix 1.

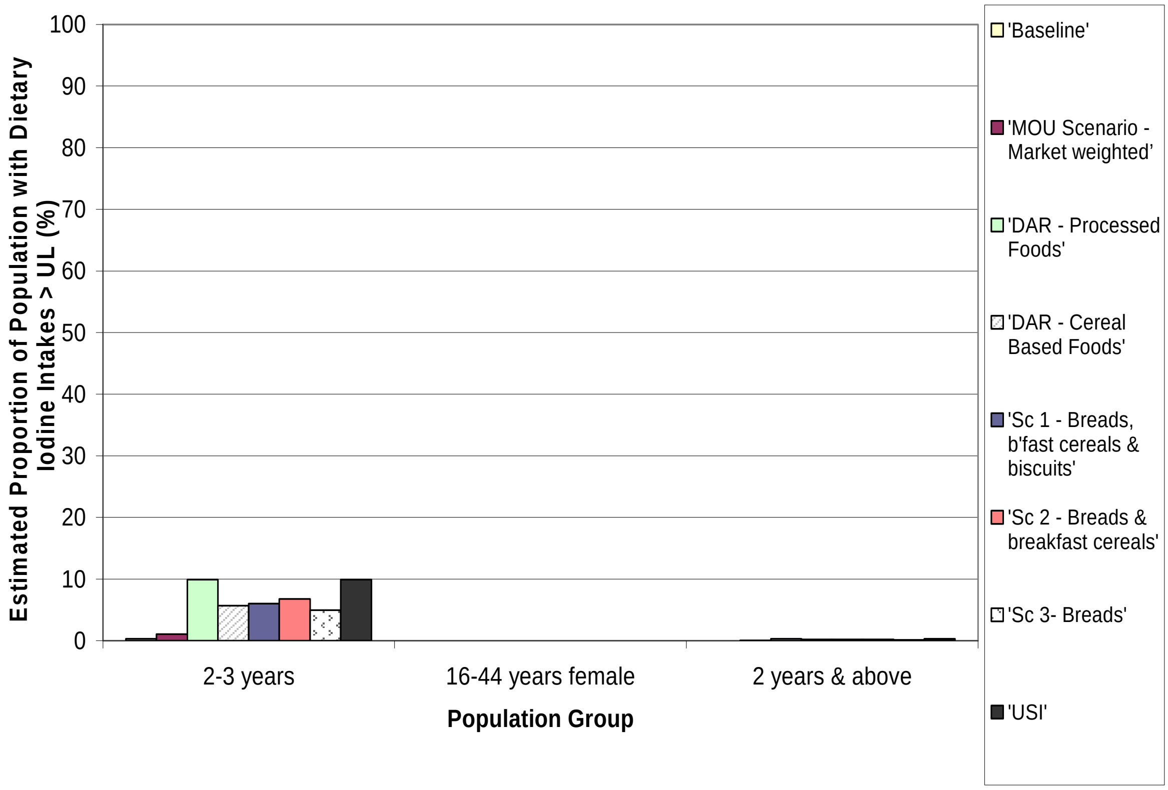

Figure 8: Estimated proportion of Australian target groups with dietary iodine intakes above the upper level of intake

Results New Zealand children aged 5-14 years, using the 2002 Children's National Nutrition Survey (CNS)

When discretionary salt was not included, the 'Cereal based foods scenario and the 'Processed foods' scenario had similar proportions of the population exceeding the UL (<1 to 2% depending on the age group), which were higher than for the 'Breads scenario (<1 to 1%). When discretionary iodised salt was included, the proportion exceeding the UL was slightly higher for all scenarios (<1 to 3%). See Table A2.3 in Appendix 2 for full results. The results for New Zealand children 5-14 years were not second day adjusted, therefore the estimated proportions of each population group with intakes exceeding the UL may be slightly different if a second day adjustment had been able to be made.

Results for New Zealand children aged 1-3 years and Australian children aged 1 year, using theoretical diets

Since dietary iodine intakes for New Zealand children aged 1-3 years and for Australian children aged 1 year were estimated using 'theoretical diets', the percentage of these population groups with dietary iodine intakes above the UL could not be determined. As an alternative, the 95th percentile dietary iodine intake (high consumers of iodine) was estimated and then compared to the UL and expressed as a percentage of the UL.

At *Baseline* for Australian children aged 1 year, the 95th percentile dietary iodine intake was equivalent to or greater than the UL (100% of UL with no FSFYC; 120% of UL with FSFYC), while for New Zealand children aged 1-3 years, the 95th percentile intake was below the UL (60% of UL with no FSFYC; 90% of UL with FSFYC).

For all mandatory fortification scenarios, 95th percentile dietary iodine intakes generally exceeded the UL for New Zealand children aged 1-3 years (95-140% of UL) and for Australians aged 1 year (120-130% UL). For *Scenario 3 – Breads* and when FSFYC were not consumed, the 95th percentile intake was below the UL for New Zealand children aged 1-3 years. For additional information, refer to Table A1.4 in Appendix 1.

Summary of P230 DAR and FAR comparison

For New Zealand women aged 16-44 years, , the *Universal salt iodisation* and P230 *DAR – Processed foods'* scenarios produced the highest mean dietary iodine intakes and lowest proportion of respondents with inadequate dietary iodine intakes, followed by P230 *DAR – Processed foods*'. All other scenarios produced lower mean intakes which were similar to each other and higher proportions of the population with inadequate dietary iodine intakes.

For Australia, a similar pattern was seen whereby the *Universal salt iodisation* and P230 *DAR – Processed foods'* scenarios generally produced the highest mean dietary iodine intakes, lowest proportion of respondents with inadequate dietary iodine intakes, and highest proportion of children aged 2-3 years with dietary iodine intakes above the UL. All other mandatory fortification scenarios produced lower mean dietary iodine intakes which were similar to each other, higher proportions of respondents with inadequate dietary iodine intakes, and lower proportions of respondents with dietary iodine intakes above the UL.

For all population groups examined, the voluntary MOU fortification scheme produced the lowest mean dietary iodine intakes, highest proportion of the population group with inadequate dietary iodine intakes and lowest proportion of respondents with intakes above the UL in comparison to the mandatory fortification scenarios. Under voluntary fortification, mean dietary iodine intakes increased by approximately 10-30% for New Zealand and Australian population groups. For *Scenario 3 – Breads*, mean dietary iodine intakes increased by approximately 40-120%, with increases of approximately 60-140% estimated for *Universal salt iodisation*, depending on the population group examined. The smaller increase in mean dietary iodine intakes for the voluntary MOU fortification approach could be attributed to the lower proportion of breads, breakfast cereals and biscuits proposed to be voluntarily fortified. It is important to note that for the voluntary fortification scenario, the definition of breads, breakfast cereals and biscuits was slightly different to that used for FSANZ's proposed mandatory fortification scenario.

Comparison between *Scenario 3 – Breads* and *Universal salt iodisation*

As discussed in above, the *Universal salt iodisation* and P230 *DAR – Processed foods* scenarios produced the highest mean dietary iodine intakes and the lowest estimated proportion of respondents with inadequate dietary iodine intakes, followed by *Scenario 3 – Breads* for all population groups assessed. Since the option of mandatorily fortifying processed foods was not the preferred option at Draft Assessment for P230, only *Universal salt iodisation* and *Scenario 3 – Breads* have been examined in further detail in this section of the report.

Unlike above, the comparison between *Universal salt iodisation* and *Scenario 3 – Breads* in this section takes into account the consumption of discretionary salt. For *Universal salt iodisation* all discretionary salt was iodised; for *Scenario 3 – Breads* the iodine concentration in discretionary salt was weighted to reflect the proportion of the New Zealand and Australian discretionary salt markets that are iodised (60% for New Zealand; 20% for Australia). This comparison shows the impact of each of these assessments on the population over a period of time.

Estimated mean dietary iodine intakes for *Universal salt iodisation* and *Scenario 3 – Breads* mandatory fortification

Mean dietary iodine intakes were estimated for various New Zealand and Australian population groups for both *Universal Salt Iodisation* and *Scenario 3 – Breads* (see Figure 9 and Figure 10 and in Table A1.8 in Appendix 1). For all New Zealand population groups assessed, the estimated mean dietary iodine intakes were higher for *Scenario 3 – Breads* than they were for the *Universal Salt Iodisation* scenario. However, the reverse was found for all Australian population groups assessed, i.e. the estimated mean dietary iodine intakes were higher for the *Universal Salt Iodisation* scenario than they were for *Scenario 3 – Breads*.

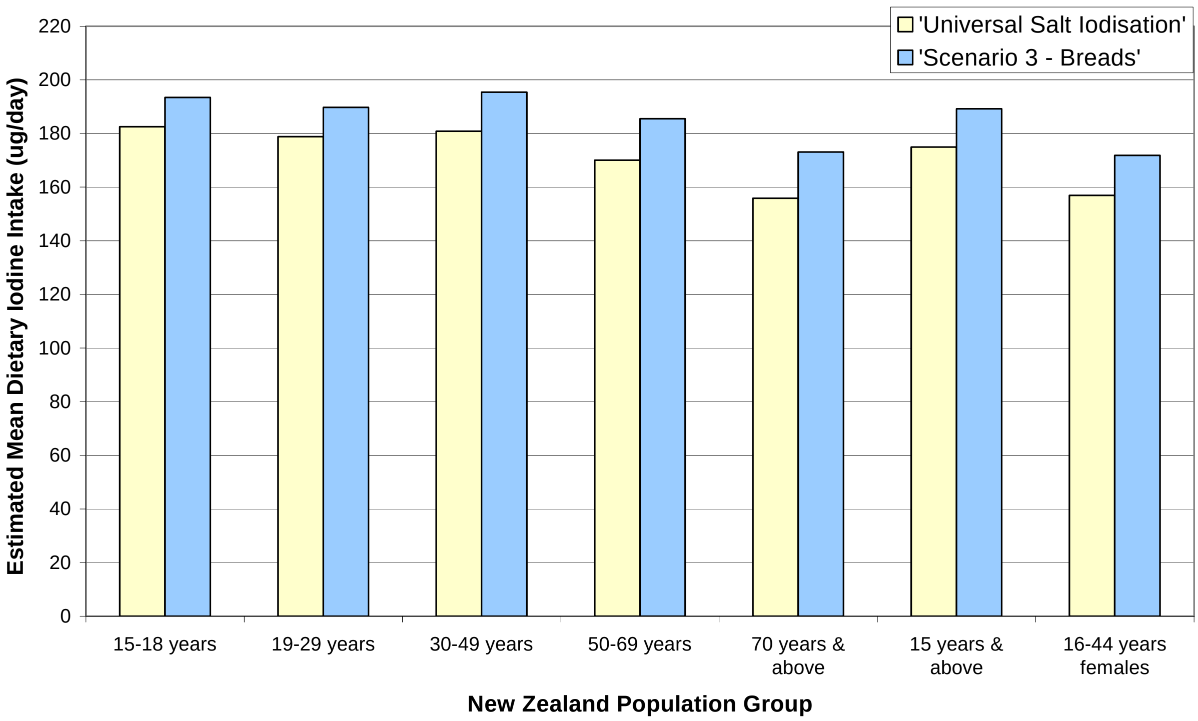

Figure 9: Estimated mean dietary iodine intakes for New Zealand population groups for Universal salt iodisation *and* Scenario 3 – Breads

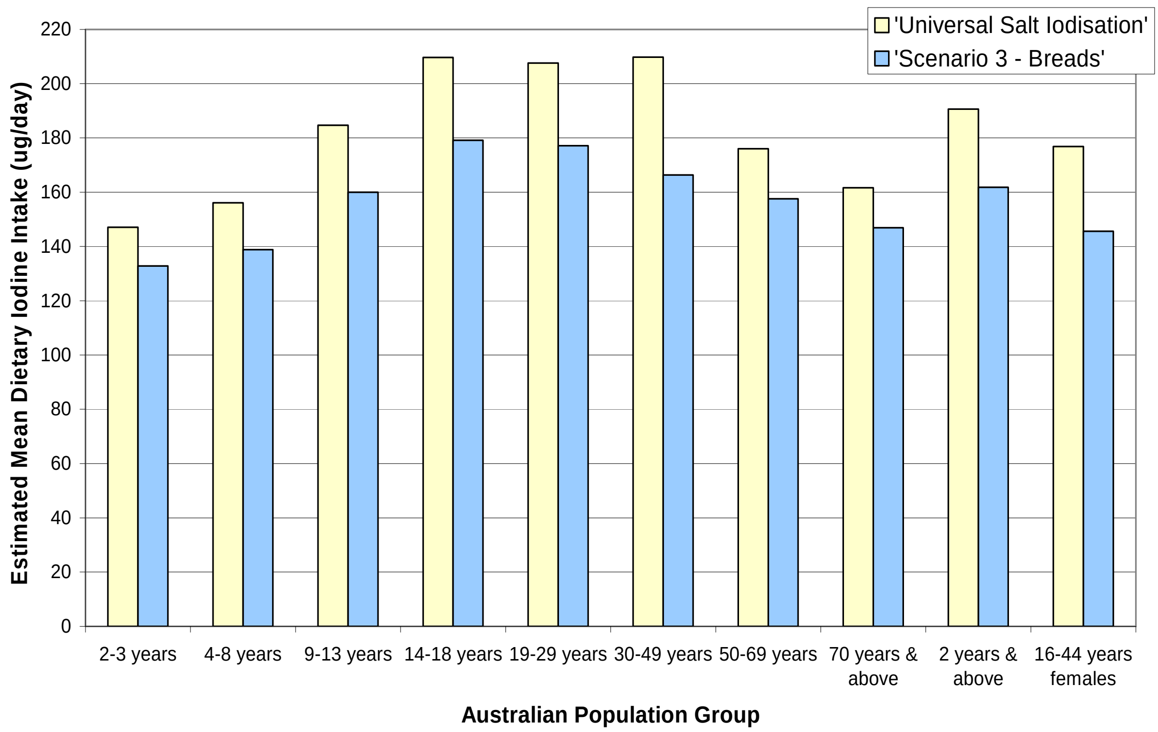

Figure 10: Estimated mean dietary iodine intakes for Australian population groups for Universal salt iodisation *and* Scenario 3 – Breads

The results indicate that New Zealand women of child-bearing age have a larger incremental increase in iodine intakes from *Baseline* for *Scenario 3 – Breads* compared to the same population group for Australia (Table 2). In order to determine why this was the case, the amount of salt consumed from breads was investigated. It was found that the higher incremental increase was potentially due to the higher intakes of salt from mandatorily fortified bread (*Scenario 3 – Breads*) for New Zealand population groups in comparison to Australians (see Figure 11 and Table A1.7 in Appendix 1).

For *Universal salt iodisation*, Australian population groups showed a larger incremental increase in mean dietary iodine intakes from *Baseline*. This may be due to the lower proportion of discretionary salt that is iodised at *Baseline* for Australia.

Table 2: Estimated mean dietary iodine intakes, and increase in iodine intakes from *Baseline*, for Australian and New Zealand population groups

Scenario	Mean dietary iodine intake (increase in iodine intake from *Baseline*) (µg/day)				
	Australia			**New Zealand**	
	2-3 years	**16-44 years female**	**2 years and above**	**16-44 years female**	**15 years and above**
Baseline	95	100	108	99	105
Scenario 3 – Breads	133 (+38)	146 (+46)	162 (+54)	172 (+73)	189 (+84)
Universal salt iodisation	147 (+52)	177 (+77)	191 (+83)	157 (+58)	175 (+70)

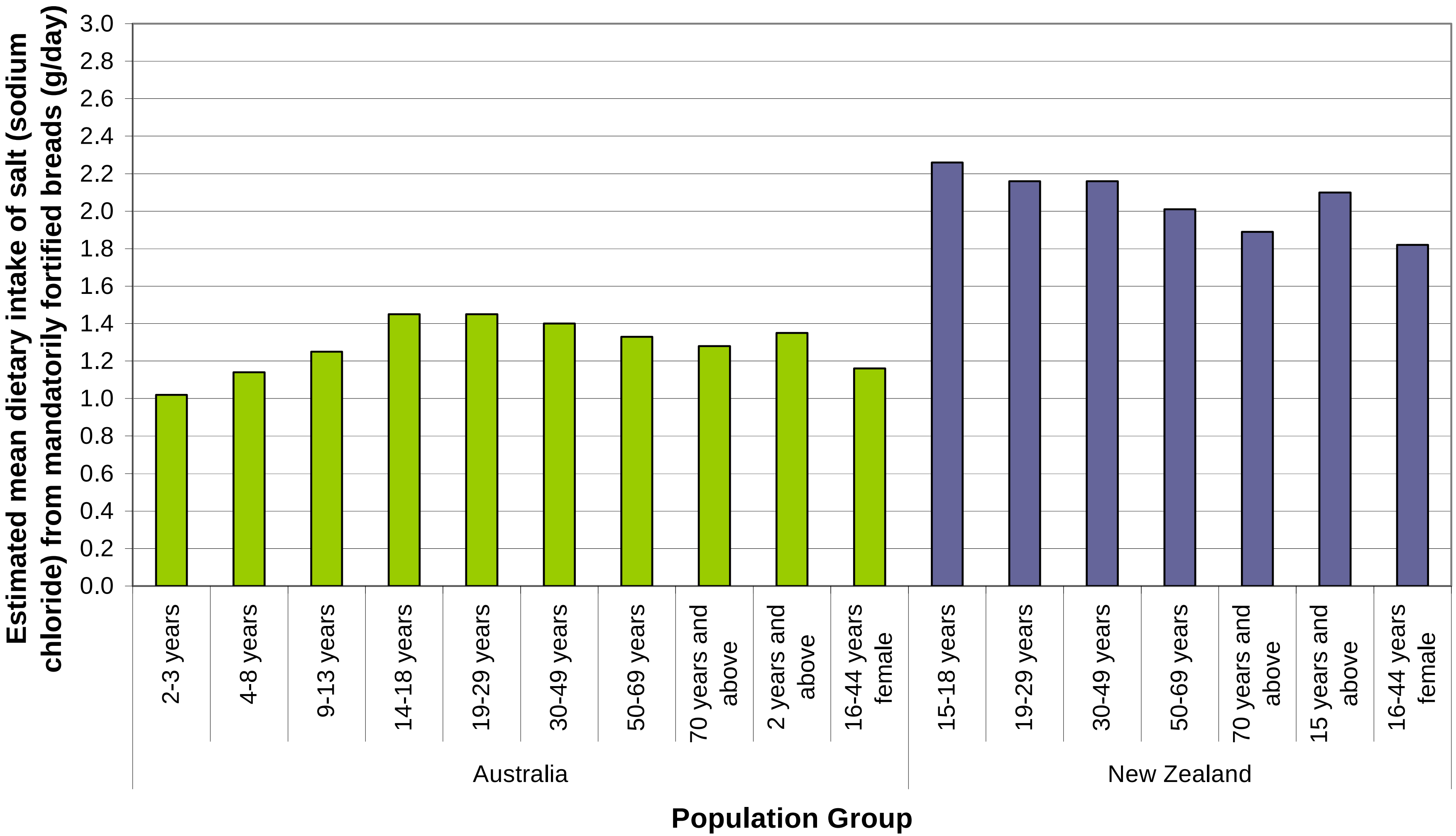

Figure 11: Estimated mean dietary intake of salt (sodium chloride) from mandatorily fortified breads

Proportion of the population groups with inadequate dietary iodine intakes

For all Australian population groups assessed, the estimated proportion of respondents with inadequate dietary iodine intakes was higher for *Scenario 3 – Breads* than for the *Universal salt iodisation* scenario. The opposite was found for New Zealand population groups, with the proportion of respondents being higher for the *Universal salt iodisation* scenario than for *Scenario 3 – Breads*. For further details, refer to Figure 12 and Figure 13 and to Table A1.9 in Appendix 1.

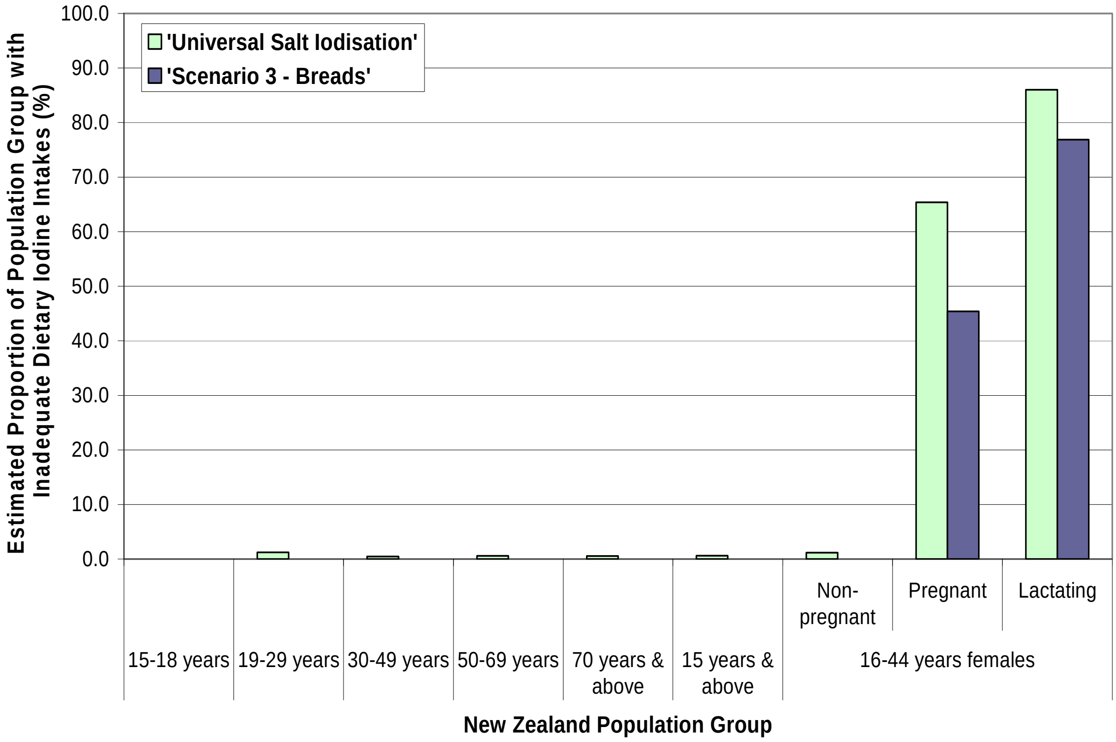

Figure 12: Estimated proportion of New Zealand population groups with inadequate dietary iodine intakes for Universal salt iodisation *and* Scenario 3 – Breads

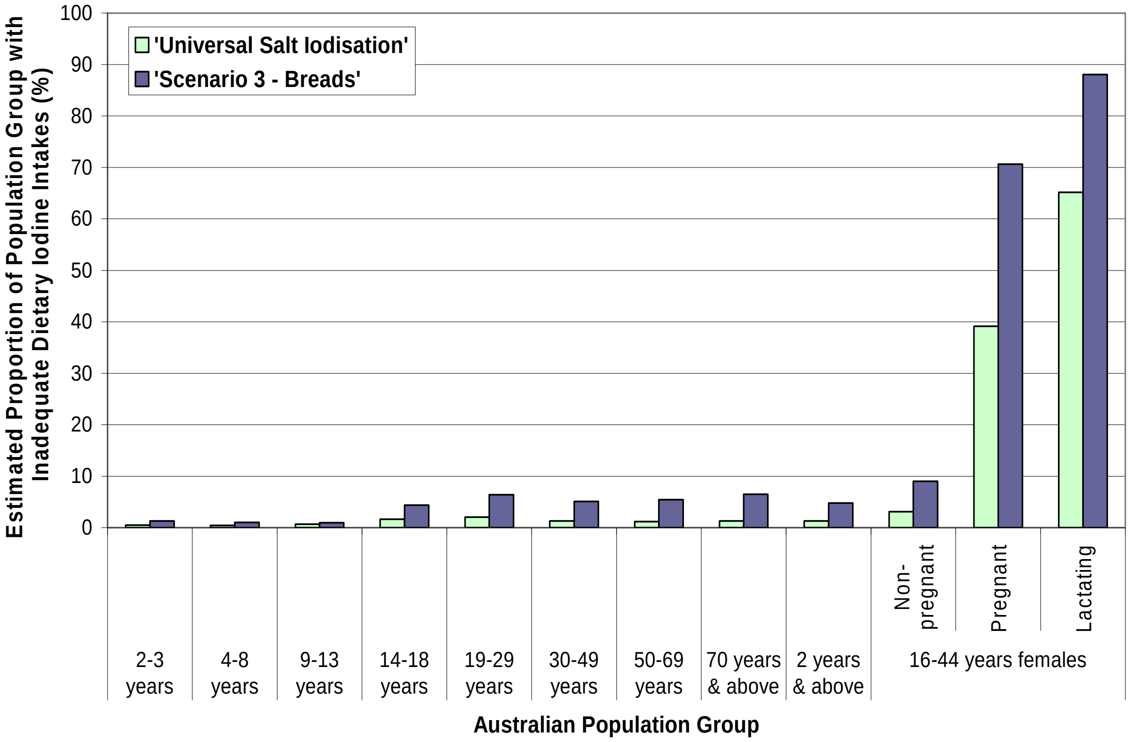

Figure 13: Estimated proportion of Australian population groups with inadequate dietary iodine intakes for Universal salt iodisation and Scenario 3 – Breads

Proportion of the population groups with estimated dietary iodine intakes above the UL

For all Australian population groups investigated, the proportion of respondents with estimated dietary iodine intakes above the UL was higher for the *Universal Salt Iodisation* scenario than for *Scenario 3 – Breads*. For New Zealand population groups, the reverse was found – i.e. the proportion of respondents was higher for *Scenario 3 – Breads* than for the *Universal Salt Iodisation* scenario. For all New Zealand population groups examined and all Australian population sub-groups aged 4 years and above, less than 1% of respondents had dietary iodine intakes above the UL. For Australian children aged 2-3 years, 6% of the population group had intakes above the UL for *Scenario 3 – Breads* and 11% for *Universal Salt Iodisation*. These results are shown in Figure 14 and Figure 15 for New Zealand and Australia, respectively (further details in Table A1.10 in Appendix 1).

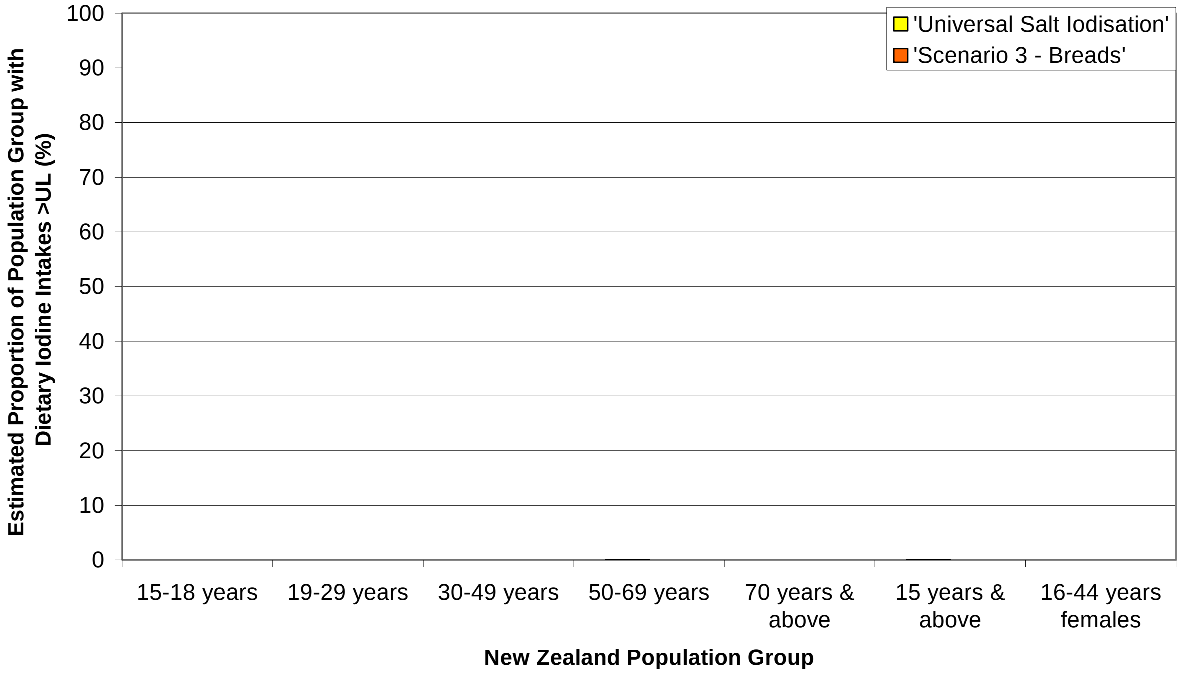

Figure 14: Estimated proportion of New Zealand population groups with dietary iodine intakes greater than the UL for Universal Salt Iodisation *and* Scenario 3 – Breads

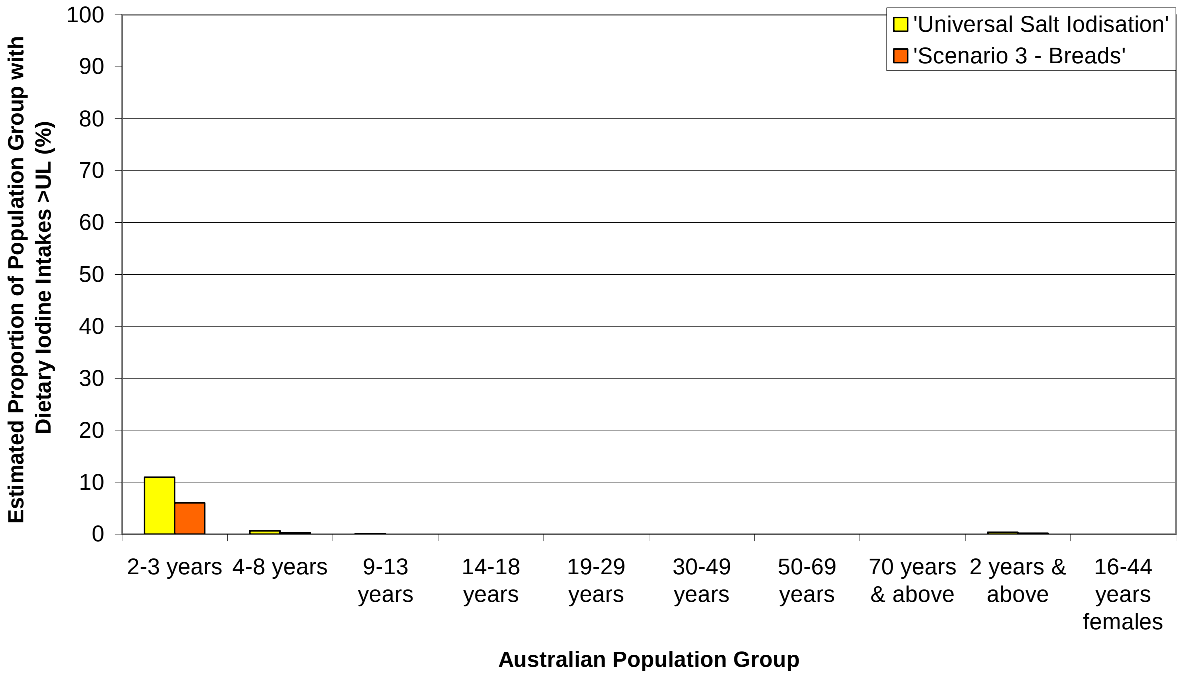

Figure 15: Estimated proportion of Australian population groups with dietary iodine intakes greater than the UL for Universal Salt Iodisation *and* Scenario 3 – Breads

Summary

When discretionary iodised salt consumption was taken into account, the *Scenario 3 – Breads* scenario produced a higher mean dietary iodine intake and lower proportion of respondents with inadequate iodine intakes but a higher proportion of respondents with intakes above the UL for New Zealand population groups. For example, the increase in mean dietary iodine intakes for New Zealanders 15 years and above was estimated at 80% for *Scenario 3 – Breads* and 65% for *Universal Salt Iodisation*.

For Australia, the *Universal Salt Iodisation* scenario produced a higher mean dietary iodine intake and lower proportion of respondents with inadequate iodine intakes but a higher proportion of respondents with intakes above the UL. For example, the increase in mean dietary iodine intakes for Australians 2 years and above was estimated at 50% for *Scenario 3 – Breads* and 75% for *Universal Salt Iodisation*.

REFERENCES

Health Canada (2006) *Canadian Community Health Survey Cycle 2.2, Nutrition (2004) A Guide to Accessing and Interpreting the Data*. http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/cchs_guide_escc_a3_e.htmL. Accessed on 3 July 2007.

Appendix 1

Complete information on dietary intake assessment results

Table A1.1: Proportion of Australian and New Zealand population groups who consume breads, breakfast cereals and biscuits

Country	Population Group	Number of Respondents	% of Respondents Consuming				
			Breads	Breakfast cereals	Biscuits	Breads and/ or breakfast cereals	Breads and/ or, breakfast cereals and/ or biscuits
New Zealand	Females 16-44 yrs	1,509	83	29	37	88	92
	15 years and above	4,636	87	36	40	91	94
Australia	2-3 years	383	88	67	51	97	99
	Females 16-44 yrs	3,178	85	33	36	91	94
	2 years and above	13,858	88	44	41	93	96

Notes:

4. It was assumed, for the purpose of calculating the 'percentage of respondents consuming' that all breads, biscuits and breakfast cereals contain salt and are commercially prepared.
5. Cooked oats and unprocessed brans were excluded.
6. A NNS respondent was counted as a consumer if they consumed at least one of the foods listed above or a mixed food that contains a food listed above, irrespective of the amount of the food eaten (e.g. if a person ate a chocolate crackle that contains breakfast cereal, they were counted as a consumer of breakfast cereal).

Table A1.2: Estimated dietary iodine intakes for New Zealand and Australian target population groups for different fortification scenarios, when discretionary salt is not considered*

a. New Zealanders aged 15 years and above

	Scenario	Salt Fortification Level for Fortification (mg I/kg salt)	Mean dietary iodine intake (ug/day)	
			16-44 yrs female	15 years & above
Current	*Baseline*	-	66	72
Voluntary	*MOU Scenario – Market weighted*	45	83	94
Mandatory	*P230 DAR - Processed foods'*	15	138	157
	P230 DAR – Cereal-based foods	30	130	147
	Scenario 1 – Breads, breakfast cereals & biscuits	30	126	143
	Scenario 2 – Breads and breakfast cereals	40	132	151
	Scenario 3– Breads	45	138	157
	Universal salt iodisation	15	138	157

b. Australians aged 2 years and above

	Scenario	Salt Fortification Level for Fortification (mg I/kg salt)	Mean dietary iodine intake (ug/day)		
			2-3 yrs	16-44 yrs female	2 years and above
Current	*Baseline*	-	93	94	102
Voluntary	*MOU Scenario – Market weighted*	45	103	106	117
Mandatory	*P230 DAR - Processed foods'*	15	143	157	175
	P230 DAR – Cereal-based foods	30	135	141	158
	Scenario 1 – Breads, breakfast cereals & biscuits	30	131	136	152
	Scenario 2 – Breads and breakfast cereals	40	132	139	156
	Scenario 3– Breads	45	130	140	156
	Universal salt iodisation	15	143	157	175

c. New Zealanders aged 1-3 years#

	Scenario	Salt Fortification Level for Fortification (mg I/kg salt)	Estimated dietary iodine intake (ug/day)	
			Mean	95th percentile
Current	*Baseline*	-	48 – 72	119 – 180
Mandatory	*P230 DAR - Processed foods'*	15	89 – 113	221 – 283
	P230 DAR – Cereal-based foods	30	84 – 109	210 – 272
	Scenario 1 – Breads, breakfast cereals & biscuits	30	90 – 115	226 – 287
	Scenario 2 – Breads and breakfast cereals	40	80 – 104	199 – 261
	Scenario 3– Breads	45	77 – 102	193 – 254
	Universal salt iodisation	15	89 – 113	221 – 283

Note: In this table, the lower number in the range is the mean dietary iodine intake when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the mean dietary iodine intake when 1 serve/day of FSFYC is included in the diet.
Calculated using theoretical diet.

d. Australians aged 1 year*

	Scenario	Salt Fortification Level for Fortification (mg I/kg salt)	Estimated dietary iodine intake (ug/day)	
			Mean	95th percentile
Current	*Baseline*	-	79 – 92	198 – 230
Mandatory	*P230 DAR - Processed foods'*	15	96 – 108	240 – 270
	P230 DAR – Cereal-based foods	30	96 – 108	239 – 269
	Scenario 1 – Breads, breakfast cereals & biscuits	30	95 – 107	237 – 268
	Scenario 2 – Breads and breakfast cereals	40	96 – 108	239 – 270
	Scenario 3– Breads	45	95 – 107	238 – 268
	Universal salt iodisation	15	96 – 108	240 – 270

Note: In this table, the lower number in the range is the mean dietary iodine intake when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the mean dietary iodine intake when 1 serve/day of FSFYC is included in the diet.
* Calculated using theoretical diet.

Table A1.3: Estimated proportion of respondents with inadequate dietary iodine intakes for different fortification scenarios, when discretionary salt is not considered

a. New Zealand

	Scenario	Salt Fortification Level for Mandatory Fortification (mg I/kg salt)	Estimated proportion of respondents with inadequate dietary iodine intakes (%)			
			16-44 years female			15 years & above
			Non-pregnant	Pregnancy EAR	Lactation EAR	
Current	*Baseline*	-	95	99	99	91
Voluntary	*MOU Scenario – Market weighted*	45	86	98	99	67
Mandatory	*P320 DAR - Processed foods'*	15	11	80	92	7
	P230 DAR – Cereal-based foods	30	18	87	94	10
	Scenario 1 – Breads, breakfast cereals & biscuits	30	21	89	95	12
	Scenario 2 – Breads and breakfast cereals	40	16	84	93	9
	Scenario 3– Breads	45	14	80	91	8
	Universal salt iodisation	15	11	80	92	7

b. Australia

	Scenario	Salt Fortification Level for Mandatory Fortification (mg I/kg salt)	Estimated proportion of respondents with inadequate dietary iodine intakes (%)				
			2-3 years	16-44 years female			2 years & above
				Non-pregnant	Pregnancy EAR	Lactation EAR	
Current	*Baseline*	-	18	65	95	98	50
Voluntary	*MOU Scenario – Market weighted*	45	11	51	92	97	34
Mandatory	*P230 DAR - Processed foods'*	15	1	6	60	81	3
	P230 DAR – Cereal-based foods	30	1	14	74	89	7
	Scenario 1 – Breads, breakfast cereals & biscuits	30	2	19	77	90	10
	Scenario 2 – Breads and breakfast cereals	40	2	16	76	89	8
	Scenario 3– Breads	45	2	13	75	90	7
	Universal salt iodisation	15	1	6	60	81	3

Table A1.4: Estimated mean dietary iodine intakes, as a percentage of the EAR, for New Zealand children aged 1-3 years and Australian children aged 1 year for different mandatory fortification scenarios, based on theoretical diets

a. New Zealand children aged 1-3 years

	Scenario	Salt Fortification Level for Fortification (mg I/kg salt)	EAR (µg/day)	Estimated mean dietary iodine intake (%EAR)
Current	*Baseline*	-	65	75 – 110
Mandatory	*P230 DAR - Processed foods'*	15	65	140 – 170
	P230 DAR – Cereal-based foods	30	65	130 – 170
	Scenario 1 – Breads, breakfast cereals & biscuits	30	65	140 – 180
	Scenario 2 – Breads and breakfast cereals	40	65	120 – 160
	Scenario 3– Breads	45	65	120 – 160
	Universal salt iodisation	15	65	140 – 170

Note: In this table, the lower number in the range is the percentage of the EAR when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the EAR when 1 serve/day of FSFYC is included in the diet.

b. Australian children aged 1 year

	Scenario	Salt Fortification Level for Fortification (mg I/kg salt)	EAR (µg/day)	Estimated mean dietary iodine intake (%EAR)
Current	*Baseline*	-	65	120 – 140
Mandatory	*P230 DAR - Processed foods'*	15	65	150 – 170
	P230 DAR – Cereal-based foods	30	65	150 – 170
	Scenario 1 – Breads, breakfast cereals & biscuits	30	65	150 – 160
	Scenario 2 – Breads and breakfast cereals	40	65	150 – 170
	Scenario 3– Breads	45	65	150 – 170
	Universal salt iodisation	15	65	150 – 170

Note: In this table, the lower number in the range is the percentage of the EAR when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the EAR when 1 serve/day of FSFYC is included in the diet.

Table A1.5: Estimated proportion of respondents with dietary iodine intakes above the UL for different fortification scenarios, when discretionary salt is not considered

a. New Zealand

	Scenario	**Salt Fortification Level for Mandatory Fortification (mg I/kg salt)**	**Estimated proportion of respondents with dietary iodine intakes > UL (%)**	
			16-44 yrs female	**15 years & above**
Current	*Baseline*	-	0	0
Voluntary	*MOU Scenario – Market weighted*	45	0	0
Mandatory	*P230 DAR - Processed foods'*	15	0	0
	P230 DAR – Cereal-based foods	30	0	0
	Scenario 1 – Breads, breakfast cereals & biscuits	30	0	0
	Scenario 2 – Breads and breakfast cereals	40	0	0
	Scenario 3– Breads	45	0	0
	Universal salt iodisation	15	0	0

b. Australia

	Scenario	Salt Fortification Level for Mandatory Fortification (mg I/kg salt)	Estimated proportion of respondents with dietary iodine intakes > UL (%)		
			2-3 years	16-44 years female	2 years & above
Current	*Baseline*	-	<1	0	<1
Voluntary	*MOU Scenario – Market weighted*	45	1	0	<1
Mandatory	*P230 DAR - Processed foods'*	15	10	0	<1
	P230 DAR – Cereal-based foods	30	6	0	<1
	Scenario 1 – Breads, breakfast cereals & biscuits	30	6	0	<1
	Scenario 2 – Breads and breakfast cereals	40	7	0	<1
	Scenario 3– Breads	45	5	0	<1
	Universal salt iodisation	15	10	0	<1

Table A1.6: Estimated mean and 95th percentile dietary iodine intakes, as a percentage of the UL, for New Zealand children aged 1-3 years and Australian children aged 1 year for different mandatory fortification scenarios, based on theoretical diets

a. New Zealand children aged 1-3 years

	Scenario	**Salt Fortification Level for Fortification (mg I/kg salt)**	**UL (µg/day)**	**Estimated dietary iodine intake (%UL)**	
				Mean	**95th percentile**
Current	*Baseline*	-	200	25 – 35	60 – 90
Mandatory	*P230 DAR - Processed foods'*	15	200	45 – 55	110 – 140
	P230 DAR – Cereal-based foods	30	200	40 – 55	110 – 140
	Scenario 1 – Breads, breakfast cereals & biscuits	30	200	45 – 55	110 – 140
	Scenario 2 – Breads and breakfast cereals	40	200	40 – 50	100 – 130
	Scenario 3– Breads	45	200	40 – 50	95 – 130
	Universal salt iodisation	15	200	45 – 55	110 – 140

Note: In this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

b. Australian children aged 1 year

	Scenario	Salt Fortification Level for Fortification	UL	Estimated dietary iodine intake (%UL)	
		(mg I/kg salt)	(µg/day)	Mean	95th percentile
Current	*Baseline*	-	200	40 – 45	100 – 120
Mandatory	*P230 DAR - Processed foods'*	15	200	50 – 55	120 – 140
	P230 DAR – Cereal-based foods	30	200	50 – 55	120 – 140
	Scenario 1 – Breads, breakfast cereals & biscuits	30	200	45 – 55	120 – 130
	Scenario 2 – Breads and breakfast cereals	40	200	50 – 55	120 – 130
	Scenario 3– Breads	45	200	50 – 55	120 – 130
	Universal salt iodisation	15	200	50 – 55	120 – 130

Note: In this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

Table A1.7: Estimated intake of salt (sodium chloride) from the breads proposed for mandatory iodine fortification

Country	Age Group	Estimated Intake of Salt (Sodium Chloride) from Breads Proposed for Mandatory Iodine Fortification (g/day)	
		Mean	95^{th} percentile
New Zealand	15-18 years	2.3	4.2
	19-29 years	2.2	4.1
	30-49 years	2.2	4.1
	50-69 year	2.0	3.5
	70 years and above	1.9	3.1
	15 years and above	2.1	3.9
	16-44 years female	1.8	3.0
Australia	2-3 years	1.0	1.5
	4-8 years	1.1	1.8
	9-13 years	1.3	2.1
	14-18 years	1.5	2.6
	19-29 years	1.5	2.8
	30-49 years	1.4	2.7
	50-69 year	1.3	2.5
	70 years and above	1.3	2.2
	2 years and above	1.4	2.5
	16-44 years female	1.2	1.8

Table A1.8: Estimated mean dietary iodine intakes for New Zealand and Australia for *Universal Salt Iodisation* and *Scenario 3 – Breads*

Country	**Age Group**	**Mean Dietary Iodine Intakes (ug/day)**	
		Universal Salt Iodisation	***Scenario 3 - Breads***
New Zealand	15-18 years	183	193
	19-29 years	179	190
	30-49 years	181	195
	50-69 years	170	185
	70 years & above	156	173
	15 years & above	175	189
	16-44 years females	157	172
Australia	2-3 years	147	133
	4-8 years	156	139
	9-13 years	185	160
	14-18 years	210	179
	19-29 years	208	177
	30-49 years	210	166
	50-69 years	176	158
	70 years & above	162	147
	2 years & above	191	162
	16-44 years females	177	146

Table A1.9: Estimated proportion of the population with inadequate dietary iodine intakes for New Zealand and Australia for *Universal Salt Iodisation* and *Scenario 3 – Breads*

Country	Age Group		Proportion of Population with Inadequate Iodine Intakes (%)	
			Universal Salt Iodisation	***Scenario 3 - Breads***
New Zealand	15-18 years		0	0
	19-29 years		1	0
	30-49 years		<1	0
	50-69 years		<1	0
	70 years & above		<1	0
	15 years & above		<1	0
	16-44 years females	Non-pregnant	1	0
		Pregnancy EAR	65	45
		Lactation EAR	86	77
Australia	2-3 years		<1	1
	4-8 years		<1	1
	9-13 years		<1	<1
	14-18 years		2	4
	19-29 years		2	6
	30-49 years		1	5
	50-69 years		1	5
	70 years & above		1	6
	2 years & above		1	5
	16-44 years females	Non-pregnant	3	9
		Pregnancy EAR	39	71
		Lactation EAR	65	88

Table A1.10: Estimated proportion of the population with mean dietary iodine intakes greater than the UL for New Zealand and Australia for *Universal Salt Iodisation* and *Scenario 3 – Breads*

Country	**Age Group**	**Proportion of Population with Iodine Intakes > UL (%)**	
		Universal Salt Iodisation	***Scenario 3 - Breads***
New Zealand	15-18 years	0	0
	19-29 years	0	0
	30-49 years	0	0
	50-69 years	<1	0
	70 years & above	0	0
	15 years & above	<1	0
	16-44 years females	0	0
Australia	2-3 years	11	6
	4-8 years	<1	<1
	9-13 years	<1	0
	14-18 years	0	0
	19-29 years	0	0
	30-49 years	0	0
	50-69 years	0	0
	70 years & above	0	0
	2 years & above	<1	<1
	16-44 years females	0	0

Appendix 2

Complete information on the dietary intake assessments for New Zealand children aged 5-14 years, as derived from the 200 New Zealand National Children's Nutrition Survey

Table A2.1: Estimated mean dietary iodine intakes for New Zealand children aged 5-14 years, as derived from the 2002 NZ CNS

Age Group	Estimated Mean Dietary Iodine Intake (µg/day)			
	NZ CNS Baseline	*NZ CNS Scenario 1 – Processed Foods*	*NZ CNS Scenario 2 – Cereal Based Foods*	*NZ CNS Scenario 3 – Breads*
5-8 years	50 – 95	120 – 140	125 – 145	106 – 151
9-13 years	54 – 99	138 – 158	140 – 160	119 – 164
14 years	64 – 109	161 – 181	164 – 184	137 – 182

Note: In this table, the lower number in the range is the mean dietary iodine intake of the population when discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake of the population group when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads* and 20 mg iodine/kg salt for *NZ CNS Scenario 1 – Processed Foods* and *NZ CNS Scenario 2 – Cereal Based Foods*.

Table A2.2: Estimated proportion of New Zealand children aged 5-14 years with inadequate dietary iodine intakes, as derived from the 2002 NZ CNS

Age Group	Estimated Proportion of the Population with Inadequate Dietary Iodine Intakes			
	NZ CNS Baseline	*NZ CNS Scenario 1 – Processed Foods*	*NZ CNS Scenario 2 – Cereal Based Foods*	*NZ CNS Scenario 3 – Breads*
5-8 years	13 – 79	5 – 14	5 – 16	2 – 26
9-13 years	28 – 81	7 – 17	8 – 18	6 – 28
14 years	54 – 85	15 – 23	12 – 24	11 – 33

Note: In this table, the lower number in the range is the estimated proportion of the population with inadequate dietary iodine intakes when all discretionary salt is iodised; the upper number in the range is the estimated proportion of the population with inadequate dietary iodine intakes when discretionary salt is non-iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads* and 20 mg iodine/kg salt for *NZ CNS Scenario 1 – Processed Foods* and *NZ CNS Scenario 2 – Cereal Based Foods*.

Table A2.3: Estimated proportion of New Zealand children aged 5-14 years with dietary iodine intakes above the UL, as derived from the 2002 NZ CNS

Age Group	Estimated Proportion of the Population with Dietary Iodine Intakes > UL			
	NZ CNS Baseline	***NZ CNS Scenario 1 – Processed Foods***	***NZ CNS Scenario 2 – Cereal Based Foods***	***NZ CNS Scenario 3 – Breads***
5-8 years	<1 – <1	2 – 2	2 – 3	1 – 3
9-13 years	<1 – <1	<1 – <1	<1 – <1	<1 – <1
14 years	<1 – <1	<1 – <1	<1 – <1	<1 – <1

Note: In this table, the lower number in the range is the estimated proportion of the population with dietary iodine intakes >UL when discretionary salt is non-iodised; the upper number in the range is the estimated proportion of the population with dietary iodine intakes >UL when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *NZ CNS Baseline* and for *NZ CNS Scenario 3 – Breads* and 20 mg iodine/kg salt for *NZ CNS Scenario 1 – Processed Foods* and *NZ CNS Scenario 2 – Cereal Based Foods*.

Attachment 3

Dietary Intake Assessment Report – Scenario 2 – Breads & Breakfast Cereals'

SUMMARY

The mandatory fortification of breads and breakfast cereals with iodine is proposed as a possible future mandatory fortification option. Consequently, a dietary intake assessment was conducted to assess the potential impact the introduction of mandatory fortification of breads and breakfast cereals with iodine in New Zealand and Australia would have on iodine intakes among the target groups of children aged up to 3 years, women of child-bearing age (assumed to be 16-44 years) and the population in general (New Zealand – 15 years and above; Australia – 2 years and above).

Salt was identified as the food vehicle for iodine fortification of the breads and breakfast cereals. At Final Assessment for P230, dietary modelling was conducted to assess the impact of replacing non-iodised salt in commercially manufactured breads and breakfast cereals with salt iodised at a level of 40 mg iodine per kg salt in conjunction with the voluntary iodisation of salt at 40 mg iodine per kg salt. The proposed level of salt iodisation for bread is lower than that for *Scenario 3 – Breads*, with the aim of achieving the same outcome from fortification of breads and breakfast cereals as that for breads only.

Dietary modelling was conducted for New Zealand and Australian populations to estimate:

1. current iodine intakes (***Baseline***) from food based on current naturally occurring iodine concentrations in foods and iodine concentrations in foods resulting from the uptake of voluntary fortification uses of iodine permitted in the Code; and

2. dietary iodine intakes if non-iodised salt is replaced with iodised salt containing 40 milligrams (mg) iodine per kg of salt in breads and breakfast cereals, with 35 mg iodine/kg salt remaining in the salt of fortified breads and breakfast cereals after baking/processing (**Scenario 2 – *Breads and breakfast cereals***) and where the voluntary permission for iodine fortification of discretionary salt (salt used in cooking and/or at the table) is reduced from 25-65 mg iodine/kg salt to 40 mg iodine/kg salt.

These dietary modelling scenarios did not take into account iodine intakes from supplements containing iodine.

The dietary intake assessment results indicated that mean iodine intakes would increase with mandatory fortification of breads and breakfast cereals – Scenario 2 – *Breads and breakfast cereals*. It should be noted that:

- When the use of discretionary salt is not considered, New Zealand has lower *Baseline* iodine intakes in milk in comparison to Australia, possibly due to the lower iodine concentration in milk. Milk is a major contributor to iodine intakes.

- When the use of iodised discretionary salt is considered across the population, New Zealand and Australia have similar mean dietary iodine intakes. In New Zealand, a greater proportion of salt is currently iodised (approximately 60%) in comparison to Australia (approximately 20%).

- For *Scenario 2 –Breads and breakfast cereals*, estimated 95th percentile dietary iodine intakes exceed the UL for New Zealand children aged 1-3 years (100-130% UL) and Australian children aged 1 year (120-130% UL), the upper end of each range being for children consuming one serve of formulated supplementary foods for young children (FSFYC), which have a higher concentration of iodine than ordinary milk.

- For Australian children aged 2-3 years, a greater proportion of the population group had estimated dietary iodine intakes that exceed the UL under *Scenario 2 – Breads and breakfast cereals* (8% of the population group) in comparison to *Baseline* (<1% of the population group).

- Of all of the population groups assessed, Australian children aged 2-3 years had the largest proportion of the group exceeding the UL.

- For *Scenario 2 – Breads and breakfast cereals*, there was a reduction in the proportion of the population with inadequate dietary iodine intakes from *Baseline* for all of the population groups assessed.

- As age increased, there was a general tendency for there to be a greater proportion of the population with inadequate dietary iodine intakes, particularly for the *Baseline* scenario.
- Of all of the population groups assessed, women aged 16-44 years had the highest proportions of the population group with inadequate dietary iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals* when their intakes were compared to the EARs for pregnancy and lactation.

- While *Scenario 2 – Breads and breakfast cereals* was predicted to produce a reduction in the proportion of the population groups with inadequate dietary iodine intakes in comparison to *Baseline*, the proportion of the population groups with dietary iodine intakes above the UL increased.

Dietary modelling conducted to estimate iodine intakes

The methodology used to assess dietary iodine intakes, the population groups assessed and the limitations and assumptions used in the assessments are discussed in Attachment 1.

The overall approach for conducting the dietary intake assessments is shown in Figure 1.

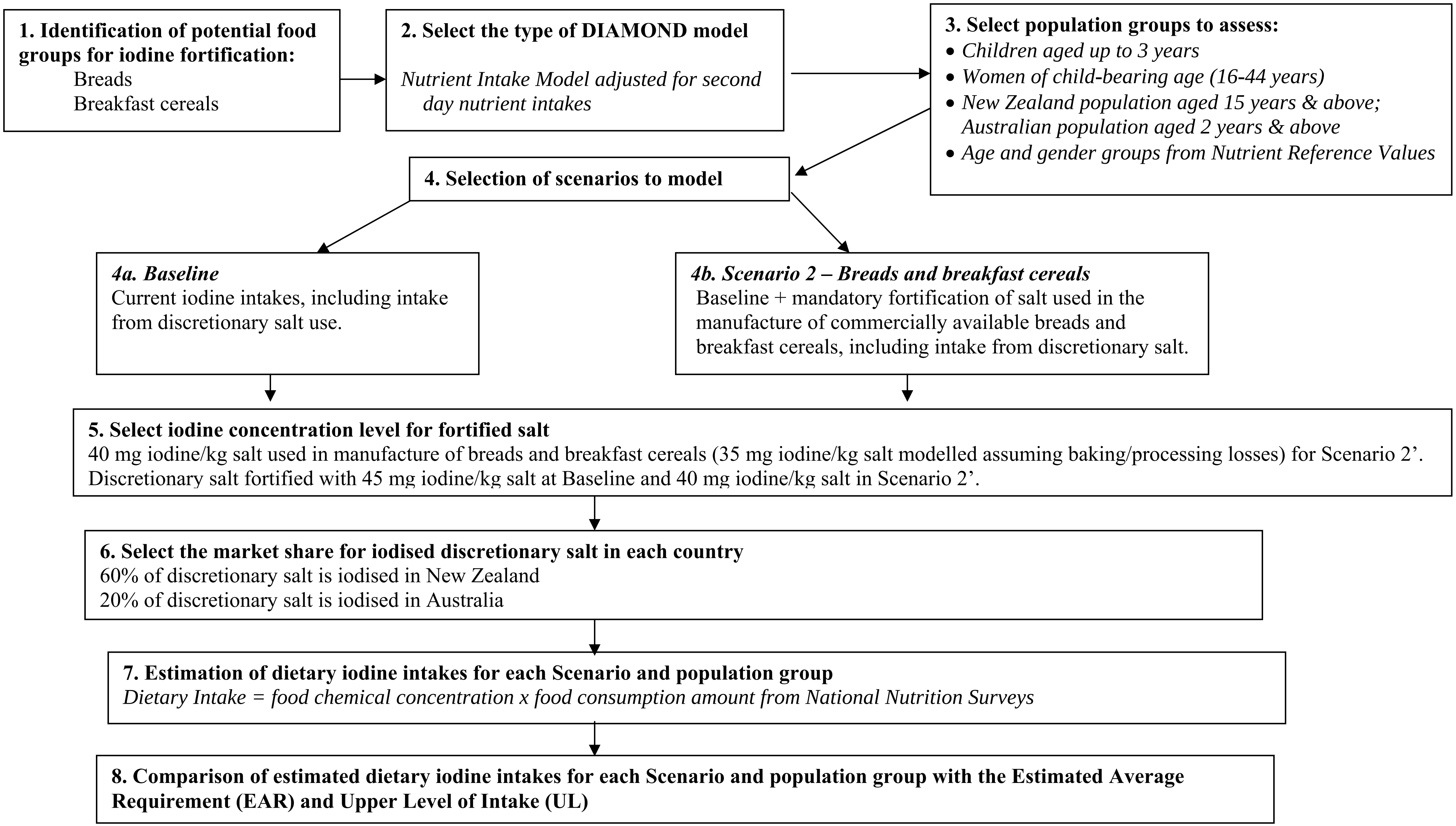

*Figure 1: Dietary Modelling approach used for assessing iodine intakes for New Zealand and Australia at Final Assessment for P230 (*Baseline *and* Scenario 2 – Breads and breakfast cereals*)*

Food vehicle

At Draft Assessment for P230, it was proposed that salt iodised at 30 mg iodine/kg salt would be used in the manufacture of breads, breakfast cereals and biscuits and voluntary discretionary salt iodisation would be reduced to 30 mg iodine/kg salt.

The issue of removing biscuits from mandatory iodine fortification was raised at Final Assessment for P230. The proportion of the target population groups consuming mandatorily iodine fortified foods was investigated in order to determine whether removing biscuits from mandatory iodine fortification would result in a substantial reduction in the proportion of the target population groups consuming mandatorily iodine fortified foods (see Figure 3 and Table A1.1 in Appendix 1 in Attachment 2). It was concluded that the removal of biscuits would result in a small drop in the proportion of the target group consuming mandatorily iodine fortified foods. This information was considered in conjunction with other issues (e.g. trade impact) and it was concluded that breads and breakfast cereals only would be considered for mandatory fortification with iodine at Final Assessment for P230. Consequently, dietary modelling was conducted to investigate the impact of using salt iodised at 40 mg iodine/kg salt in the manufacture of breads and breakfast cereals and the impact of changing voluntary discretionary salt iodisation to 40 mg iodine/kg salt. Taking into account a 10% loss in the iodine content of iodised salt on baking, it was deemed that the salt present in breads and breakfast cereals would contain 35 mg iodine/kg salt after baking/processing, for dietary intake assessment purposes. Figure 2 outlines the breads and breakfast cereals deemed to contain salt for dietary modelling purposes, based on information from food packages and food composition data.

Includes all yeast-containing plain white, white high fibre, wholemeal, grain and rye bread loaves and rolls that are baked; yeast-containing flat breads that are baked (e.g. pita bread, naan bread); focaccia; bagels (white, wholemeal, sweet); topped breads and rolls (e.g. cheese and bacon rolls); English muffins (white, white high fibre, grain, wholemeal and fruit); sweet buns; fruit breads and rolls; breadcrumbs, croutons, breakfast cereals

Excludes steamed breads; breads cooked by frying (e.g. puri/poori); yeast-free breads (e.g. chapatti, tortilla); gluten-free breads; doughnuts; pizzas and pizza bases; scones; pancakes, pikelets and crepes; crumpets; slices and bread mixes intended for home use.

Figure 2: Foods assumed contain salt for dietary modelling purposes

Scenario definition

Dietary intake assessments were conducted to estimate potential dietary iodine intakes for each population group should mandatory iodine fortification of salt used in breads and breakfast cereals be introduced in New Zealand and Australia at 40 mg iodine per kg of salt.

In ***Scenario 2 – Breads and breakfast cereals*****,** non-iodised salt was replaced with iodised salt containing 40 mg iodine per kg of salt in breads and breakfast cereals, with 35 mg iodine/kg salt remaining in fortified breads and breakfast cereals after baking/processing. The voluntary permission for iodine fortification of discretionary salt was reduced from 25-65 mg iodine/kg salt to 40 mg iodine/kg salt.

For *Scenario 2 – Breads and breakfast cereals*, the iodine concentrations present in discretionary salt were reduced to allow iodised discretionary salt to have the same iodine concentration as the salt that is mandatorily iodised for use in the manufacture of breads and breakfast cereals.

The dietary intake assessments did not take into account iodine from the use of iodine supplements or multi-vitamin supplements containing iodine. Additionally, potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. This will be captured in any future monitoring programs.

Within the *Baseline* and *Scenario 2 – Breads and breakfast cereals* dietary intake estimates, two different model types were assessed:

(a) market weighted model; and
(b) consumer behaviour models.

The market share and consumer behaviour model types are discussed in detail in the main dietary intake assessment report.

The iodine concentrations in foods that were used in the dietary intake estimates are discussed in detail in Attachment 1.

Market Weighted Discretionary Salt Model Results

The results from the 'market weighted discretionary salt' models are representative of mean **population** intakes over a period of time and reflect that currently approximately 60% is iodised in New Zealand and 20% of discretionary salt is iodised in Australia.

Estimated mean dietary iodine intakes

Dietary iodine intakes were estimated for *Scenario 2 – Breads and breakfast cereals* to assess the impact that mandatory fortification of breads and breakfast cereals could have on iodine intakes in the target groups, should breakfast cereals become an option for mandatory fortification in the future. Dietary iodine intakes were estimated for non-target groups aged between 4 and 18 years to assess the impact that mandatory fortification from *Scenario 2 – Breads and breakfast cereals* may have on public health and safety, specifically on the proportion of the population group or sub-group estimated to exceed the UL for iodine.

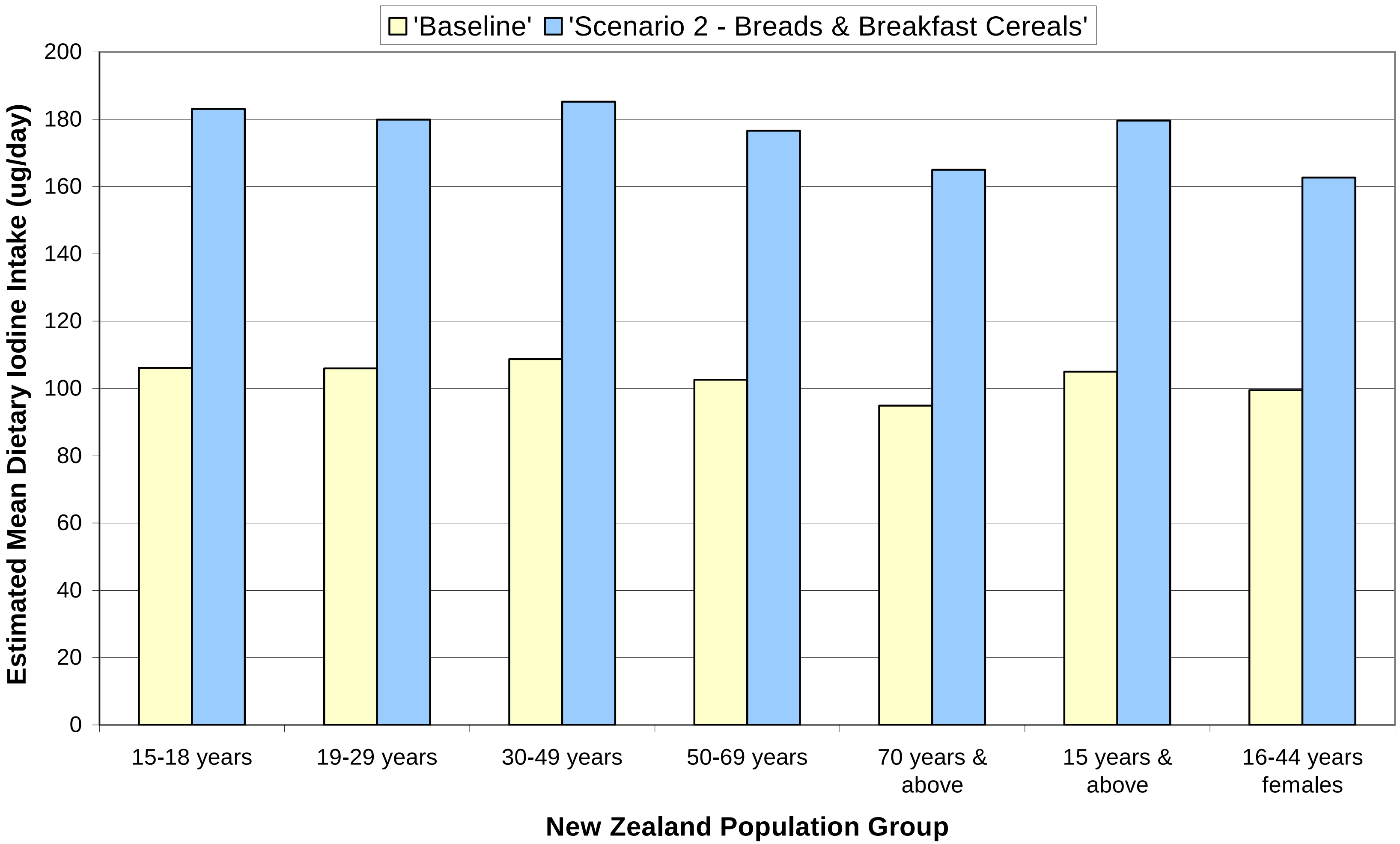

Figure 3: Market Weighted Model: Estimated mean dietary iodine intakes for New Zealand population groups

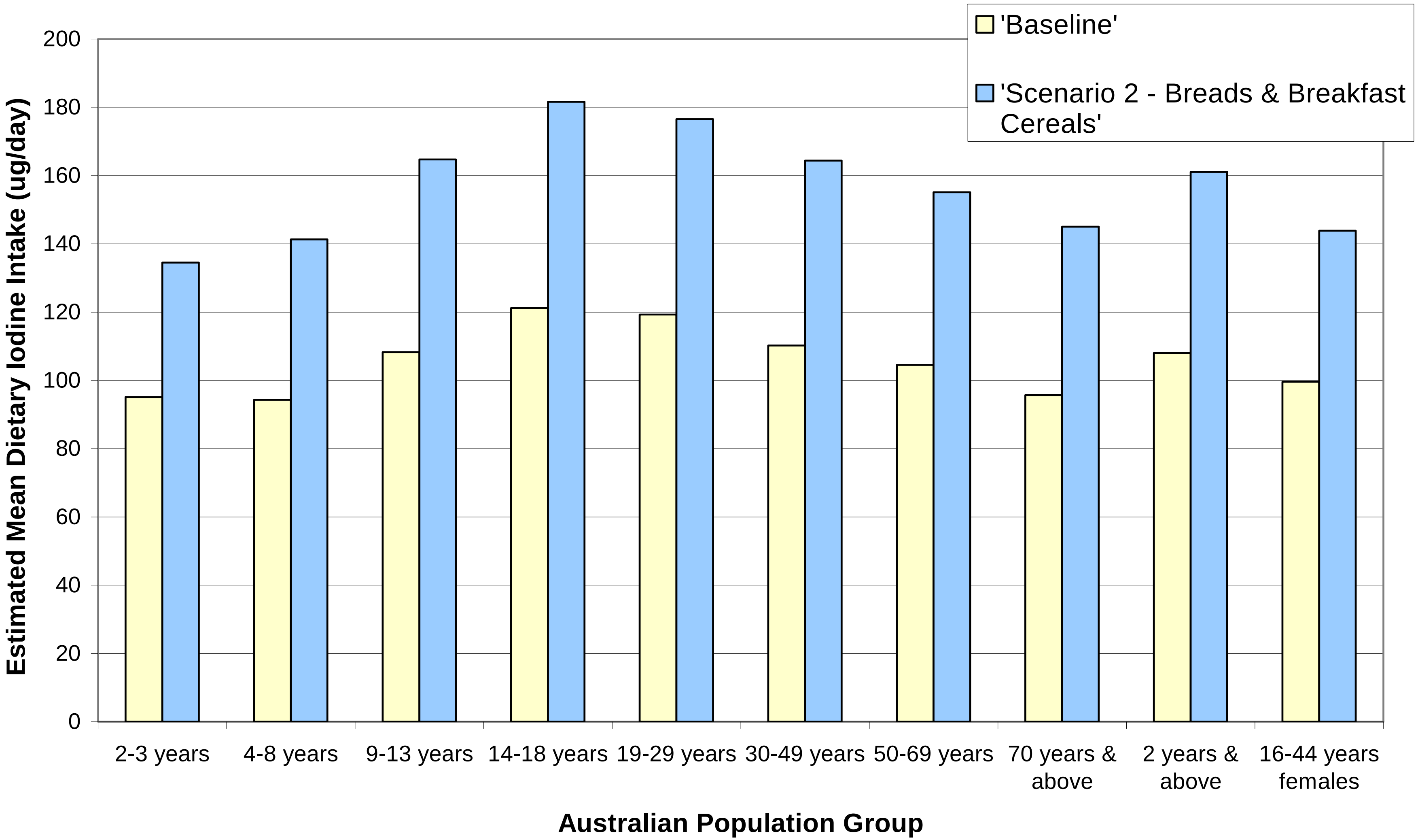

Figure 4: Market Weighted Model: Estimated mean dietary iodine intakes for Australian population groups

For all population groups assessed for New Zealand and Australia, there was an increase in estimated mean dietary iodine intakes from *Baseline* to *Scenario 2 – Breads and breakfast cereals*. Refer to Figure 3 and Figure 4 for an overview of mean dietary iodine intakes for New Zealand and Australian population groups, respectively. Additional details can be found in Table A1.1 in Appendix 1. The results indicate that the New Zealand population groups have slightly lower *Baseline* and slightly higher *Scenario 2 – Breads and breakfast cereals* mean dietary iodine intake in comparison to the Australian population groups.

Estimated increases in iodine intakes

The results show an increase in estimated dietary iodine intakes from *Baseline* to *Scenario 2 – Breads and breakfast cereals* for the target groups and all other population groups assessed. The incremental increase in iodine intake from *Baseline* for the target groups of women of child bearing age (16-44 years) and children aged 2-3 years is shown in Table 1.

Table 1: Market Weighted Model: Estimated increases in mean iodine intakes for target groups should mandatory fortification of salt in breads and breakfast cereals at 40 mg iodine/kg salt be introduced

Country	**Population group**	***Baseline* mean dietary iodine intake (µg/day)**	**Increase in mean iodine intake from *Baseline* (µg/day)**
			Scenario 2 – Breads and breakfast cereals
Australia	Children 2-3 years	95	+40
	Women 16-44 years	100	+44
New Zealand	Women 16-44 years	99	+64

Estimated proportion of the population with inadequate dietary iodine intakes

In order to determine if the proposed level of addition of iodine to salt for use in the manufacture of breads and breakfast cereals will have the potential to address any inadequate iodine intakes in the New Zealand and Australian population groups, the estimated dietary iodine intakes from the market weighted models were compared with the Estimated Average Requirement (EAR). The EARs used in this assessment are shown in Appendix 3, noting that the EARs for women who are pregnant and lactating are much higher than for other women of the same age. When certain conditions are met, the proportion of the population group with intakes below the EAR can be used to estimate the prevalence of inadequacy (Health Canada, 2006c). The proportions of the population groups with dietary iodine intakes below the EAR were assessed and used as an estimation of the prevalence of inadequate iodine intakes.

The estimated dietary intakes for iodine were determined for each individual and were compared to the relevant EAR for their age group and gender. The proportion of each population group with dietary iodine intakes estimated to be inadequate is shown in Figure 5 for New Zealand and Figure 6 for Australian target population groups and the non-target groups of children aged between 4 and 18 years.

Full details of the estimated proportions of each population group with inadequate dietary iodine intakes can be found in Table A3.1 in Appendix 3.

For all New Zealand and Australian population groups assessed, the *Baseline* scenario had the highest estimated proportion of respondents with inadequate dietary iodine intakes. The population group with the highest estimated proportion of respondents with inadequate dietary iodine intakes were women aged 16-44 years when their intakes were compared with the EAR for lactating women. Comparing the intakes of 16-44 year old females with the EAR for pregnant women produced the second highest proportion of respondents with inadequate dietary iodine intakes. These proportions remain high, even under the fortification scenarios being considered.

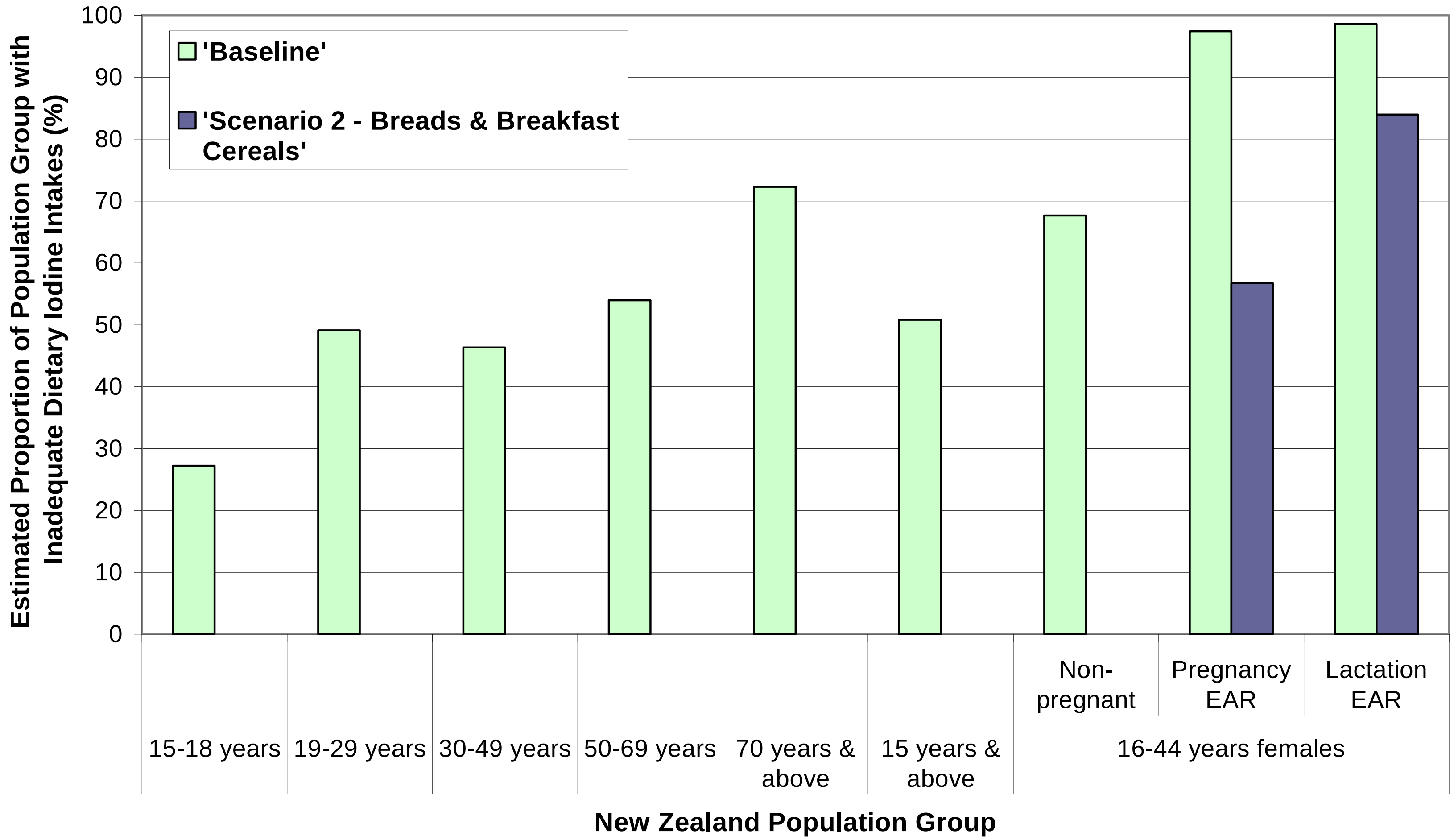

Figure 5: Market Weighted Model: Estimated proportion of New Zealand population groups with inadequate dietary iodine intakes for Baseline *and* Scenario 2 – Breads and breakfast cereals

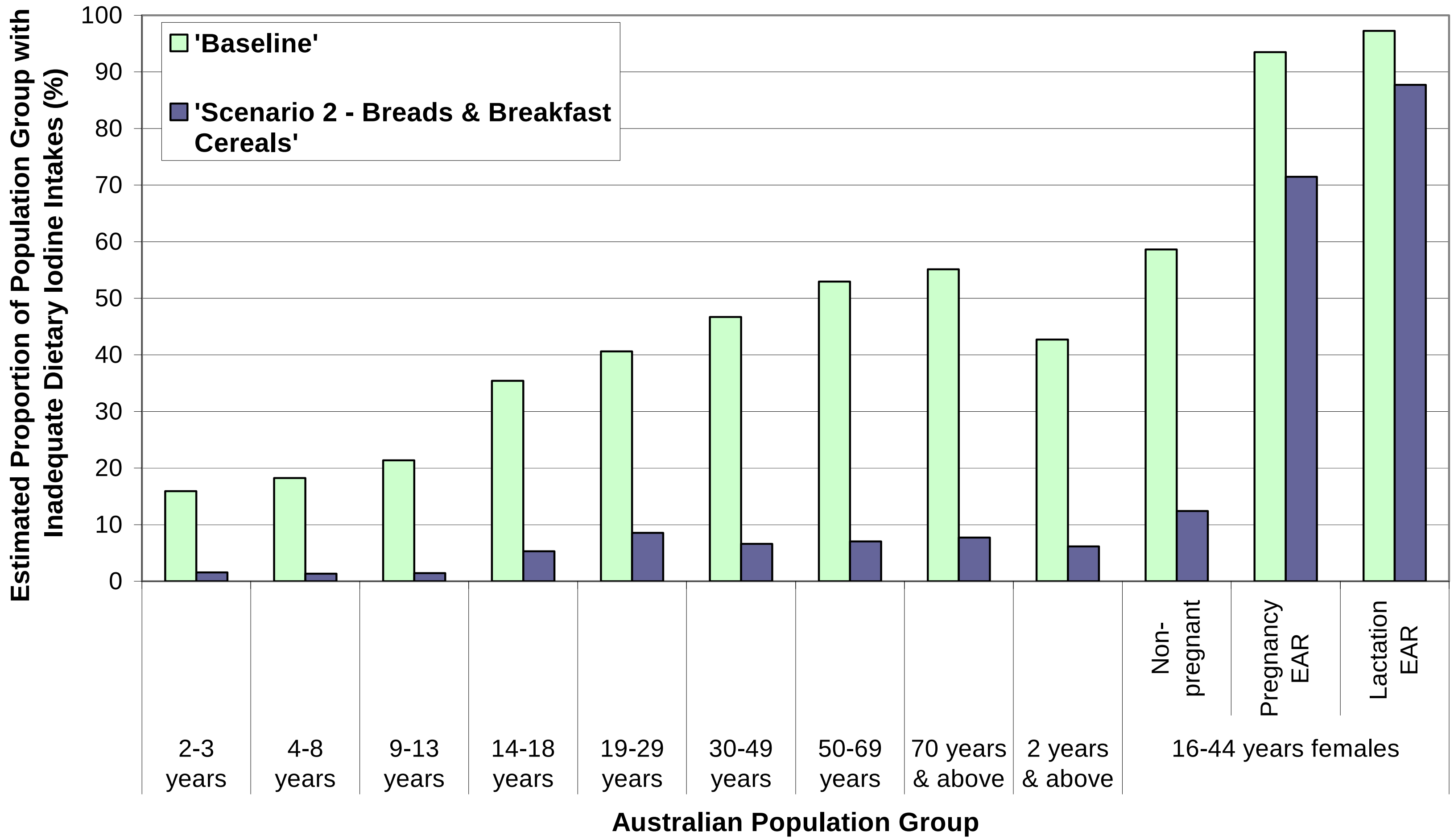

Figure 6: Market Weighted Model: Estimated proportion of Australian population groups with inadequate dietary iodine intakes for Baseline *and* Scenario 2 – Breads and breakfast cereals

Comparison of the estimated dietary intakes with the Upper Level of Intake (UL)

In order to determine if the proposed level of addition of iodine to salt for use in the manufacture of breads and breakfast cereals will be of concern to public health and safety, the estimated dietary iodine intakes from the market weighted models were compared with the Upper Level of Intake (UL).

The estimated dietary intakes for iodine were determined for each individual respondent in the 1995 and 1997 NNSs and were compared to the relevant UL for their age group and gender. Full details of the proportions of each population group above the UL can be found in Table A3.2 in Appendix 3.

For New Zealanders aged 15 years and above, the estimated proportion of the population with dietary iodine intakes that exceeded the UL for *Baseline* and *Scenario 2 – Breads and breakfast cereals* was zero.

For all Australian population groups aged 2 years and above, less than 1% of the population had dietary iodine intakes that exceeded the UL for *Baseline*. For *Scenario 2 – Breads and breakfast cereals*, Australian children aged 2-3 years had the greatest proportion of the population that exceeded the UL (8%). The proportion of 4-8 year old children with iodine intakes above the UL was less than 1% of the population for *Scenario 2 – Breads and breakfast cereals*.

In order to assess any potential risks of current (*Baseline*) and future (*Scenario 2 – Breads and breakfast cereals*) iodine intakes for Australian children aged 2-3 years and 4-8 years, maximum dietary iodine intakes and the proportion of these population groups with dietary iodine intakes above 300 µg per day[12] were estimated. These data are outlined in Table 2.

Table 2: Market Weighted Model: Maximum estimated dietary iodine intakes and proportion of the population with intakes > 300 µg/day for Australian children aged 2-8 years for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

Scenario	Maximum Estimated Iodine Intake (µg/day)		Proportion of Population Group With Iodine Intakes > 300 µg/day	
	2-3 years	4-8 years	2-3 years	4-8 years
Baseline	208	256	0	0
Scenario 2 – Breads and breakfast cereals	324	328	<1	<1

[12] A level of 300 µg/day was chosen as a basis for comparison as it represents the maximum daily intake that remains within the 1.5 fold safety margin for the UL derived for 1-3 year old children (200 µg/day). Intakes up to 300 µg/day should therefore be well tolerated by young children. Less certainty exists in relation to intakes above 300 µg/day for 1-3 year olds.

Consumer Behaviour Discretionary Salt Model Results

In the 'consumer behaviour discretionary salt models' all results are presented as ranges (mean dietary iodine intakes, proportions of the population groups with inadequate dietary iodine intakes and with intakes above the UL). The lower number in the range indicates iodine intakes for individuals who always select non-iodised salt for discretionary use (at the table and in the cooking/preparation of food); the upper number in the range indicates iodine intakes for individuals who always select iodised salt for discretionary use.

Estimated mean dietary iodine intakes

Dietary iodine intakes were estimated for *Scenario 2 – Breads and breakfast cereals* to assess the impact that mandatory fortification of breads and breakfast cereals could have on iodine intakes in the target groups if breakfast cereals become an option for mandatory fortification in the future. Dietary iodine intakes were also estimated for non-target groups aged between 4 and 18 years to assess the impact that mandatory fortification from *Scenario 2 – Breads and breakfast cereals* may have on public health and safety, specifically on the proportion of the population group or sub-group estimated to exceed the UL for iodine.

Results for young children

Mean dietary iodine intakes for New Zealand children aged 1-3 years and for Australian children aged 1 year were calculated using 'theoretical diets'. The range of dietary iodine intakes takes into consideration a previously assessed application (A528 – Maximum Iodine Limit in Formulated Supplementary Foods for Young Children) for changing permitted iodine levels in formulated supplementary foods for young children (FSFYC) or 'toddler milks'. The lower number in the results (presented as a range) represents a situation where no FSFYC or 'toddler milks' are consumed; the upper number in the range represents a situation where 1 serve (226 g) of FSFYC is consumed per day instead of cow's milk.

For *Baseline* and *Scenario 2 – Breads and breakfast cereals*, Australian children aged 1 year had higher mean dietary iodine intakes in comparison to New Zealand children aged 1-3 years (refer to Table A2.1 in Appendix 2 for details). The differences between New Zealand and Australia could be due to (1) the lower milk iodine concentration in New Zealand in comparison to Australia; (2) the different age groups being assessed; and/or (3) the different methods of constructing the theoretical diets. *Scenario 2 – Breads and breakfast cereals* gave higher mean dietary iodine intakes for New Zealand children aged 1-3 years and Australian children aged 1 year in comparison to the *Baseline*.

Results for all other population groups

For all other population groups, mean dietary iodine intakes were derived from the 1995 and 1997 NNSs. A range of dietary iodine intakes are presented; the lower number in the range represents a situation where non-iodised discretionary salt is consumed, and the upper number in the range represents where iodised discretionary salt is consumed. For New Zealand, it was assumed that all respondents in the NNS were consumers of discretionary salt. For Australia, it was assumed that 62% of respondents in the NNS were consumers of discretionary salt. Figure 7 and Figure 8 show the estimated mean dietary iodine intakes for New Zealand and Australian population groups, respectively. Full details can be found in Table A2.2 in Appendix 2.

There was an increase in estimated mean dietary iodine intakes from *Baseline* to *Scenario 2 – Breads and breakfast cereals* for all population groups assessed for New Zealand and Australia. The results indicate that the New Zealand population aged 15 years and above had a lower *Baseline* mean iodine intake compared to Australians aged 2 years and above. For women aged 16-44 years, New Zealanders had a lower *Baseline* iodine intake in comparison to Australians. The lower mean iodine intakes in New Zealand could be due to the lower iodine contents of some key foods, such as milk, in comparison to Australia.

Estimated increases in iodine intakes

The results show an increase in estimated dietary iodine intakes from *Baseline* to *Scenario 2 – Breads and breakfast cereals* for the target groups and all other population groups assessed. The incremental increase in iodine intake from *Baseline* for the target groups of children 2-3 years and women of child bearing age (16-44 years) are shown in Table 3.

The results indicate that, for New Zealand women aged 16-44 years, the increase in mean dietary iodine intakes from *Baseline* is higher in comparison to Australian women aged 16-44 years.

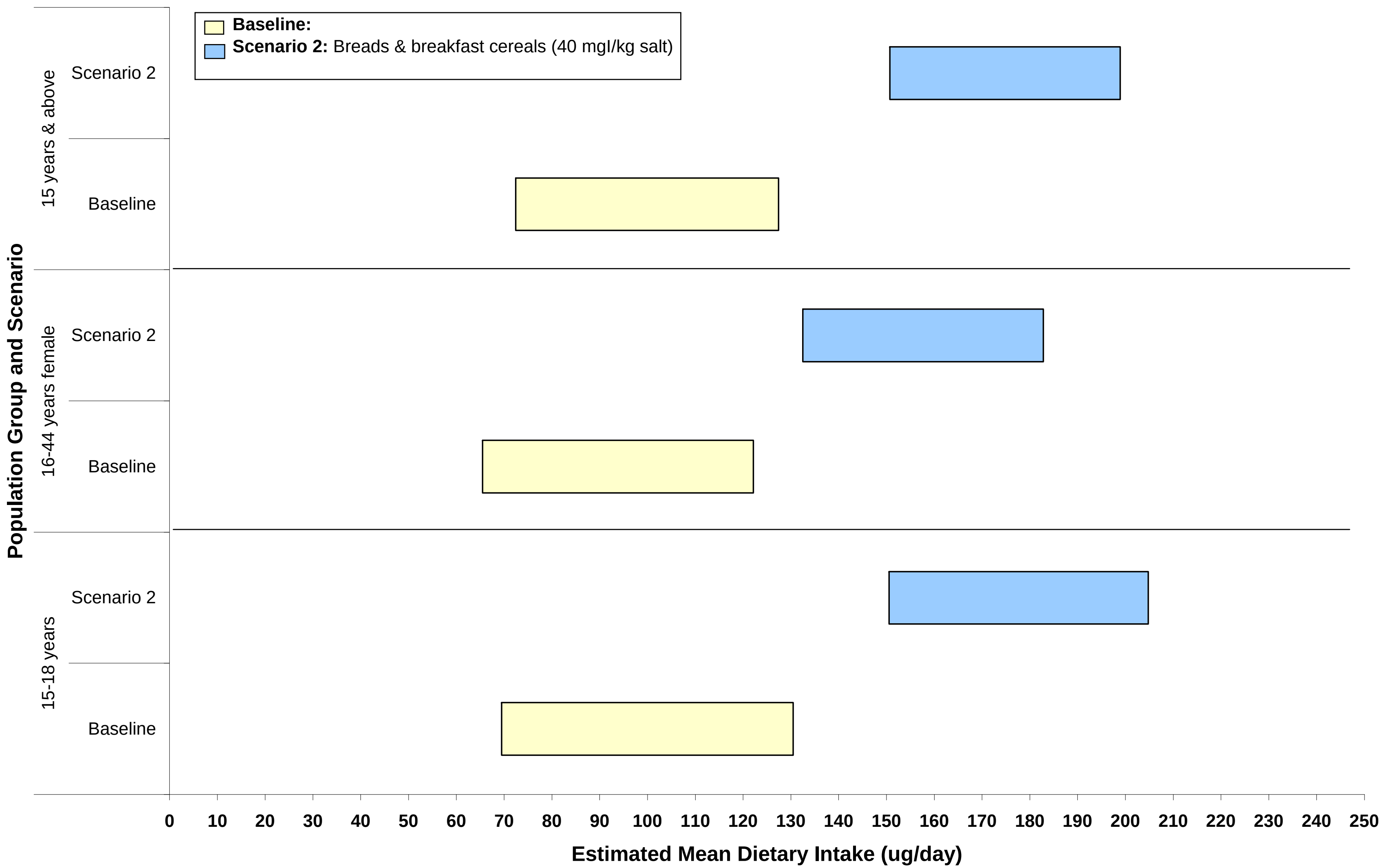

Figure 7: Consumer Behaviour Model: Estimated mean dietary iodine intakes for New Zealand population groups

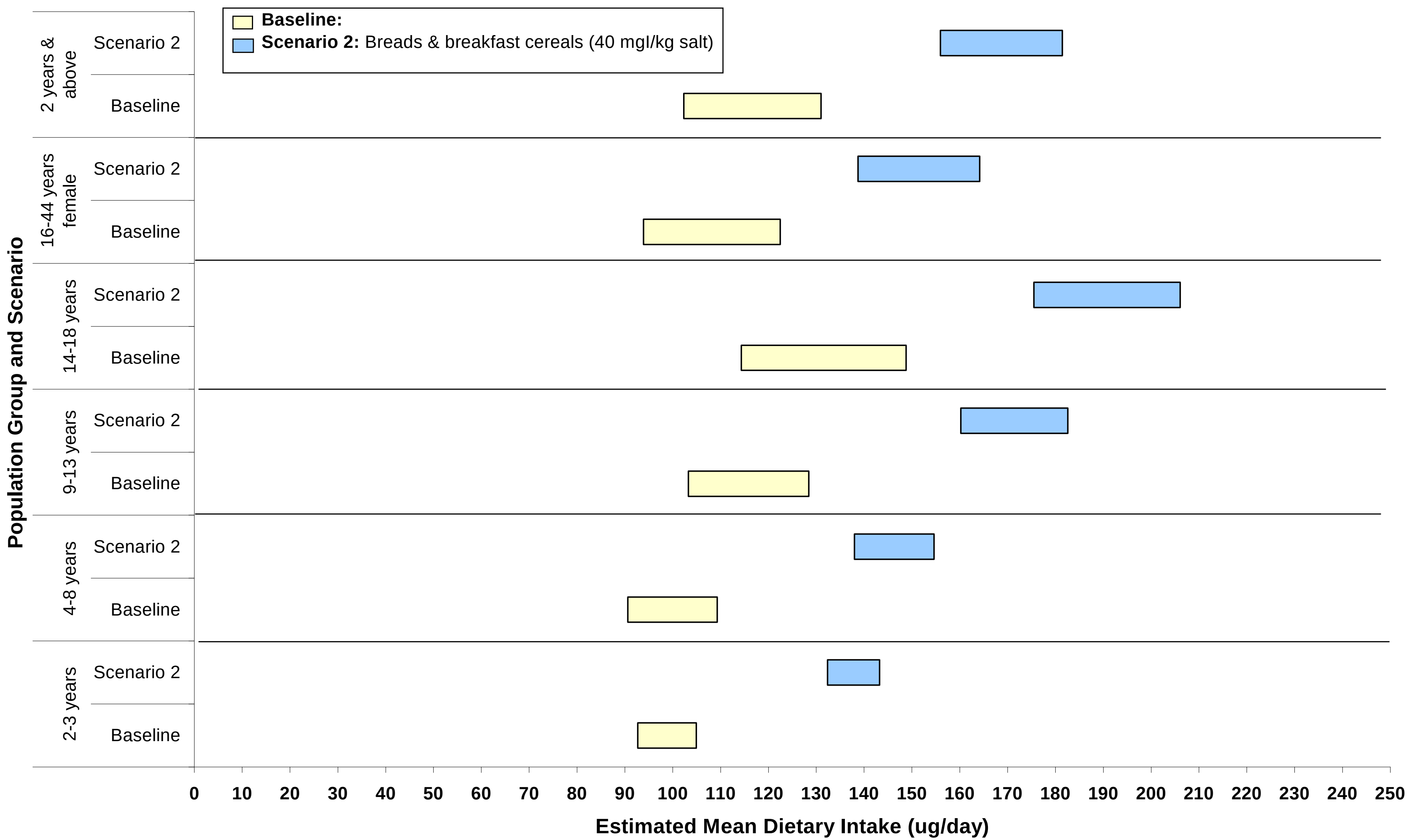

Figure 8: Consumer Behaviour Model: Estimated mean dietary iodine intakes for Australian population groups

Table 3: Consumer behaviour model: Estimated increases in mean iodine intakes for target groups should mandatory fortification of salt in breads and breakfast cereals at 40 mg iodine/kg salt be introduced

a. Based on theoretical diets

Country	**Population group**	***Baseline* mean dietary iodine intake (µg/day)**		**Increase in mean iodine intake from Baseline (µg/day)**	
		Without FSFYC	With FSFYC	Without FSFYC	With FSFYC
New Zealand	Children 1-3 years	48	72	+32	+32
Australia	Children 1 year	79	92	+17	+16

b. Based on NNS data

Country	**Population group**	***Baseline* mean dietary iodine intake (µg/day)**	**Increase in mean iodine intake from *Baseline* (µg/day)**
New Zealand	Women 16-44 years	66 – 122	+66 – 61
Australia	Children 2-3 years	93 – 105	+39 – 38
	Women 16-44 years	94 – 122	+45 – 42

Note: in this table, the lower number in the range is the mean dietary iodine intake when all discretionary salt is not iodised; the upper number in the range is the mean dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and 40 mg iodine/kg salt for *Scenario 2 – Breads and breakfast cereals*.

Major contributors to iodine intakes

The major foods contributing ≥5% to total iodine dietary intakes are shown in Figure 9-Figure 15 for children aged up to 3 years, women aged 16-44 years, and the New Zealand population aged 15 years and above and the Australian population aged 2 years and above. A full list of all the food groups and their contributions can be found in Table A2.3 and Table A2.4 in Appendix 2. The calculations for major contributing foods were based on intakes derived from the first 24-hour recall data only and do not include discretionary iodised salt consumption.

New Zealand children aged 1-3 years

When FSFYC were not included in the theoretical diet, milk, yoghurt and eggs were major contributors to iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals*. For *Scenario 2 – breads and breakfast cereals*, white and wheatmeal breads were also major contributors to iodine intakes. When FSFYC were included in the theoretical diet, the major contributor to iodine intake was FSFYC for all scenarios considered. At *Baseline*, eggs and yoghurt were major contributors and for *Scenario 2 – breads and breakfast cereals*, white bread was a major contributor to iodine intakes.

It was assumed that 1-3 year old New Zealand children do not have iodine intakes from discretionary salt use.

Australian children aged 1 year

When FSFYC were not included in the theoretical diet, milk was the major contributor to iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals*. Bread was also a major contributor for *Scenario 2 – Breads and breakfast cereals*.

When FSFYC were included in the diet, the major contributor to iodine intake was FSFYC, followed by milk for both *Baseline* and *Scenario 2 – Breads and breakfast cereals*.

It was assumed that 1 year old children do not have iodine intakes from discretionary salt use.

Australian children aged 2-3 years

When the consumption of discretionary iodised salt was not included in the dietary intake assessment, the major contributor to iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals* was milk, milk products and dishes. At *Baseline*, non-alcoholic beverages was a major contributor with cereals and cereal products (grains, flours, breakfast cereals, pastas, noodles etc.) were also major contributors to iodine intakes for *Scenario 2 – Breads and breakfast cereals*.

Women aged 16-44 years

For New Zealand women aged 16-44 years, the major contributor to iodine intakes was milk for *Baseline* and bread (includes rolls and specialty breads) for *Scenario 2 – Breads and breakfast cereal'*. Milks, fish/seafood, and eggs and egg dishes were major contributors to iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereal'*. At *Baseline*, non-alcoholic beverages and grains and pasta were major contributors to iodine intakes.

For Australian women aged 16-44 years, the major contributor to iodine intakes for *Baseline* was milk, milk products and dishes, with non-alcoholic beverages, water, cereal-based products and dishes, cereals and cereal products and fish and seafood products and dishes being other major contributors. For *Scenario 2 – Breads and breakfast cereals*, cereals and cereal products were the major contributor to iodine intakes with milk, milk products and dishes, non-alcoholic beverages, water, and cereal-based products and dishes being other major contributors to iodine intakes.

Further details on the percentage contribution of various foods to estimated dietary iodine intakes, including definitions of the types of foods in the major contributor food groups, can be found in Table A2.4 in Appendix 2.

New Zealand population aged 15 years and above and the Australian population aged 2 years and above

For Australians aged 2 years and above, the major contributors to iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals* were similar to those for the target groups, that is milk, milk products and dishes, non-alcoholic beverages, water, cereal-based products and dishes, and cereals and cereal products. Fish and seafood products and dishes were also major contributors to iodine intakes for *Baseline*.

For New Zealanders aged 15 years and above, the major contributors to iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals* were milk, fish/seafood, and eggs and egg dishes. For *Baseline*, non-alcoholic beverages were a major contributor to iodine intakes while, for *Scenario 2 – Breads and breakfast cereals*, bread (includes rolls and specialty breads) was a major contributor to iodine intakes.

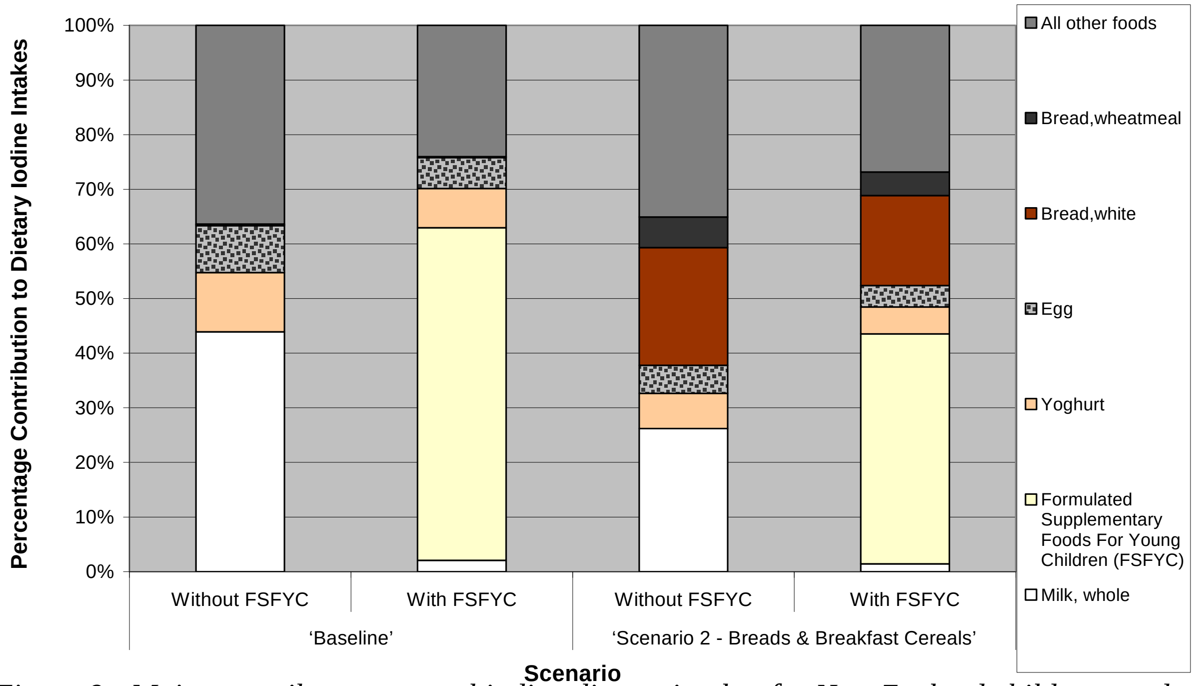

Figure 9: Major contributors to total iodine dietary intakes for New Zealand children aged 1-3 years[13]

[13] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

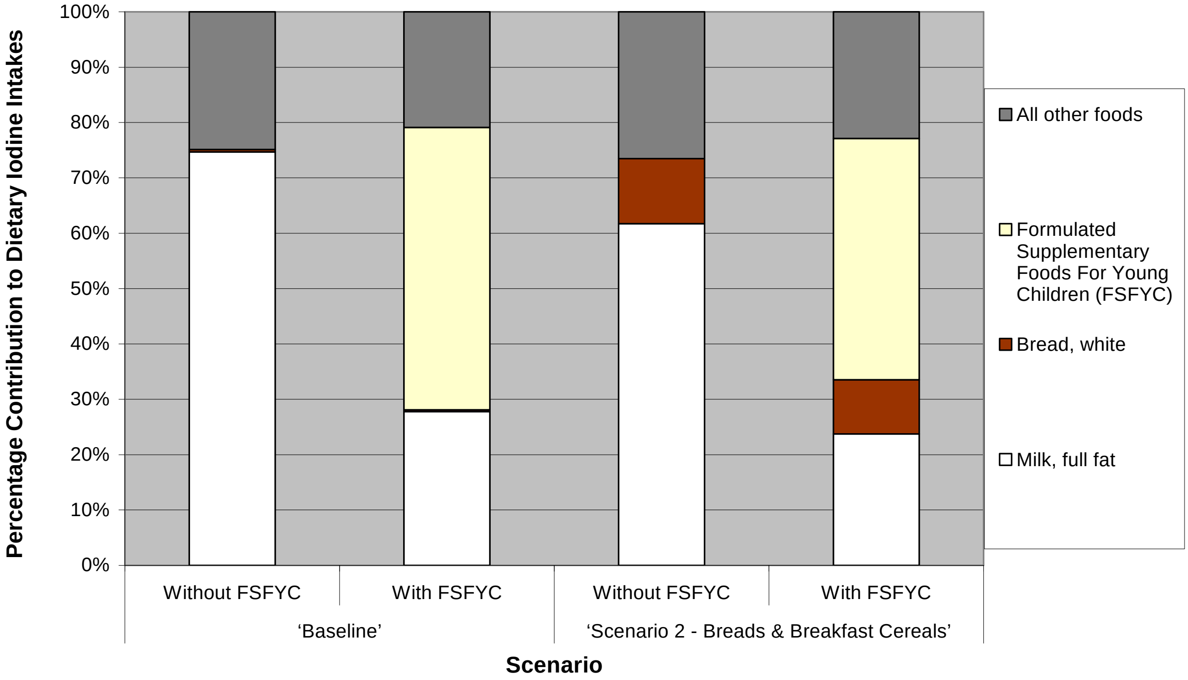

Figure 10: Major contributors to total iodine dietary intakes for Australian children aged 1 year[14]

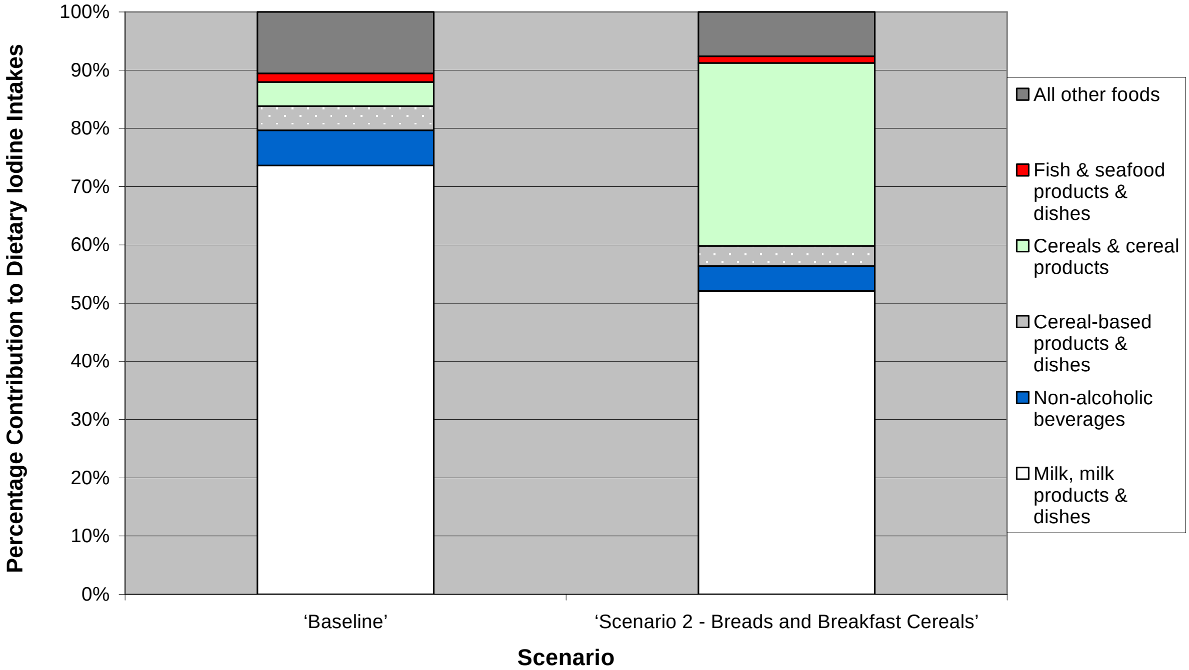

Figure 11: Major contributors to total iodine dietary intakes for Australian children aged 2-3 years[2]

[14] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

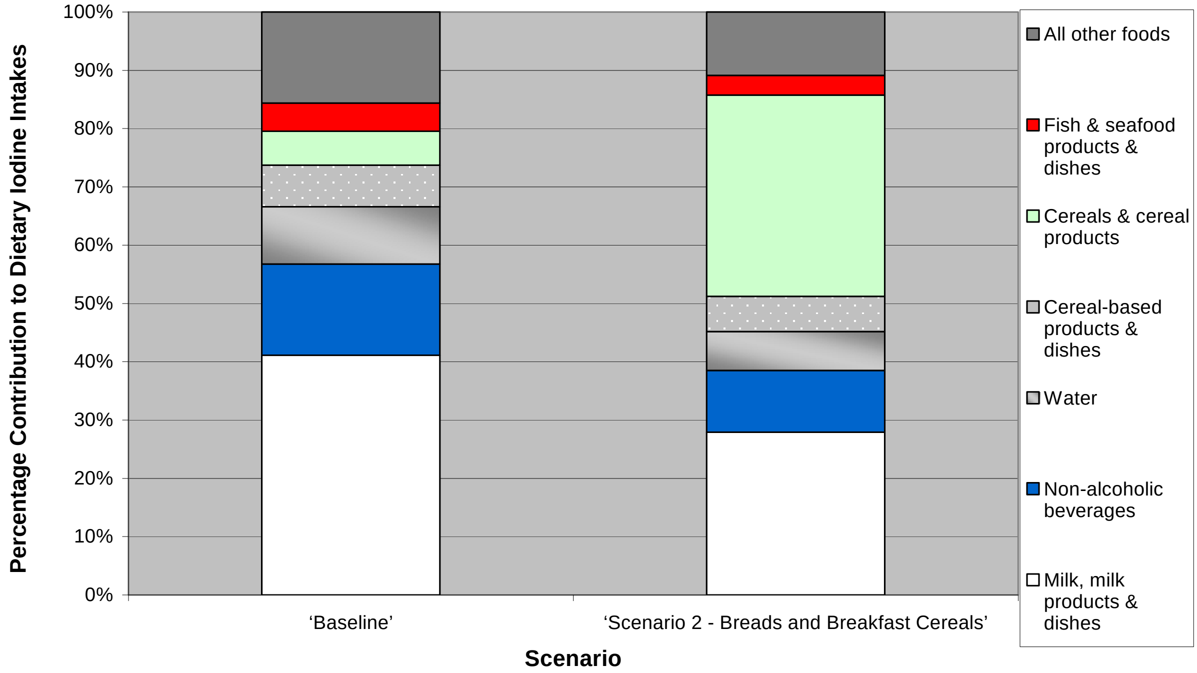

Figure 12: Major contributors to total iodine dietary intakes for Australian women aged 16-44 years[15]

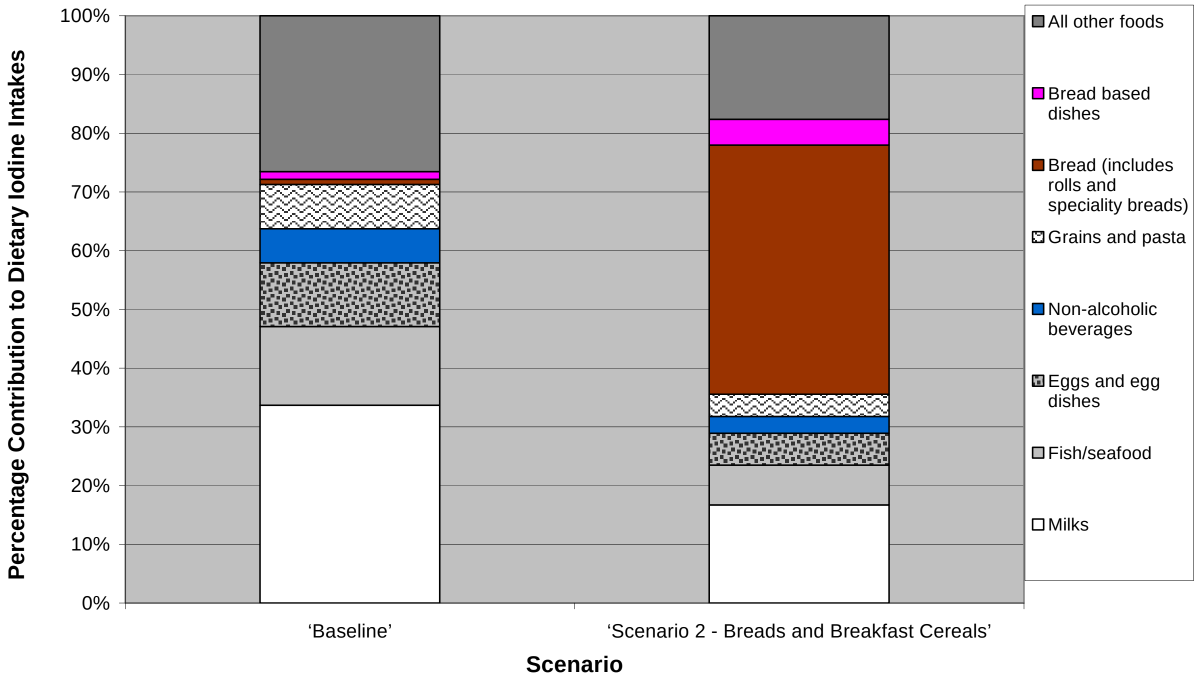

Figure 13: Major contributors to total iodine dietary intakes for New Zealand women aged 16-44 years[3]

[15] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

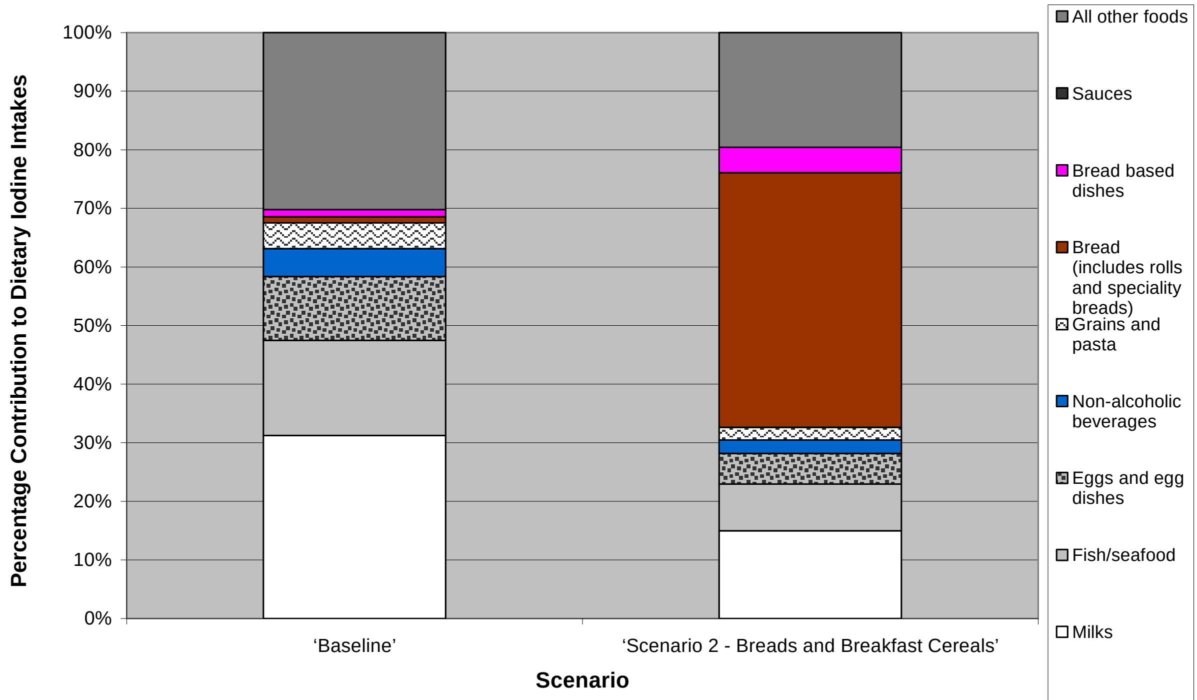

Figure 14: Major contributors to total iodine dietary intakes for New Zealanders aged 15 years and above[4]

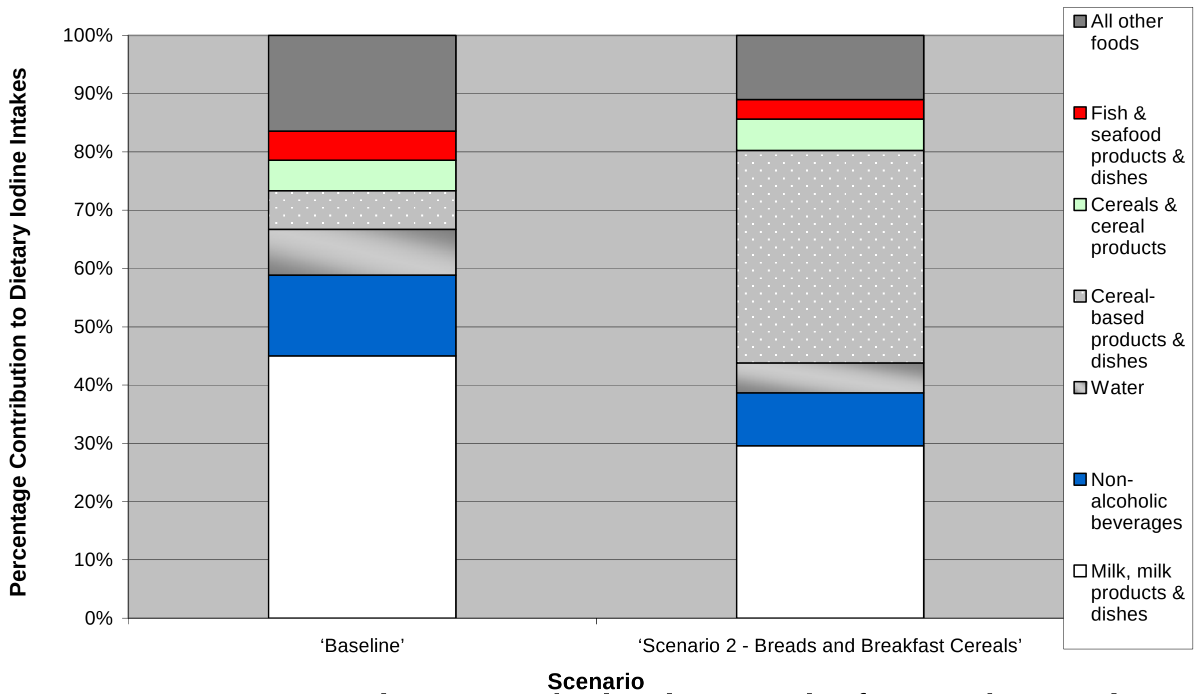

Figure 15: Major contributors to total iodine dietary intakes for Australians aged 2 years and above[16]

[16] The percent contribution of each food group is based on total iodine intakes for all consumers in the population groups assessed. Therefore the total iodine intakes differ for each population group and each scenario. Only the major contributors for each scenario are shown separately.

Estimated proportion of the population with inadequate dietary iodine intakes

In order to determine if the proposed level of addition of iodine to salt for use in the manufacture of breads and breakfast cereals will have the potential to address inadequate iodine intakes in the New Zealand and Australian population groups, the estimated dietary iodine intakes from the consumer behaviour models were compared with the EAR.

Dietary iodine intakes for New Zealand children aged 1-3 years and for Australian children aged 1 year were calculated using a 'theoretical diet'. Consequently, the proportion of these population groups with inadequate dietary iodine intakes could not be determined. Therefore it was simply compared to the EAR and expressed as a proportion of the EAR. For New Zealand children aged 1-3 years, estimated *Baseline* mean dietary iodine intakes were below the EAR when FSFYC were not considered, with estimated mean dietary iodine intakes above the EAR for *Scenario 2 – Breads and breakfast cereals*. For both *Baseline* and *Scenario 2 – Breads and breakfast cereals*, estimated mean dietary iodine intakes were above the EAR for Australian children aged 1 year.

For all other population groups, dietary iodine intakes were derived from the 1995 and 1997 NNSs. The estimated dietary intakes for iodine were determined for each individual and were compared to the relevant EAR for their age group and gender. The estimated proportion of each population group with inadequate dietary iodine intakes is shown in Figure 16 for New Zealand target population groups, Figure 17 for Australian target population groups and the non-target groups of children aged between 4 and 18 years (full details in Table A4.1 in Appendix 4).

The estimated proportion of each population group with inadequate dietary iodine intakes is presented as a range; the lower number in the range represents where iodised discretionary salt is consumed, and the upper number in the range represents where non-iodised discretionary salt is consumed.

For all New Zealand and Australian population groups assessed, *Baseline* had the highest estimated proportion of respondents with inadequate dietary iodine intakes compared to *Scenario 2 – Breads and breakfast cereals*. The population group with the highest estimated proportion of respondents with inadequate dietary iodine intakes were women aged 16-44 years when their intakes were compared with the EAR for lactating women. Comparing the intakes of 16-44 year old females with the EAR for pregnant women produced the second highest proportion of respondents with inadequate dietary iodine intakes. These proportions remain high, even under the fortification scenarios being considered.

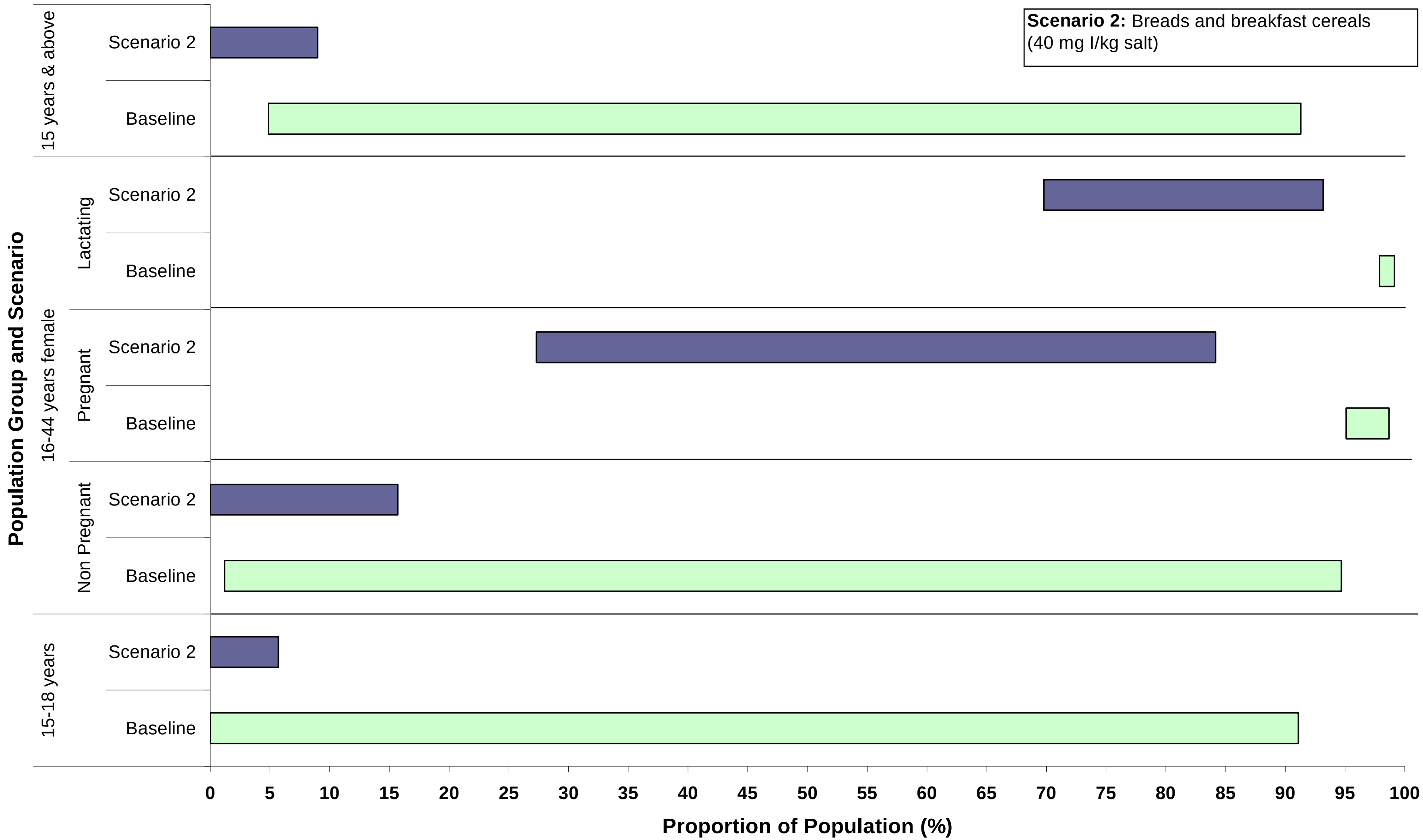

Figure 16: Consumer Behaviour Model: Estimated proportion of New Zealand population groups with dietary iodine intakes below the Estimated Average Requirement for Baseline *and Scenario 2 – Breads and breakfast cereals*

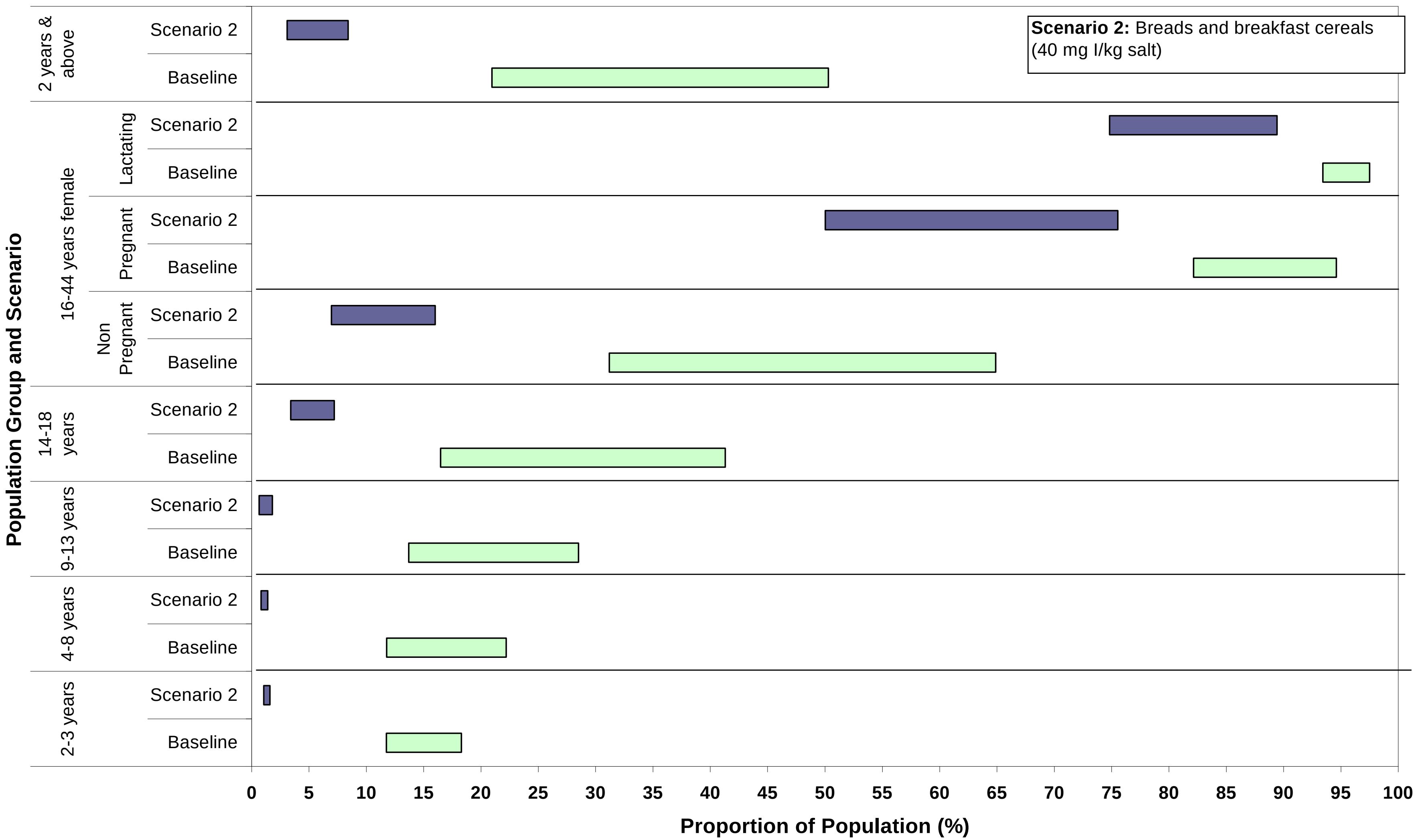

Figure 17: Consumer Behaviour Model: Estimated proportion of Australian population groups with dietary iodine intakes below the Estimated Average Requirement for Baseline *and* Scenario 2 – Breads and breakfast cereals

Comparison of the estimated dietary intakes with the Upper Level of Intake (UL)

In order to determine if the proposed level of addition of iodine to salt for use in the manufacture of breads and breakfast cereals will be of concern to public health and safety, the estimated dietary iodine intakes from the consumer behaviour models were compared with the UL.

Since dietary iodine intakes for Australian children aged 1 year and for New Zealand children aged 1-3 years were estimated using a 'theoretical diet', the proportion of these population groups with dietary iodine intakes above the UL could not be determined. As an alternative, the 95th percentile dietary iodine intake was estimated and then compared to the UL and expressed as a proportion of the UL.

At *Baseline*, New Zealand children aged 1-3 years had 95th percentile dietary iodine intakes which were below the UL (60% of UL with no FSFYC; 90% of UL with FSFYC) while, for Australian children aged 1 year, 95th percentile intakes were equivalent to or greater than the UL (100% of UL with no FSFYC; 120% of UL with FSFYC). For *Scenario 2 – Breads and breakfast cereals*, 95th percentile dietary iodine intakes were either at the UL or exceeded the UL for both New Zealanders aged 1-3 years (100-130%) and Australians aged 1 year (120-130% UL). For more information on the comparison of mean and 95th percentile dietary iodine intakes with the UL, refer to Table A4.3 in Appendix 4.

For all other population groups, the estimated dietary intakes for iodine were determined for each individual respondent in the 1995 and 1997 NNSs and were compared to the relevant UL for their age group and gender (full details Figure 18 and in Table A4.4 in Appendix 4). The proportion of each population group with dietary iodine intakes above the UL is presented as a range; the lower number in the range represents where non-iodised discretionary salt is consumed, and the upper number in the range represents where iodised discretionary salt is consumed.

For New Zealanders aged 15 years and above, the estimated percentage of the population with dietary iodine intakes that exceeded the UL for *Baseline* and *Scenario 2 – Breads and breakfast cereals* was zero.

For the population group of Australians aged 2 years and above, 1% or less of the population had dietary iodine intakes that exceeded the UL for *Baseline* and *Scenario 2 – Breads and breakfast cereals*. Australian children aged 2-3 years had the greatest proportion of the population that exceeded the UL. At *Baseline*, up to 2% of 2-3 year old children had dietary iodine intakes that exceeded the UL. For *Scenario 2 – Breads and breakfast cereals*, up to 10% of 2-3 year old children had dietary iodine intakes that exceeded the UL. The proportion of 4-8 year old children with iodine intakes above the UL was less than 1% for *Baseline* and *Scenario 2 – Breads and breakfast cereals*.

In order to assess any potential risks of current (*Baseline*) and future (*Scenario 2 – Breads and breakfast cereals*) iodine intakes for Australian children aged 2-3 years and 4-8 years, maximum dietary iodine intakes and the proportion of these population groups with dietary iodine intakes above 300 [17]µg per day were estimated. These data are outlined in Table 4.

[17] A level of 300 µg/day was chosen as a basis for comparison as it represents the maximum daily intake that remains within the 1.5 fold safety margin for the UL derived for 1-3 year old children (200 µg/day). Intakes up

Table 4: Consumer Behaviour Model: Maximum estimated dietary iodine intakes and proportion of the population with intakes > 300 µg/day for Australian children aged 2-8 years for *Scenario 2 – Breads and breakfast cereals*

Scenario	Maximum Estimated Iodine Intake (µg/day)		Proportion of Population Group With Iodine Intakes > 300 µg/day	
	2-3 years	4-8 years	2-3 years	4-8 years
Baseline	208 – 223	256 – 279	0 – 0	0 – 0
Scenario 2 – Breads and breakfast cereals	324 – 324	328 – 354	<1 – <1	<1 – <1

Note: in this table, the lower number in the range is the maximum estimated dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the maximum estimated dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and *40* mg iodine/kg salt for *Scenario 2 – Breads and breakfast cereals*.

REFERENCES

Health Canada (2006) *Canadian Community Health Survey Cycle 2.2, Nutrition (2004) A Guide to Accessing and Interpreting the Data*. http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/cchs_guide_escc_a3_e.htmL. Accessed on 3 July 2007.

to 300 µg/day should therefore be well tolerated by young children. Less certainty exists in relation to intakes above 300 µg/day for 1-3 year olds.

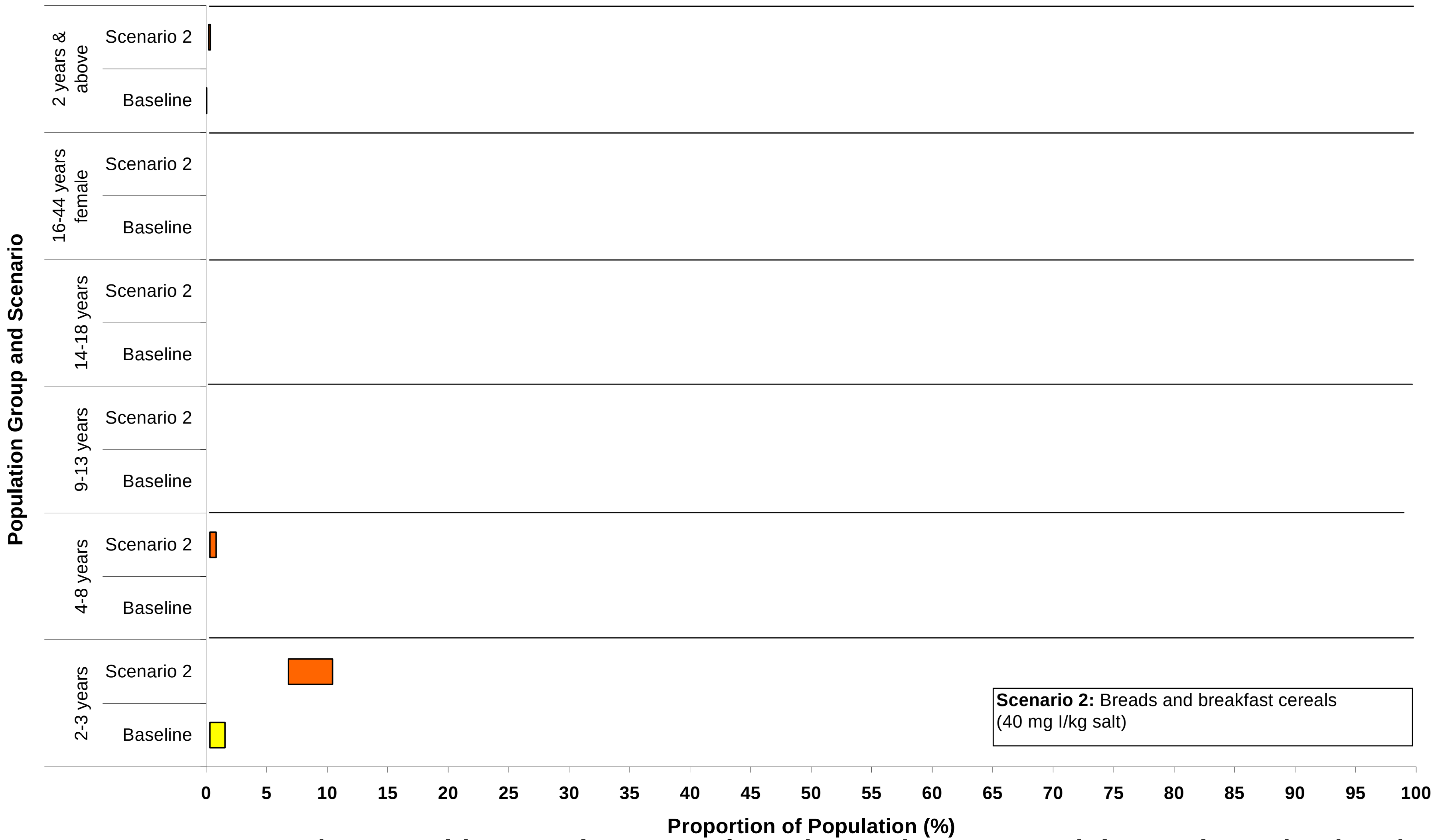

Figure 18: Consumer Behaviour Model: Estimated proportion of Australian population groups with dietary iodine intakes above the Upper Level (UL) for Baseline *and* Scenario 2 – Breads and breakfast cereals

Appendix 1

Complete information on dietary intake assessment results (Market Weighted Models)

Table A1.1: Market Weighted Model: Estimated mean dietary iodine intakes for New Zealand and Australian target population groups for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

Country	Population Group	Estimated mean dietary iodine intake (µg/day)	
		Baseline	*Scenario 2 – Breads and breakfast cereals*
New Zealand	15-18 years	106	183
	16-44 years female	99	163
	19-29 years	106	180
	30-49 years	109	185
	50-69 years	103	177
	70 years & above	95	165
	15 years & above	105	180
Australia	2-3 years	95	135
	4-8 years	94	141
	9-13 years	108	165
	14-18 years	121	182
	16-44 years female	100	144
	19-29 years	119	177
	30-49 years	110	164
	50-69 years	105	155
	70 years & above	96	145
	2 years & above	108	161

Appendix 2

Complete information on dietary intake assessment results (Consumer Behaviour Models)

Table A2.1: Consumer Behaviour Models: Estimated mean and 95th percentile dietary iodine intakes, in µg/day, for New Zealand children aged 1-3 years and Australian children aged 1 year for *Baseline*, and *Scenario 2 – Breads and breakfast cereals*

a. New Zealand children aged 1-3 years

Scenario	Estimated dietary iodine intake (µg/day)	
	Mean	**95th percentile**
Baseline	48 – 72	119 – 180
Scenario 2 – Bread and breakfast cereals	80 – 104	199 – 261

Note: in this table, the lower number in the range is the mean dietary iodine intake when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the mean dietary iodine intake when 1 serve/day of FSFYC is included in the diet.

b. Australian children aged 1 year

Scenario	Estimated dietary iodine intake (µg/day)	
	Mean	**95th percentile**
Baseline	79 – 92	198 – 230
Scenario 2 – Bread and breakfast cereals	96 – 108	239 – 270

Note: in this table, the lower number in the range is the mean dietary iodine intake when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the mean dietary iodine intake when 1 serve/day of FSFYC is included in the diet.

Table A2.2: Consumer Behaviour Model: Estimated mean dietary iodine intakes for New Zealand and Australian target population groups for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

Country	Population Group	Estimated mean dietary iodine intake (µg/day)	
		Baseline	***Scenario 2 – Breads and breakfast cereals***
New Zealand	15-18 years	69 – 131	150 – 205
	16-44 years female	66 – 122	132 – 183
	19-29 years	72 – 129	149 – 200
	30-49 years	75 – 131	155 – 205
	50-69 years	72 – 123	149 – 195
	70 years & above	67 – 114	140 – 182
	15 years & above	72 – 127	151 – 199
Australia	2-3 years	93 – 105	132 – 143
	4-8 years	91 – 109	138 – 155
	9-13 years	103 – 128	160 – 183
	14-18 years	114 – 149	175 – 206
	16-44 years female	94 – 122	139 – 164
	19-29 years	113 – 145	171 – 199
	30-49 years	104 – 133	159 – 185
	50-69 years	98 – 129	150 – 177
	70 years & above	90 – 120	140 – 166
	2 years & above	102 – 131	156 – 181

Note: in this table, the lower number in the range is the mean dietary iodine intake when all discretionary salt is non-iodised; the upper number in the range is the mean dietary iodine intake when all discretionary salt is iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and 40 mg iodine/kg salt for *Scenario 2 – Breads and breakfast cereals*.

Table A2.3: Major contributors (≥5%), excluding discretionary salt, to estimated iodine intakes for New Zealand and Australian toddlers

a. New Zealanders aged 1-3 years

Food Group Name	Major contributors to Iodine Intakes (% iodine intake)			
	Baseline		*Scenario 2 – Breads and breakfast cereals*	
	Without FSFYC	With FSFYC	Without FSFYC	With FSFYC
Milk, whole	**44**		**26**	
Formulated Supplementary Foods For Young Children (FSFYC)	0	**61**	0	**42**
Yoghurt	11	7	6	
Egg	9	6	5	
Bread, white			22	16
Bread, wheatmeal			6	

Notes:
[1] The numbers in **bold** indicate the major contributor to iodine intake for the population group for that scenario.
[2] The percent contribution is listed only if it is ≥ 5% - the shaded cells indicate that the food contributes to iodine intakes but that the contribution is < 5%.

b. Australians aged 1 year

Food Group Name	Major contributors to Iodine Intakes (% iodine intake)			
	Baseline		*Scenario 2 – Bread and breakfast cereals*	
	Without FSFYC	With FSFYC	Without FSFYC	With FSFYC
Milk, full fat	**75**	28	**62**	24
Bread, white			12	10
Formulated Supplementary Foods For Young Children (FSFYC)	0	**51**	0	**44**

Notes:
[1] The numbers in **bold** indicate the major contributor to iodine intake for the population group for that scenario.
[2] The percent contribution is listed only if it is ≥ 5% - the shaded cells indicate that the food contributes to iodine intakes but that the contribution is < 5%.

Table A2.4: Contributors, excluding discretionary salt, to estimated iodine intakes for New Zealand and Australian target population groups

a. New Zealand

Food Group Name	**Contributors to Iodine Intakes (% iodine intake)**			
	Females 16-44 years		**15 years and above**	
	Baseline	***Scenario 2'***	***Baseline***	***Scenario 2'***
Milk[1]	**33**	**17**	**31**	**15**
Fish/Seafood[2]	**13**	**7**	**16**	**8**
Eggs and egg dishes	**11**	**5**	**11**	**5**
Non-alcoholic beverages[3]	**6**	3	**5**	2
Grains and Pasta[4]	**7**	4	4	2
Bread (includes rolls and speciality breads)[5]	<1	**42**	<1	**43**
Bread based dishes	1	4	1	4
Breakfast cereals	<1	3	<1	3
Biscuits	<1	<1	<1	<1
Cakes and muffins	4	2	3	2
Puddings	1	<1	1	<1
Dairy products	3	2	3	1
Cheese	1	<1	1	<1
Butter and Margarine	<1	<1	<1	<1
Fats and oils	<1	<1	<1	<1
Beef and Veal	<1	<1	<1	<1
Lamb/Mutton	<1	<1	<1	<1
Pork	<1	<1	<1	<1
Poultry	<1	<1	<1	<1
Other meat	<1	<1	<1	<1
Sausages and processed meats	2	2	3	3
Pies and pasties	1	<1	1	<1
Vegetables	2	1	3	1
Potatoes and kumara	2	<1	2	<1
Snack foods	<1	<1	<1	<1
Fruit	1	<1	2	<1
Nuts and Seeds	<1	<1	<1	<1
Sugar/sweets	1	<1	<1	<1
Soups and stocks	<1	<1	<1	1
Sauces	1	<1	1	<1
Alcoholic beverages	2	<1	3	2
Dietary supplements	<1	<1	<1	<1
Herbs and spices	<1	<1	<1	<1

Note: The numbers in **bold** indicate the major contributors to iodine intake for the population group for that scenario

6. **Milk** includes cow's and goat's milks, evaporated milk, powdered milk, milkshakes, flavoured milk and soy beverages
7. **Fish/seafood** includes battered and crumbed fish, canned fish, plain cooked fish, smoked fish, shellfish, crustacean (plain cooked, battered, crumbed, canned, smoked) and dishes made from fish/seafood
8. **Non-alcoholic beverages** includes teas, coffees, hot chocolate drinks, fruit juices, cordials, fruit drinks, soft drinks, waters (tap, mineral) and sports drinks
9. **Grains and pasta** includes plain cooked rice, pasta, and noodles, filled pastas, savoury rice-based dishes, pasta-based dishes (e.g. lasagne, macaroni cheese), instant noodles, noodle-based dishes (e.g. chow mein), flours, bran and germ
10. **Bread** includes white, wholemeal, multigrain, rye, fruit bread, flat breads, topped breads (e.g. cheese topped), bagels, English-style muffins, crumpets and buns

b. Australia

Food Group Name	Contributors to Iodine Intakes (% iodine intake)					
	2-3 years		Females 16-44 years		2 years and above	
	Baseline	*Scenario 2'*	*Baseline*	*Scenario 2'*	*Baseline*	*Scenario 2'*
Milk, milk products and dishes[1]	**71**	**51**	**41**	**28**	**45**	**30**
Non-alcoholic beverages[2]	**6**	4	**16**	**11**	**14**	**9**
Cereal-based products and dishes[3]	4	3	**7**	**6**	**7**	**5**
Cereals and cereal products[4]	4	**31**	**6**	**35**	**5**	**36**
Fish and seafood products and dishes[5]	1	1	**5**	3	**5**	3
Water	4	3	**10**	**7**	**8**	**5**
Fats and oils	<1	<1	<1	<1	<1	<1
Fruit products and dishes	1	<1	<1	<1	1	<1
Egg products and dishes	2	2	3	2	4	2
Meat, poultry and game products and dishes	2	2	3	2	3	2
Soup	<1	<1	1	<1	<1	<1
Seed and nut products and dishes	<1	<1	<1	<1	<1	<1
Savoury sauces and condiments	<1	<1	1	<1	<1	<1
Vegetable products and dishes	1	<1	3	2	2	2
Legume and pulse products and dishes	<1	<1	<1	<1	<1	<1
Snack foods	<1	<1	<1	<1	<1	<1
Sugar products and dishes	<1	<1	<1	<1	<1	<1
Confectionery and health bars	<1	<1	1	<1	<1	<1
Alcoholic beverages	<1	<1	1	<1	2	1
Special dietary foods	<1	<1	<1	<1	<1	<1
Miscellaneous	<1	<1	<1	<1	<1	<1
Infant formulae and foods	<1	<1	<1	<1	<1	<1

Note: The numbers in **bold** indicate the major contributors to iodine intake for the population group for that scenario.

6. **Milk, milk products and dishes** includes milks (plain and flavoured), evaporated milk, condensed milk, milk powders, yoghurts (plain, flavoured and fruit), creams, cheeses, ice creams and ice confections (dairy and soy-based), frozen yoghurts, custards and other dairy-based desserts and soy-based beverages.
7. **Non-alcoholic beverages** includes teas, coffees, fruit and vegetable juices and drinks, cordials, soft drinks and mineral waters, electrolyte drinks, sports drinks, bottled water and tap water.
8. **Cereal-based products and dishes** includes biscuits (sweet and savoury), cakes, buns, muffins (cake style), scones, slices, 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, pancakes, crepes, pikelets and doughnuts.
9. **Cereals and cereal products** includes grains, cereal flours and starch powders, breads and rolls, breakfast cereals, English-style muffins, crumpets, tortillas, pastas, noodles and rice.
10. **Fish and seafood products and dishes** includes fresh, frozen, smoked, canned, crumbed and battered fish, molluscs and crustacea, fish fingers, fish cakes and mixed dishes containing fish or other seafood.

Appendix 3

Complete information on risk characterisation (Market Weighted Models)

Table A3.1: Market Weighted Model: Estimated proportion of New Zealand and Australian population groups with inadequate dietary iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

Country	Population Group	EAR (µg/day)	Estimated proportion of the population with inadequate dietary iodine intakes (%)	
			Baseline	*Scenario 2 – Breads and breakfast cereals*
New Zealand	15-18 years	95	27	0
	16-44 years female (non-pregnant)	95/100*	68	0
	16-44 years female (pregnancy EAR)	160	97	57
	16-44 years female (lactation EAR)	190	99	84
	19-29 years	100	49	0
	30-49 years	100	46	0
	50-69 years	100	54	0
	70 years & above	100	72	0
	15 years & above	*	51	0
Australia	2-3 years	65	16	2
	4-8 years	65	18	1
	9-13 years	75	21	1
	14-18 years	95	35	5
	16-44 years female (non-pregnant)	95/100*	59	12
	16-44 years female (pregnancy EAR)	160	93	71
	16-44 years female (lactation EAR)	190	97	88
	19-29 years	100	41	9
	30-49 years	100	47	7
	50-69 years	100	53	7
	70 years & above	100	55	8
	2 years & above	*	43	6

* The appropriate EAR for each age group was used for each individual respondent.

Table A3.2: Market Weighted Model: Estimated proportion of New Zealand and Australian population groups with dietary iodine intakes above the Upper Level (UL) for Baseline, and *Scenario 2 – Breads and breakfast cereals*

Country	Population Group	UL (µg/day)	Estimated proportion of the population with dietary iodine intakes > UL (%)	
			Baseline	***Scenario 2 – Breads and breakfast cereals***
New Zealand	15-18 years	900	0	0
	16-44 years female	900/1,100*	0	0
	19-29 years	1,100	0	0
	30-49 years	1,100	0	0
	50-69 years	1,100	0	0
	70 years & above	1,100	0	0
	15 years & above	*	0	0
Australia	2-3 years	200	<1	8
	4-8 years	300	0	<1
	9-13 years	600	0	0
	14-18 years	900	0	0
	16-44 years female	900/1,100*	0	0
	19-29 years	1,100	0	0
	30-49 years	1,100	0	0
	50-69 years	1,100	0	0
	70 years & above	1,100	0	0
	2 years & above	*	<1	<1

* The appropriate UL for each age group was used for each individual respondent.

Appendix 4

Complete information on risk characterisation (Consumer Behaviour Models)

Table A4.1: Estimated mean dietary iodine intakes, as a percentage of the EAR, for New Zealand children aged 1-3 years and Australian children aged 1 year for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

a. New Zealand children aged 1-3 years

Scenario	EAR (µg/day)	Estimated mean dietary iodine intake (%EAR)
Baseline	65	75 – 110
Scenario 2 – Breads and breakfast cereals	65	120 – 160

Note: in this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

b. Australian children aged 1 year

Scenario	EAR (µg/day)	Estimated mean dietary iodine intake (%EAR)
Baseline	65	120 – 140
Scenario 2 – Breads and breakfast cereals	65	150 – 170

Note: in this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

Table A4.2: Consumer Behaviour Models: Estimated proportion of New Zealand and Australian population groups with inadequate dietary iodine intakes for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

Country	Population Group	EAR (µg/day)	Estimated proportion of the population with dietary iodine intakes < EAR (%)	
			Baseline	*Scenario 2 – Breads and breakfast cereals*
New Zealand	15-18 years	95	0 – 91	0 – 6
	16-44 years female (non-pregnant)	95/100*	1 – 95	0 – 16
	16-44 years female (pregnancy EAR)	160	95 – 99	27 – 84
	16-44 years female (lactation EAR)	190	98 – 99	70 – 93
	19-29 years	100	<1 – 91	0 – 12
	30-49 years	100	<1 – 90	0 – 9
	50-69 years	100	8 – 92	0 – 8
	70 years & above	100	22 – 96	0 – 8
	15 years & above	*	5 – 91	0 – 9
Australia	2-3 years	65	12 – 18	1 – 2
	4-8 years	65	12 – 22	<1 – 1
	9-13 years	75	14 – 29	<1 – 2
	14-18 years	95	16 – 41	3 – 7
	16-44 years female (non-pregnant)	95/100*	31 – 65	7 – 16
	16-44 years female (pregnancy EAR)	160	82 – 95	50 – 76
	16-44 years female (lactation EAR)	190	93 – 98	75 – 89
	19-29 years	100	22 – 47	5 – 10
	30-49 years	100	23 – 54	4 – 9
	50-69 years	100	22 – 61	3 – 10
	70 years & above	100	26 – 72	3 – 12
	2 years & above	*	21 – 50	3 – 8

Note: in this table, the lower number in the range is the proportion of the population group below the EAR when all discretionary salt is iodised; the upper number in the range is the proportion of the population group below the EAR when discretionary salt is non-iodised. The concentration of iodine in discretionary iodised salt is 45 mg iodine/kg salt at *Baseline* and 40 mg iodine/kg salt for *Scenario 2 – Breads and breakfast cereals*.
* The appropriate EAR for each age group was used for each individual respondent.

Table A4.3: Estimated mean and 95th percentile dietary iodine intakes, as a percentage of the UL, for New Zealand children aged 1-3 years and Australian children aged 1 year for *Baseline* and *Scenario 2 – Breads and breakfast cereals*

a. New Zealand children aged 1-3 years

Scenario	UL (µg/day)	Estimated dietary iodine intake (%UL)	
		Mean	95th percentile
Baseline	200	25 – 35	60 – 90
Scenario 2 – Breads and breakfast cereals	200	40 – 50	100 – 130

Note: in this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

b. Australian children aged 1 year

Scenario	UL (µg/day)	Estimated dietary iodine intake (%UL)	
		Mean	95th percentile
Baseline	200	40 – 45	100 – 120
Scenario 2 – Breads and breakfast cereals	200	50 – 55	120 – 130

Note: in this table, the lower number in the range is the percentage of the UL when no Formulated Supplementary Foods For Young Children (FSFYC) are included in the diet; the upper number in the range is the percentage of the UL when 1 serve/day of FSFYC is included in the diet.

Table A4.4: Consumer Behaviour Models: Estimated proportion of New Zealand and Australian population groups with dietary iodine intakes above the Upper Level (UL) for *Baseline*, and *Scenario 2 – Breads and breakfast cereals*

Country	Population Group	UL (µg/day)	Estimated proportion of the population with dietary iodine intakes > UL (%)	
			Baseline	***Scenario 2 – Breads and breakfast cereals***
New Zealand	15-18 years	900	0 – 0	0 – 0
	16-44 years female	900/1,100*	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 & above	1,100	0 – 0	0 – 0
	15 years & above	*	0 – 0	0 – 0
Australia	2-3 years	200	<1 – 2	7 – 10
	4-8 years	300	0 – 0	<1 – <1
	9-13 years	600	0 – 0	0 – 0
	14-18 years	900	0 – 0	0 – 0
	16-44 years female	900/1,100*	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 & above	1,100	0 – 0	0 – 0
	2 years & above	*	<1 – <1	<1 – <1

* The appropriate UL for each age group was used for each individual respondent.

Attachment 4

Dietary Intake Assessment Report – *Universal salt iodisation*

Summary

A dietary intake assessment was conducted to assess the potential impact of the introduction of mandatory fortification of salt used in all processed foods and discretionary salt with iodine (*Universal salt iodisation*) in New Zealand and Australia on iodine intakes among the target groups of children aged up to 3 years, women of child-bearing age (assumed to be 16-44 years) and the population in general (New Zealand – 15 years and above; Australia – 2 years and above).

Dietary intake assessments were conducted for New Zealand and Australian populations to estimate:

1. current iodine intakes (***Baseline***) from food based on current naturally occurring iodine concentrations in foods and iodine concentrations in foods resulting from the uptake of voluntary fortification uses of iodine permitted in the Code; and

2. iodine intakes when non-iodised salt is replaced with iodised salt containing 15 mg iodine per kg of salt in the manufacture of processed foods, the permission for iodine fortification of discretionary salt is mandatory and reduced from 25-65 mg iodine/kg salt to 15 mg iodine/kg salt.

These dietary intake assessment scenarios did not take into account iodine intakes from supplements containing iodine. Potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. This will be captured in any future monitoring programs.

The dietary intake assessment results indicated that mean iodine intakes would increase under *Universal salt iodisation* in comparison to *Baseline*. It should be noted that:

- For *Universal salt iodisation*, there was a reduction in the estimated proportion of the population with inadequate dietary iodine intakes from *Baseline* for all of the population groups assessed.

- Of all of the population groups assessed, women aged 16-44 years had the highest estimated proportions of the population group with inadequate dietary iodine intakes for *Baseline* and for *Universal salt iodisation*, especially when dietary iodine intakes were compared with the Estimated Average Requirements (EARs) for pregnancy and lactation.

- While *Universal salt iodisation* has the capacity to reduce the proportion of the population groups with inadequate dietary iodine intakes when compared to *Baseline*, the proportion of Australian children aged 2-3 years with dietary iodine intakes above the Upper Level of intake (UL) increases.

- Under *Universal salt iodisation*, 11% of Australian children aged 2-3 years had estimated dietary iodine intakes that exceed the UL whereas at *Baseline*, <1% of the population group had estimated intakes above the UL.

Dietary modelling conducted to estimate iodine intakes

The methodology used to assess dietary iodine intakes, the population groups assessed and the limitations and assumptions used in the assessments are discussed in Attachment 1.

Scenarios and iodine concentration data

In comments on the Issues Paper for P230 – Consideration of Mandatory Fortification with Iodine, a number of stakeholders expressed their preference for mandatory universal salt iodisation (USI). Consequently, dietary intake assessments were conducted to estimate potential dietary iodine intakes should mandatory iodine fortification of salt be introduced in New Zealand and Australia at 15 mg iodine per kg of salt. In ***Universal salt iodisation***, non-iodised salt was replaced with iodised salt containing 15 mg iodine per kg of salt in processed foods. The voluntary permission for iodine fortification of discretionary salt was made mandatory and was reduced from a level of 25-65 mg iodine/kg salt to 15 mg iodine/kg salt. An overview of the approach for the USI assessment is shown in Figure 1.

The dietary intake assessments did not take into account iodine from the use of iodine supplements or multi-vitamin supplements containing iodine. Additionally, potential future uptake of voluntary iodine fortification permissions was not taken into account in the dietary intake estimates. This will be captured in any future monitoring programs.

Within the *Baseline* and *Universal salt iodisation* dietary intake estimates, only one model type was assessed: (a) the market share model; this produces dietary intake estimates that represent population intakes over a period of time. For the *Universal salt iodisation* scenario, the market share model and the consumer behaviour models would result in the same dietary iodine intakes since mandating salt iodisation under *Universal salt iodisation* means that there is no choice but to have processed foods that contain iodised salt and to have discretionary salt that is iodised. (The market share and consumer behaviour model types are discussed in detail in the main dietary intake assessment report).

The iodine concentrations in foods that were used in the dietary intake estimates are discussed in detail in Attachment 1.

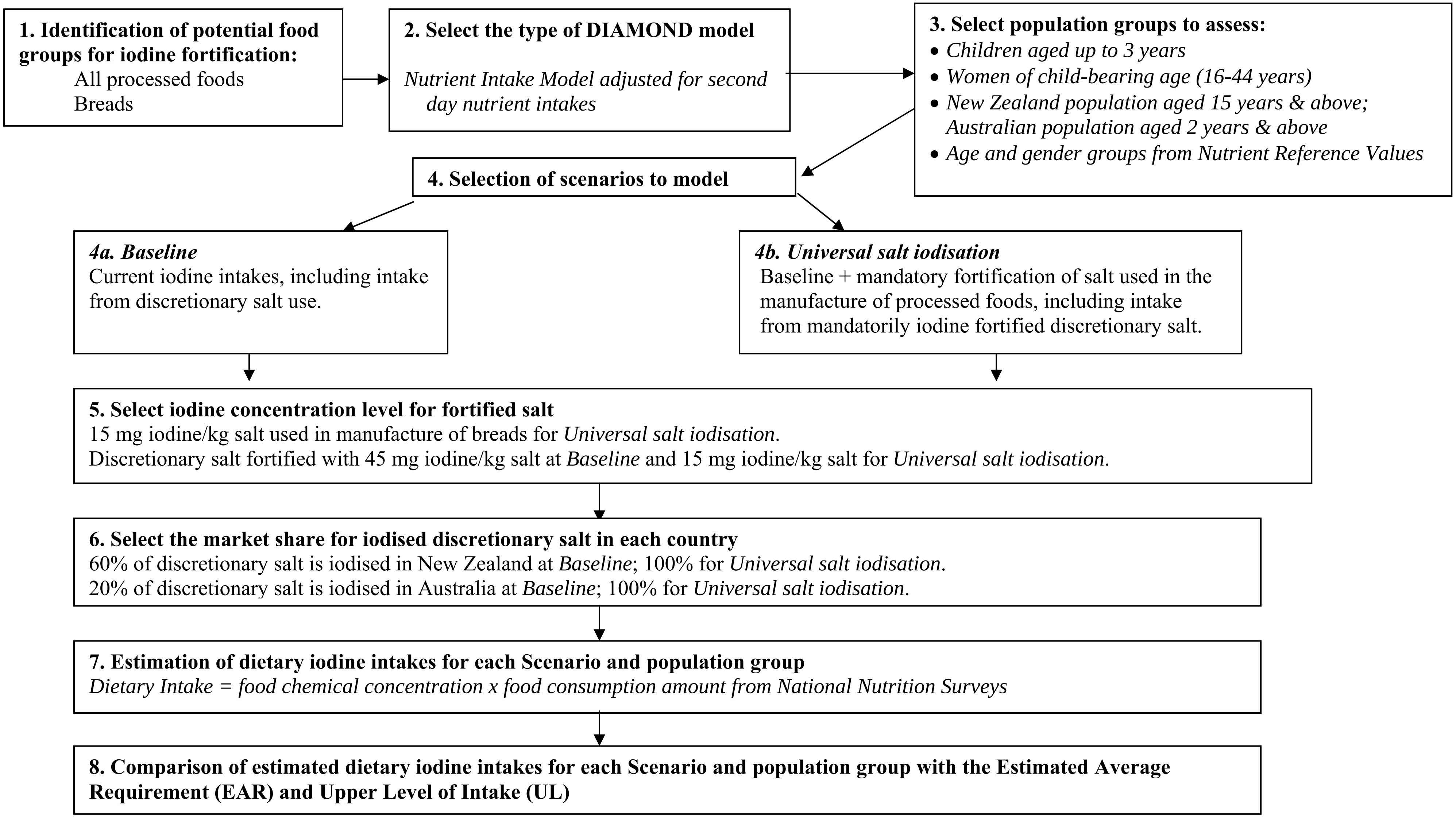

Figure 1: Dietary modelling approach used for assessing iodine intakes for New Zealand and Australia at Final Assessment for P230 (Baseline and Universal salt iodisation)

Comparison between *Baseline* and *Universal salt iodisation*

Estimated Mean Dietary Iodine Intakes

Mean dietary iodine intakes were estimated for various New Zealand and Australian population groups for both *Baseline* and *Universal salt iodisation*. The results are shown in Figure 2 for New Zealand and Figure 3 for Australia (further details can be found in (Table A1.1 of Appendix 1). For all New Zealand and Australian population groups investigated, the estimated mean dietary iodine intakes were higher for the *Universal salt iodisation* scenario than they were for *Baseline*.

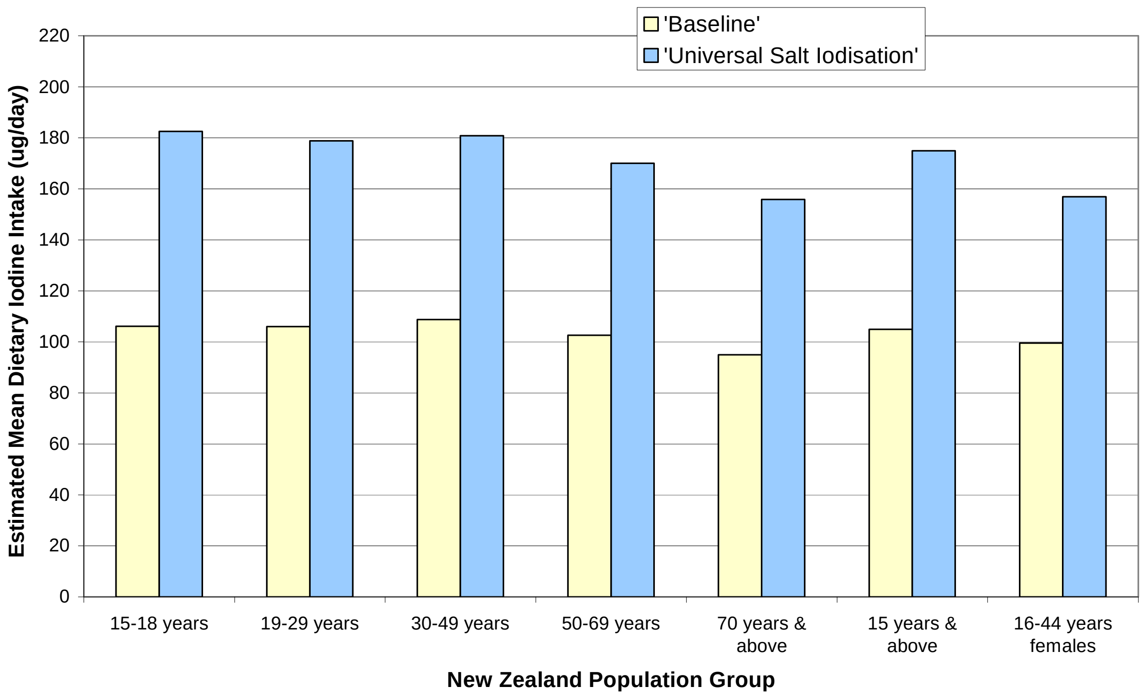

Figure 2: Estimated mean dietary iodine intakes for New Zealand for Baseline *and* Universal salt iodisation

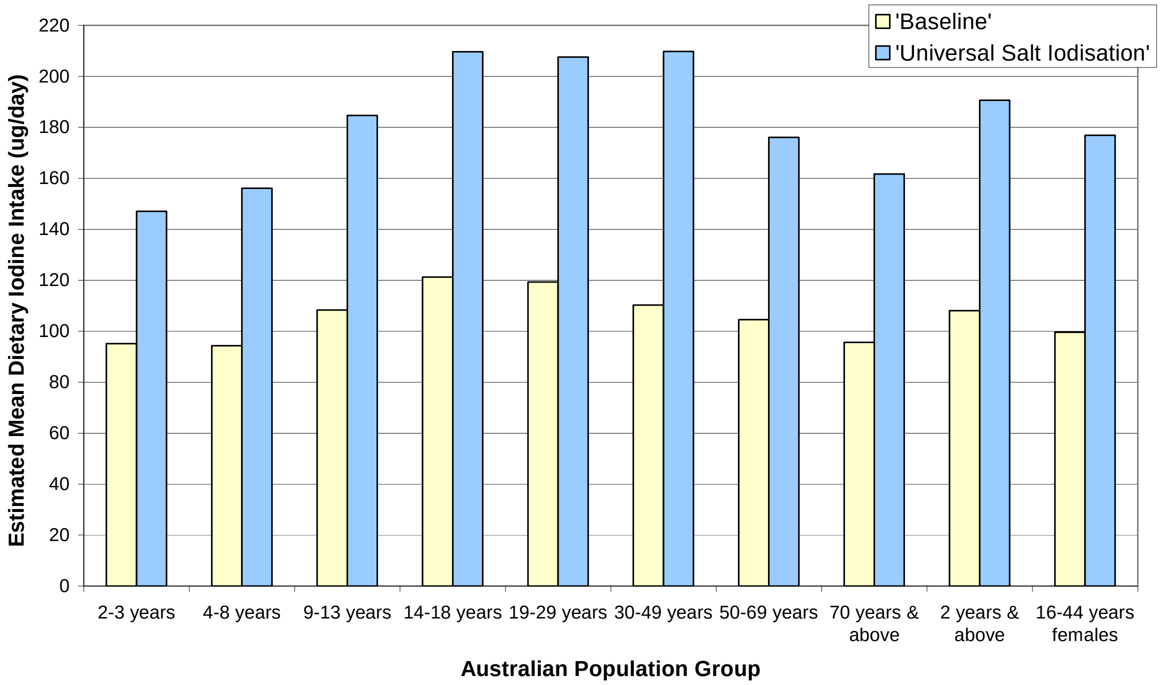

Figure 3: Estimated mean dietary iodine intakes for Australia for Baseline *and* Universal salt iodisation

Estimated proportion of the population groups with inadequate dietary iodine intakes

For all New Zealand and Australian population groups assessed, the estimated proportion of respondents with inadequate dietary iodine intakes was higher for *Baseline* than for the *Universal salt iodisation* scenario. The population group with the highest estimated proportion of respondents with inadequate dietary iodine intakes at *Baseline* were women aged 16-44 years when their intakes were compared with the EAR for lactating women. Comparing the intakes of 16-44 year old females with the EAR for pregnant women produced the second highest proportion of respondents with inadequate dietary iodine intakes. Even with universal salt iodisation these proportions remain high. These results are shown in Figure 4 for New Zealand and Figure 5 for Australia (further details can be found in Table A1.2 of Appendix 1).

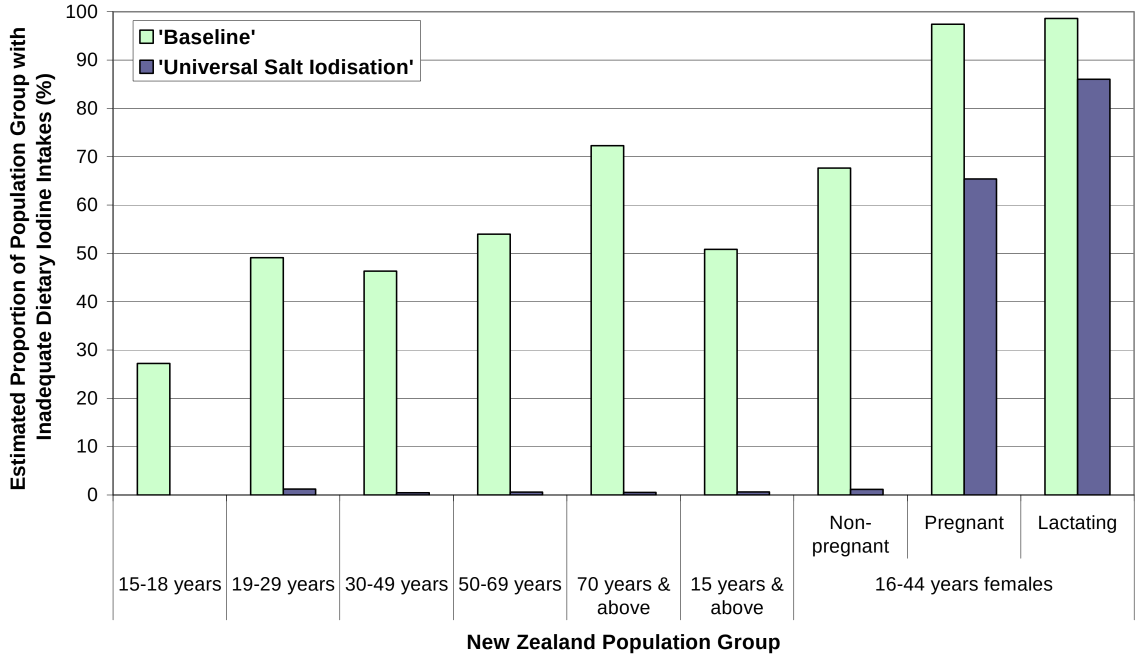

Figure 4: Estimated proportion of the population with inadequate dietary iodine intakes for New Zealand for Baseline *and* Universal salt iodisation

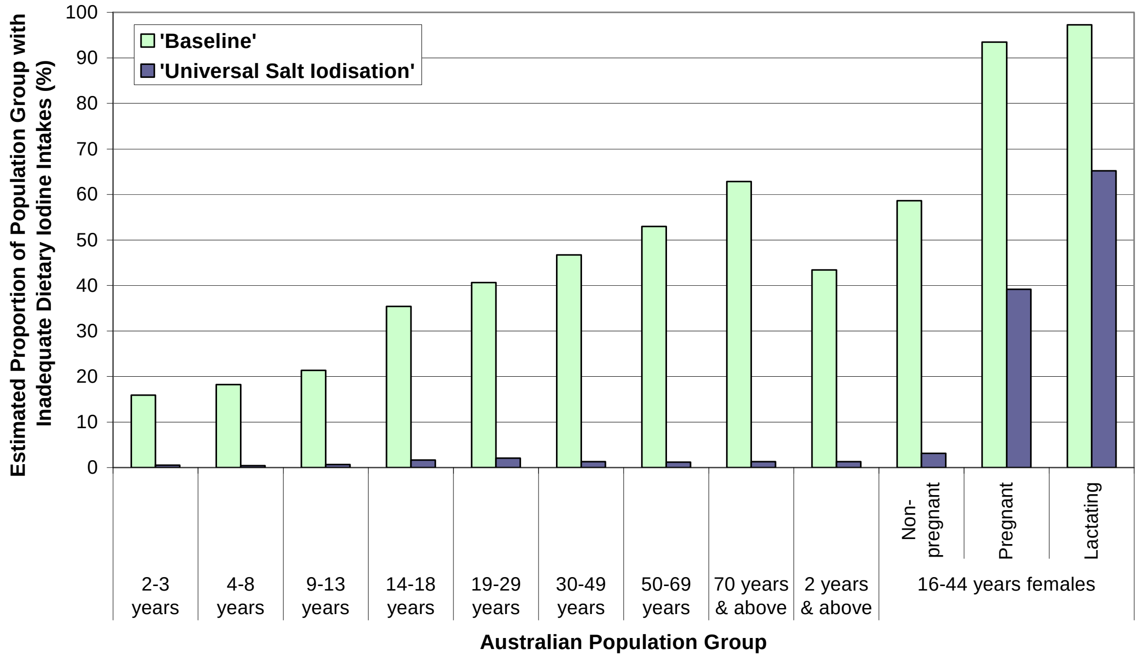

Figure 5: Estimated proportion of the population with inadequate dietary iodine intakes for Australia for Baseline *and* Universal salt iodisation

Proportion of the population groups with estimated dietary iodine intakes above the UL

For all New Zealand and Australian population groups investigated, the proportion of respondents with estimated dietary iodine intakes above the UL was higher for the *Universal salt iodisation* scenario than for *Baseline*. At *Baseline*, less than 1% of Australian children aged 2-3 years had dietary iodine intakes above the UL. T his proportion rose to 11% when universal salt iodisation was considered. The proportion of Australian children aged 4-18 years with dietary iodine intakes above the UL rose from 0% to <1% with *Universal salt iodisation*. The increase from 0% to <1% was also seen for New Zealanders aged 50-69 years. These results can be found in Table A1.3 of Appendix 1.

Summary

For New Zealand and Australian population groups, the *Universal salt iodisation* scenario produced a higher mean dietary iodine intake and lower estimated proportion of respondents with inadequate iodine intakes but a higher proportion of respondents with intakes above the UL in comparison to *Baseline*.

Appendix 1

Complete information on the comparison between *Baseline* and *Universal salt iodisation*

Table A1.1: Estimated mean dietary iodine intakes for New Zealand and Australia for *Baseline* and *Universal salt iodisation*

Country	Age Group	Mean Dietary Iodine Intakes (µg/day)	
		Baseline	*Universal salt iodisation*
New Zealand	15-18 years	106	183
	19-29 years	106	179
	30-49 years	109	181
	50-69 years	103	170
	70 years & above	95	156
	15 years & above	105	175
	16-44 years females	99	157
Australia	2-3 years	95	147
	4-8 years	94	156
	9-13 years	108	185
	14-18 years	121	210
	19-29 years	119	208
	30-49 years	110	210
	50-69 years	105	176
	70 years & above	96	162
	2 years & above	108	191
	16-44 years females	100	177

Table A1.2: Estimated proportion of the population with inadequate dietary iodine intakes for New Zealand and Australia for *Baseline* and *Universal salt iodisation*

Country	Age Group	EAR used	Estimated Proportion of Population with Inadequate Iodine Intakes (%)	
			Baseline	***Universal salt iodisation***
New Zealand	15-18 years		27	0
	19-29 years		49	1
	30-49 years		46	<1
	50-69 years		54	<1
	70 years & above		72	<1
	15 years & above		51	<1
	16-44 years females	Non-pregnant	68	1
		Pregnancy	97	65
		Lactation	99	86
Australia	2-3 years		16	<1
	4-8 years		18	<1
	9-13 years		21	<1
	14-18 years		35	2
	19-29 years		41	2
	30-49 years		47	1
	50-69 years		53	1
	70 years & above		63	1
	2 years & above		43	1
	16-44 years females	Non-pregnant	59	3
		Pregnancy	93	39
		Lactation	97	65

Table A1.3: Estimated proportion of the population with dietary iodine intakes greater than the UL for New Zealand and Australia for *Baseline* and *Universal salt iodisation*

Country	Age Group	Proportion of Population with Iodine Intakes > UL (%)	
		Baseline	***Universal salt iodisation***
New Zealand	15-18 years	0	0
	19-29 years	0	0
	30-49 years	0	0
	50-69 years	0	<1
	70 years & above	0	0
	15 years & above	0	<1
	16-44 years females	0	0
Australia	2-3 years	<1	11
	4-8 years	0	<1
	9-13 years	0	<1
	14-18 years	0	0
	19-29 years	0	0
	30-49 years	0	0
	50-69 years	0	0
	70 years & above	0	0
	2 years & above	<1	<1
	16-44 years females	0	0

Attachment 5

Dietary Intake Assessment Report – Alternative Approaches

Summary

Through submissions, two alternative iodine fortification options were proposed:

1. an alternative option for the mandatory fortification of breads (based on the exclusion of heavy grain bread); and

2. a voluntary fortification system.

The alternative mandatory fortification option based on the exclusion of heavy grain breads did not result in as high a proportion of the target population group consuming mandatorily fortified foods in comparison to the FSANZ preferred option, albeit by a small percentage. The exclusion of heavy grain breads from mandatory fortification would make the alternative mandatory fortification option inconsistent with the 'Dietary Guidelines for Australian Adults', in particular '1.2 - Eat plenty of cereals (including breads, rice , pasta and noodles), preferably wholegrain' and reduces the proportion of the target population groups consuming fortified breads. It is noted that the consumption of these breads increases with age (mostly for females), and older Australians have a higher proportion of their population groups with inadequate dietary iodine intakes.

At Draft Assessment for P230, a voluntary fortification system was proposed by the food industry where food manufacturers would sign on to a 'Memorandum of Understanding (MOU)' agreement to fortify specific foods with iodine. Under the proposed MOU, specific brands of breads, breakfast cereals and biscuits would be voluntarily fortified. Estimated mean dietary iodine intakes increased minimally from *Baseline* for the proposed MOU voluntary fortification scheme in comparison to the FSANZ proposed mandatory fortification of all breads.

Submitter proposed alternative mandatory fortification approach

Through submissions, an alternative option for the mandatory fortification of breads (based on the exclusion of heavy grain bread) was proposed. Before conducting detailed intake assessments for this option, the following assessments were made:

1. the proportion of New Zealand population groups consuming heavy grain breads; and

2. the proportion of the target population (females 16-44 years for New Zealand only) who consume foods from the suggested option was assessed (the 'proportion consuming') and compared to the proportion of the target population consuming breads as proposed by FSANZ for mandatory fortification.

The proportion of Australian population groups consuming heavy grain breads could not be investigated since the Australian NNS did not record whether grain breads were heavy or light; food descriptors were only defined as 'grain' breads.

The investigations outlined above were used to decide whether the alternative mandatory fortification option warranted a more detailed investigation. An assessment was not performed for New Zealand children aged 5-14 years since data from the 2002 New Zealand Children's Nutrition Survey were not held by FSANZ in the correct format to enable this assessment to be undertaken.

The proportion of New Zealand population groups consuming heavy grain breads

As can be seen in Figure 1, a greater proportion of New Zealand women consume heavy grain breads in comparison to men, with the proportion of women consuming heavy grain breads increasing with age. Given that the proportion of the population with dietary iodine intakes below the Estimated Average Requirement (EAR) also increases with age, the mandatory fortification of heavy grain breads could assist in increasing dietary iodine intakes, particularly in older population groups of women.

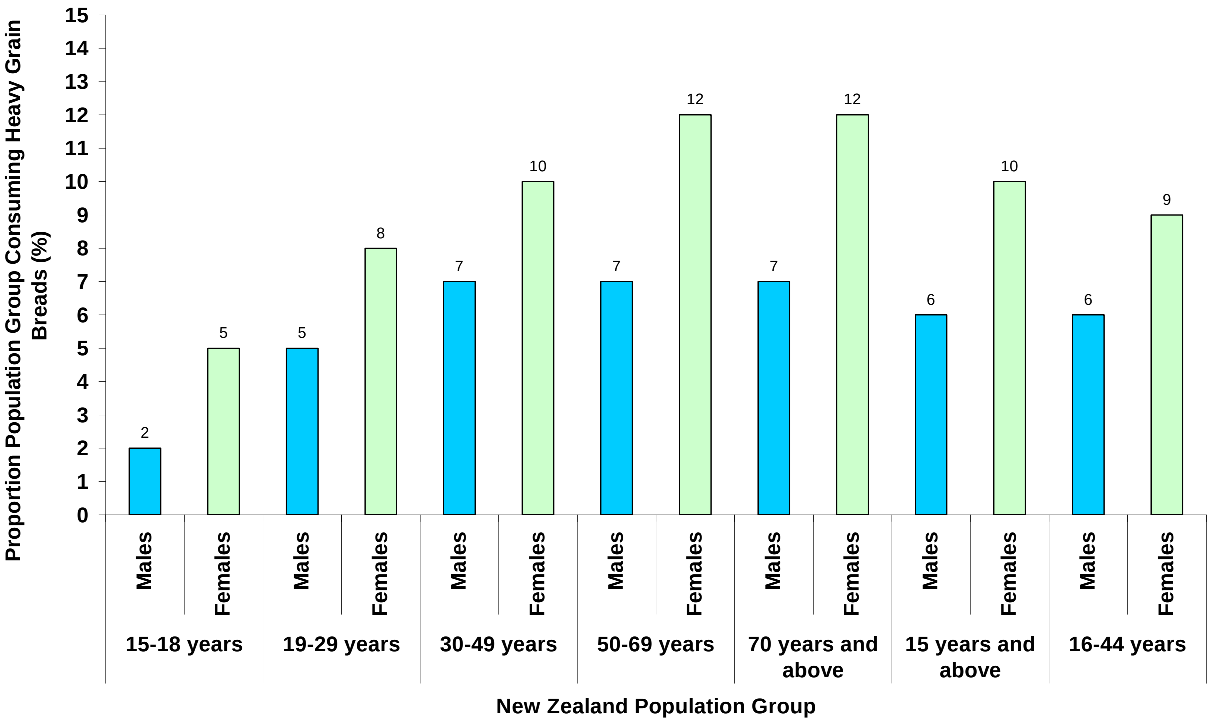

Figure 1: Proportion of New Zealand population groups consuming heavy grain breads

Proportion of New Zealand target population groups consuming breads under the different mandatory fortification options

When compared to the preferred option of mandatory fortification for all breads, the removal of heavy grain breads from mandatory fortification program would result in a decrease (approximately 5% of the population group) in the proportion of the population group consuming mandatorily fortified foods for the target population groups. Further details can be found in Figure 2. In the figure, *Scenario 3 – Breads* refers to the FSANZ preferred option at Final Assessment for P230.

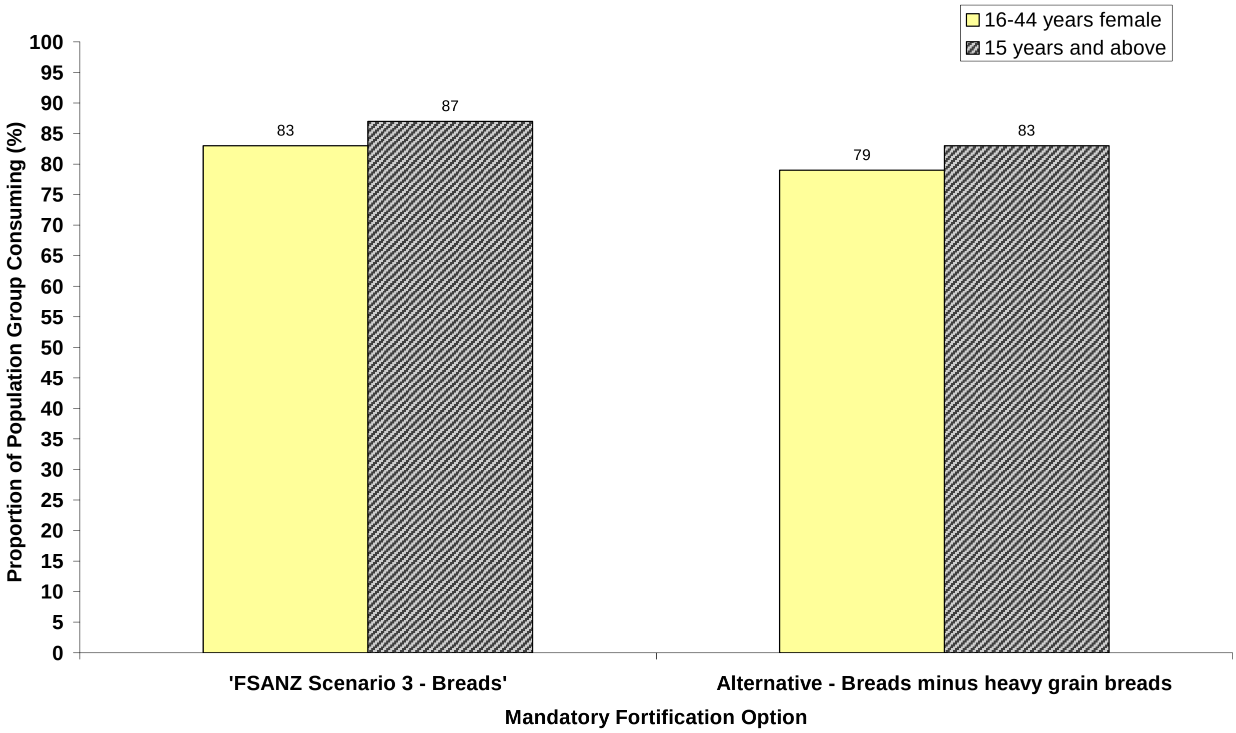

Figure 2: Proportion of New Zealand target population groups consuming breads under the different mandatory fortification options

Conclusions

The alternative mandatory fortification option proposed did not result in as high a proportion of the target population group consuming mandatorily fortified foods in comparison to the FSANZ preferred option, albeit by a small difference.

The exclusion of heavy grain breads would allow a small amount of consumer choice in relation to bread without added iodine, however, naturally occurring iodine would still be present in these breads. The exclusion of heavy grain breads from mandatory fortification would make the alternative mandatory fortification option inconsistent with the 'Dietary Guidelines for Australian Adults', in particular '1.2 – Eat plenty of cereals (including breads, rice , pasta and noodles), preferably wholegrain' (National Health and Medical Research Council, 2003) and reduces the proportion of the target population groups consuming fortified breads. It has been shown above that the consumption of these breads increases with age (mostly for females), and that older Australians have a higher proportion of their population groups below the EAR.

Therefore, as the aim of the fortification program is to target the highest proportion of target population groups, further more detailed assessments of iodine intakes based on the alternative mandatory fortification option were not conducted.

Consideration of a voluntary fortification system

At Draft Assessment for P230, a voluntary fortification system was proposed by the food industry where food manufacturers would sign on to a 'Memorandum of Understanding (MOU)' agreement to fortify specific foods with iodine.

The foods proposed included certain breads, breakfast cereals and biscuits. Data on the proportion of the market likely to be voluntarily fortified under such a scheme and the level of salt in these foods were provided. Since only voluntary permissions were requested and these were given by brand, FSANZ was unable to estimate the proportion of the population consuming these nominated foods (the 'reach'), as the National Nutrition Survey (NNS) data do not provide this level of detail. As an alternative, dietary iodine intakes were estimated using market weighted iodine concentrations that reflected the estimated market share that could be achieved under the MOU for the target groups.

In comments to the Issues Paper for this Proposal, the food industry recommended promoting the use of iodine as a processing aid in conjunction with the proposed MOU. In 2005, the Application A493 – Iodine as a Processing Aid was gazetted, which permitted the use of iodine as 'permitted bleaching agents, washing and peeling agents' on fruits, vegetables and eggs. Samples of fruits, vegetables and eggs were collected as a part of the 22nd Australian Total Diet Study (ATDS) in mid- to late-2004 and were analysed for iodine. These data are the most recent analyses that FSANZ has for fruits, vegetables and eggs, however these foods were sampled prior to the use of iodine as a processing aid being permitted. The current uptake of iodine as a processing aid is unknown. Any changes in the iodine contents of foods due to the use of iodine as a processing aid would be captured in the future in ongoing monitoring programs.

FSANZ derived iodine concentrations for the MOU voluntary fortification scheme using *Baseline* iodine concentrations, salt concentrations in foods as provided by the relevant food manufacturers and an iodine concentration of 45 mg iodine per kg salt. Voluntary fortification of salt is currently at 45 mg iodine per kg salt on average, noting that this is also the midpoint of the range of currently permitted iodine fortification of salt (25–65 mg iodine/kg salt). As with the mandatory fortification scenarios at Final Assessment for P230, it was assumed in the intake assessment that there would be a 10% loss of iodine from the iodised salt upon baking/cooking/extruding of breads, biscuits and breakfast cereals.

Iodine intakes were estimated using the FSANZ nutrient intake methodology (2nd day adjustment). Further details on the 2nd day adjustment methodology, the limitations and general assumptions can be found in Attachment 1.

FSANZ estimated the increase in iodine intakes from voluntarily fortified foods under a MOU agreement from *Baseline*. Since the data on market share were provided as 'commercial-in-confidence', the market shares were rounded and aggregated, as presented in Table 1. The actual market shares provided were used in the dietary intake assessments. The mean of the salt concentrations provided for individual brands were used for each food group. Other assumptions made in the assessment of the MOU fortification scheme were that voluntarily fortified breads would not be used in food service (e.g. for commercially prepared sandwiches, hamburgers) and voluntarily fortified breads would always be used in the production of commercially-prepared breadcrumbs.

Table 1: Approximate market share for voluntarily fortified foods under the MOU

Food Group	Approximate Market Share (%)
Breads	30
Ready-to-eat Breakfast Cereals	15
Biscuits	15

Scenarios assessed

Iodine intakes were estimated for the following scenarios:

1. ***Baseline*** – estimate of current iodine intakes from food alone, based on current naturally occurring iodine concentrations in foods and iodine concentrations in foods resulting from permitted uses of iodine in the Code. *Baseline* assumes the food industry does not take up further voluntary iodine permissions. The use of discretionary salt was not considered.

2. **MOU *Scenario – Market weighted*** – assumes that non-iodised salt is replaced with iodised salt containing 45 mg iodine per kg of salt in approximately 30% of breads, 15% of breakfast cereals and 15% of biscuits on a voluntary basis. Assuming that there would be a 10% loss of iodine from the salt during baking/ cooking/ extruding, iodised salt was deemed to contain 40 mg I/kg salt for dietary intake assessment purposes. A market weighted intake estimate represents the likely impact of a voluntary iodine fortification scheme across the population over a period of time. The use of discretionary salt was not considered.

3. **FSANZ *Scenario 3 – Breads*** – non-iodised salt is replaced with iodised salt containing 45 mg iodine per kg of salt in breads on a mandatory basis, with the same assumptions relating to processing as the MOU scenario. The use of discretionary salt was not considered. For further details, refer to the Main Dietary Intake Assessment report.

Estimated dietary intakes

The results (see Table 2 and Figure 3) show that, under the industry MOU voluntary approach (*MOU Scenario – market weighted*), estimated mean dietary iodine intakes for the New Zealand population increased minimally from *Baseline*, +17 µg/day for women aged 16-44 years and +22 µg/day for New Zealanders aged 15 years and above. For Australians, estimated mean dietary iodine intakes also increased minimally from *Baseline* for 2-3 year old children (+10 µg/day), Australian women aged 16-44 years (+12 µg/day) and the Australian population aged 2 years and above (+15 µg/day). Mandatory iodine fortification of all salt used in breads, as proposed by FSANZ at Final Assessment for P230, increased the mean dietary iodine intake by +72 µg/day and +85 µg/day for New Zealanders aged 16-44 years (females) and 15 years and above, respectively, and by +37 µg/day, +46 µg/day and +54 µg/day for Australians aged 2-3 years, 16-44 years (female) and 2 years and above, respectively.

The smaller increase for the voluntary approach proposed by the food industry could be attributed to the lower proportion of breads, breakfast cereals and biscuits proposed to be voluntarily fortified.

It is important to note that for all voluntary fortification scenarios, the definition of breads, breakfast cereals and biscuits is slightly different to that used for FSANZ's proposed mandatory fortification scenario due to how the data provided were able to be used in the dietary intake assessments.

One of the aims of mandatory nutrient fortification is to optimise nutrient intakes for the maximum proportion of the target population(s).
Under the proposed MOU, specific brands within each food category would be voluntarily fortified; hence the proportion of the population reached would be lower than with a mandatory scheme. During consultations with the food industry, the issue of increasing the iodine concentration in salt used for a voluntary fortification scheme was raised, with the aim of producing similar dietary iodine intakes to those produced under the mandatory fortification scenarios. Although this could increase iodine intakes it would impact on a smaller proportion of the target population groups as it would only increase intakes for consumers eating the brands that were voluntarily fortified.

Table 2: Estimated mean iodine intakes from food for New Zealand and Australian target groups

Scenario	**Mean dietary iodine intake (µg/day)** ***[Increase in iodine intake from Baseline (µg/day)]***				
	Australia			**New Zealand**	
	2-3 years	**Females 16-44 years**	**2 years & above**	**Females 16-44 years**	**15 years & above**
Baseline	93	94	102	66	72
MOU Scenario – Market weighted	103 [+10]	106 [+12]	117 [+15]	83 [+17]	94 [+22]
FSANZ Scenario 3 – Breads	130 [+37]	140 [+46]	156 [+54]	138 [+72]	157 [+85]

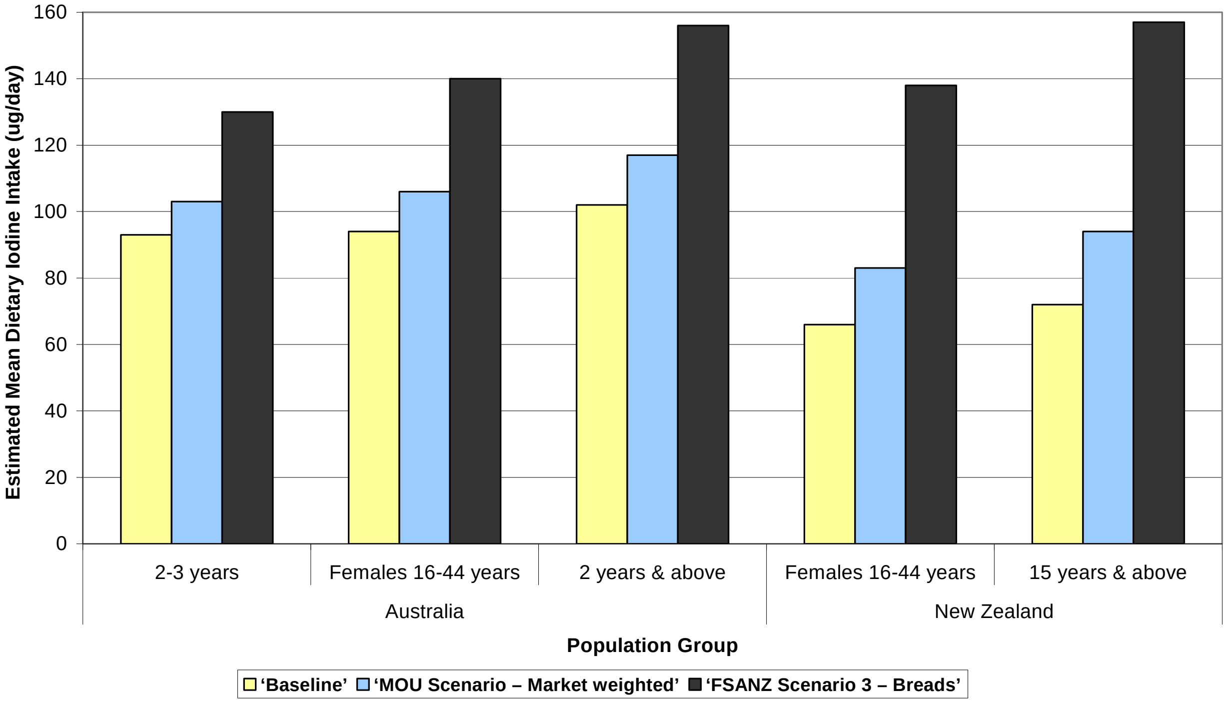

Figure 3: Estimated mean iodine intakes for Baseline, MOU Scenario – Market weighted *and FSANZ* Scenario 3 – Breads *for New Zealand and Australian target groups*

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