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

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FINAL ASSESSMENT REPORT

PROPOSAL P295

CONSIDERATION OF MANDATORY FORTIFICATION WITH FOLIC ACID

Attachments 7a and 7b

Attachment 7a

Methodology and Results of Dietary Modelling at Final Assessment

CONTENTS

EXECUTIVE SUMMARY

A dietary intake assessment was conducted to assess the potential impact the introduction of mandatory fortification of food with folic acid in Australia and New Zealand would have on:

- folic acid intakes among the target group, women of child-bearing age; and
- folic acid intakes among the general population

The aim was to determine a level of fortification that maximised folic acid intake for the target group to assist in achieving their recommended intake of 400 µg of folic acid a day, whilst preventing a significant proportion of people in the target and non-target groups exceeding upper safe levels of intake.

The dietary intake assessment was conducted for females aged 16-44 years who were assumed to represent the target group of women of child-bearing age and also for the age and gender groups specified in the National Health and Medical Research Councils (NHMRC) Nutrient Reference Values for Australia and New Zealand document for easy comparison of estimated folic acid intakes with the upper levels of intake. Two dietary intake assessments for women of child bearing age were considered: (1) folic acid intakes from food alone; and (2) folic acid intakes from food and supplement use.

In considering mandatory fortification of food with folic acid at Draft Assessment, bread making flour was selected as the food vehicle, based on a high percentage of women of child-bearing age consuming products containing bread-making flour and international experience. Following consultations the mandatory fortification of food with folic acid via bread rather than bread-making flour was proposed. Therefore, further dietary modelling for this Final Assessment was undertaken to consider the mandatory fortification of bread with folic acid and its potential impact on folic acid intakes.

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

- current folic acid intakes from food alone (**Baseline**) based on the current uptake by industry of voluntary folic acid permissions outlined in Standard 1.3.2 of the *Australia New Zealand Food Standards Code* (the Code) for each relevant food category;
- folic acid intakes from food alone for current uptake by industry of voluntary folic acid permissions (excluding bread) in addition to the introduction of mandatory fortification of all bread at 135 µg folic acid per 100 g of bread (**Scenario 1**).

The NZFSA submitted modelling for New Zealand children aged 5-14 years, based on the 2002 Children's Nutrition Survey as FSANZ does not have access to this data set. Estimated intakes of folic acid under different mandatory fortification scenarios were also submitted for the New Zealand population aged 15 years and above. However different levels of fortification, assumptions and methodologies were used so results are not directly comparable with the FSANZ modelling.

In response to submission received and consultations at Draft Assessment, two alternative approaches were further assessed. One submitter suggested four other options for mandatory fortification of bread, each one with different bread types to be included in the mandatory fortification program. The percentage of the target population who consume the different types of breads was assessed).

Of the four options proposed, Option 4 (mandatory fortification of all breads excluding heavy grain breads) had the maximum proportion of the target population consuming. Option 4 was similar to the mandatory fortification scenario proposed by FSANZ including all breads so was not modelled separately. Options 1, 2 and 3 resulted in a lower proportion of the target population consuming fortified products, so although these three options were considered, the predicted folic acid intakes estimates based on these options were not modelled. The exclusion of heavy grain breads from Options 1 to 4 makes these options 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 consuming fortified breads.

Another submitter suggested a voluntary fortification system with an increased range of foods compared to the foods that are currently voluntarily fortified. FSANZ investigated the folic acid intakes from voluntarily fortified foods from 'Baseline' in addition to voluntarily fortified high fibre white bread, low and reduced fat natural yoghurts and frozen diet ready-to-eat meals. The market share for fortified breads was assumed to increase from the 15% at 'Baseline' to 20% as the submitter suggested that there would be more bread products on the market that would be voluntary fortified under their alternative approach. This scenario was only modelled for the target group of women aged 16-44 years.

These dietary modelling scenarios did not take into account naturally occurring folates in food or folic acid from folic acid supplements or multivitamins containing folic acid.

It should be noted that:

- Current folic acid intake from food by the target group is low.
- New Zealand has lower baseline folic acid intakes from food for all age groups considered compared to Australian populations due to a lower level of uptake of voluntary folic acid permissions by industry.
- Mandatory fortification of bread is predicted to increase mean folic acid intakes for each population group assessed by FSANZ, for the target group by +101 µg/day and +140 µg/day for Australia and New Zealand, respectively.
- Despite these increases in folic acid intakes from food, the mean dietary folic acid intake for the target group is still well below the recommended 400 µg per day.
- Children aged 2-3 and 4-8 years are the most likely population groups to exceed the upper level (UL) if mandatory fortification of bread were to be introduced. The proportion of children in the FSANZ proposed option (Scenario 1) exceeding the UL is low.
- At the mandatory fortification level modelled by FSANZ, only a small proportion of respondents exceeded the UL for all other Australian and New Zealand population groups assessed (including the target group).
- Based on assessments submitted for New Zealand children, the results indicate that New Zealand children 5-14 years would show a similar proportion of respondents with folic acid intakes above the UL compared to Australian children of the same age, despite using different methodologies. The proportion of New Zealand children exceeding the UL is low.
- Three of the four options proposed in submissions for fortifying different types of breads resulted in lower proportions of the target population consuming fortified products and so were not further considered, the fourth option was similar to the FSANZ preferred option so was not modelled separately.

- The submitter proposed approach suggesting a voluntary fortification system with an increased range of foods increases the mean dietary folic acid intake for the target group from 'Baseline' by +8 µg/day and +4 µg/day for Australia and New Zealand respectively.

The impact of women of child bearing age consuming folic acid from supplements in addition to food was also considered by FSANZ. These additional calculations assumed women of child-bearing age received an additional 200 µg or 500 µg of folic acid a day from supplements in Australia, and an additional 200 µg or 800 µg of folic acid a day from supplements in New Zealand, based on current supplement use and the recommended amount in each country.

Approximately 40% of Australian and New Zealand women of child-bearing age would receive the recommended 400 µg of folic acid per day when mandatory fortification of all bread occurs at 135 µg of folic acid per 100 g of bread and an additional 200 µg of folic acid from a supplement is taken. Less than 1% of Australian and New Zealand women of child-bearing age would have dietary folic acid intakes that exceed the Upper Level when the consumption of a 200 µg folic acid dietary supplement is considered in addition to fortification of food. If a 500 µg supplement is considered for Australian women of child-bearing age, 1% of the population at Baseline and 3% at 'Scenario 1 – mandatory folic acid fortification of all bread' exceed the Upper Level. For New Zealand women of child-bearing age, the consumption of an 800 µg folic acid supplement at 'Baseline' results in 9% of the population exceeding the Upper Level, with 44% of this group estimated to exceed the Upper Level for 'Scenario 1 – mandatory folic acid fortification of all bread'.

One of the concerns for any fortification program is that the benefits should apply across all socio-economic groups, so dietary modelling was conducted by an index that describes socio-economic status (SEIFA index). The amount of bread consumed and folic cid intakes derived from the 1995 NNS were assessed against SEIFA quintiles. The SEIFA quintile of the respondent made little difference to the amount of bread consumed or to folic acid intakes by women of child-bearing age and there was no consistent trend in bread consumption. This conclusion was further supported by Roy Morgan Single Source data for 2001-2006, where there were no trends in the proportion of the target population consuming bread when analysed by income. The socio-economic status of the consumer, therefore, appears not to influence bread consumption patterns or folic acid intakes and has not been considered further as an issue for fortification. These studies, however, did not take into consideration the use of additional supplements that may have been consumed in this target population and, in particular, by women in different SEIFA quintiles or income brackets.

Bread was a major contributor (>5%) to folic acid intakes for the population groups assessed at both 'Baseline' (around 20%) and 'Scenario 1- mandatory fortification of all bread' (around 60-70%), for both Australia and New Zealand based on NNS data. This is because of the large proportion of consumers of bread in both populations and the large amount consumed. Analysis of more up to date data on the proportion of populations consuming bread indicates that bread is still consumed by a large proportion of the target group and general population, indicating that bread remains a good vehicle for the delivery of folic acid to the target population. Other major contributors (>5%) to estimated folic acid intakes for Australians and New Zealanders were voluntarily fortified breakfast cereals and yeast extracts.

1. Dietary Modelling conducted to estimate folic acid intake from food only

1.1 What is dietary modelling?

Dietary modelling is a tool used to estimate intakes of food chemicals from the diet as part of the FSANZ risk assessment process. To estimate dietary intake of food chemicals, records of the foods people have eaten and reports of how much of the food chemical of interest is in each food, are needed. The accuracy of these intake estimates depends on the quality of the data used in the dietary models. Sometimes all of the data needed are not available or the 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 intake estimates, however, each modelling process requires decisions to be made about how to set the model up and what assumptions to make; a different decision may result in a different answer. 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.

1.2 Dietary modelling approach

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

Dietary intake = food chemical concentration x food consumption amount

The dietary folic acid intake was estimated by combining usual patterns of food consumption, as derived from National Nutrition Survey (NNS) data, with current levels of fortification based on the uptake of voluntary fortification permissions by industry and proposed levels of folic acid in foods if mandatory folic acid fortification is introduced (see Figure 1 for an overview of the dietary modelling approach that was used to assess the folic acid intakes only). More details of each step in the process are given below.

At final assessment, FSANZ has assessed the impact of requiring the addition of folic acid to bread (as opposed to bread making flour modelled at Draft Assessment). In addition, FSANZ assessed a number of different scenarios based on alternative fortification suggestions and additional data provided through submissions and targeted consultation to the P295 Draft Assessment Report (DAR) for the target population. The assessments undertaken at Final Assessment were as follows:

- the impact on dietary folic acid intakes of the mandatory fortification of all breads as proposed by FSANZ;
- the impact on dietary folic acid intakes of the voluntary fortification of some breads in addition to low fat and reduced fat yoghurts and frozen diet ready-to-eat meals (as proposed through submissions);
- the proportion of the target population (women 16-44 years) who consume any type of bread;
- the proportion of the target population (women 16-44 years) who could consume a more limited range of certain types of mandatorily fortified breads;

- the proportion of the target population (women 16-44 years) who consume breads, based on socio-economic status;
- the impact on dietary folic acid intakes of the mandatory fortification of all breads as proposed by FSANZ for socio-economic groups; and
- trends in analysed bread consumption patterns over time.

1.3 Dietary survey data used

DIAMOND contains dietary survey data for both Australia and New Zealand; the 1995 NNS from Australia that surveyed 13,858 people aged 2 years and above, and the 1997 New Zealand NNS that 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 collected on a subset of respondents in both surveys. Standard methodologies were used to estimate intake from a single 24 hour record (day one) and to adjust these records to estimate 'usual intake' by including information from a second 24 hour record (day two) (see Appendix 1*: How were the estimated dietary intakes estimated*).

It is recognised that these survey data have several limitations. For a complete list of limitations see Section 7*: Limitations*.

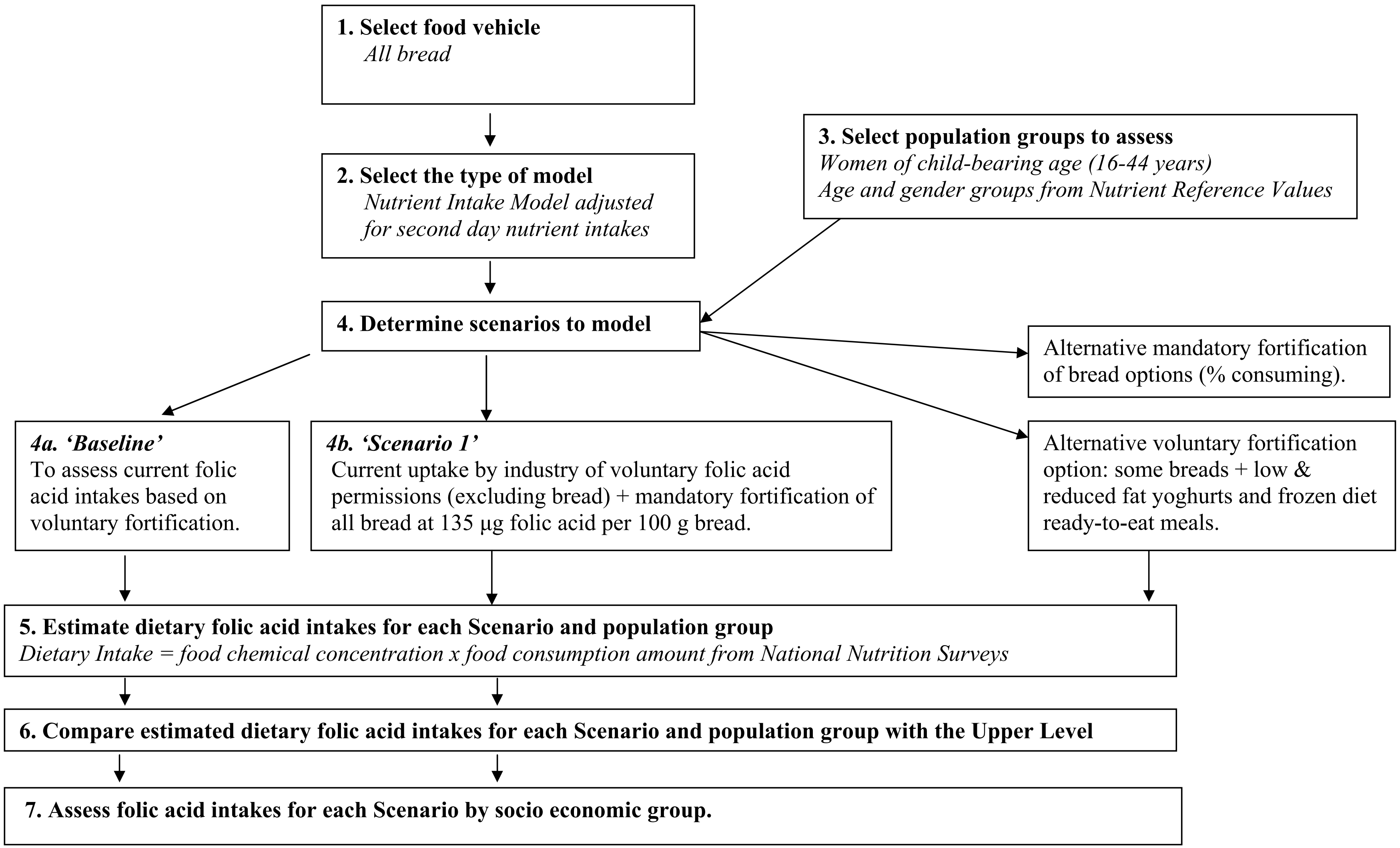
1.4 Population groups assessed

The dietary intake assessment was conducted separately for Australia and New Zealand population sub-groups.

Females 16-44 years were assessed for both Australia and New Zealand to determine the impact of mandatory fortification in the target group, women of child-bearing age. The NHMRC Nutrient Reference Values for Australia and New Zealand (NRVs) (National Health and Medical Research Council, 2006) was used as a guide in selecting the other age groups to assess. As different NRVs were given to different age and gender groups for folic acid, conducting the dietary modelling based on the NRV age groups allowed for easy comparison of the estimated intakes with the relevant NRV for risk assessment purposes.

As the Australian 1995 NNS was conducted on people aged 2 years and above, the following age groups were modelled: the population 2 years and above, 2-3 years, 4-8 years, 9-13 years, 14-18 years 19-29 years, 30-49 years, 50-69 years and 70 years and above, all split by gender. The New Zealand 1997 NNS was conducted on people aged 15 years and above so the following age groups were assessed: the population 15 years and above, 15-18 years 19-29 years, 30-49 years, 50-69 years and 70 years and above, all split by gender.

Figure 1: Dietary Modelling approach used at Final Assessment for assessing folic acid intakes from food for Australia and New Zealand



1.5 Food vehicle

At Draft Assessment, all wheat bread-making flour was selected as the food vehicle for incorporating folic acid into foods due to the high consumption of products assumed to contain bread-making flour as an ingredient by the target group. Following consultations, the mandatory fortification of food with folic acid in bread, rather than in bread-making flour was proposed. Therefore, further dietary modelling was undertaken at Final Assessment to consider the mandatory fortification of bread and its potential impact on folic acid intakes. The definition for bread in the Food Standards Code, was used to identify the foods that were included in the dietary modelling. The Food Standards Code states that bread is made from cereal flour, is yeast leavened and is baked.

Figure 2: Definition of all bread for dietary modelling purposes

All Bread:

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; and breadcrumbs.

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; and bread mixes intended for home use.

1.6 Scenarios and folic acid concentration data

FSANZ first assessed what impact the change from fortifying bread making flour to bread had in relation to the proportion of the target population likely to consume products containing folic acid from mandatory fortification. The results showed a drop of only 3% of the target population consuming the foods proposed to be fortified with folic acid.

1.6.1 Dietary modelling scenarios for assessing folic acid intakes

To ensure that the estimated dietary folic acid intakes at Final Assessment gave equivalent outcomes to those at Draft Assessment, that is maximum folic acid intake for the target group whilst minimising intakes that exceed the UL, a number of bread fortification scenarios were examined, with the final two scenarios FSANZ modelled being as follows:

1. '**Baseline**' to estimate current folic acid intakes from food alone based on current uptake of voluntary folic acid permissions by industry;
2. '**Scenario 1**' to estimate folic acid intakes from food alone from current uptake by industry of voluntary folic acid permissions (except those for bread) plus the introduction of mandatory fortification of all bread at 135 µg folic acid per 100 g of bread.

'Baseline'

This model represents current estimated folic acid intakes for each population group assessed before mandatory folic acid fortification permissions are given in Australia and New Zealand. This model only considers those voluntary folic acid permissions outlined in Standard 1.3.2 of the *Australia New Zealand Food Standards Code* (the Code) that have been taken up by industry, as evidenced by products available on the supermarket shelves. It does not include foods or food groups where voluntary fortification of folic acid is permitted in the Code but has not been taken up by industry. It does not take into account naturally occurring folates in food or folic acid from the use of folic acid supplements or multi-vitamin supplements containing folic acid.

Baseline concentrations for foods voluntarily fortified with folic acid were derived from four major sources:

- unpublished FSANZ analytical data for samples purchased in Australia in 1997, 2005 and 2006; samples included in these analyses included a number of different types of common breakfast cereals, fortified breakfast juice and white bread;
- analytical data for samples purchased in New Zealand in 2003 and 2004 (Thomson, 2005); samples included in these analyses included breakfast cereals, juice, bread and food drinks;
- current label data for foods where no analytical values were available, without adjustment for potential under- or overages of folic acid; and
- recipe calculation for foods that contain a folic acid fortified food as one of their ingredients (e.g. chocolate crackles that contain fortified puffed rice breakfast cereal).

The effect of cooking foods was also taken into account when constructing the folic acid concentration database. For example, when cooking bread to make toast, both losses in folic acid from heat were taken into account along with weight change factors due to moisture losses when making bread into toast.

Information from the above mentioned four sources was matched against the 1995 Australian and 1997 New Zealand NNS food codes for all those foods identified as being fortified with folic acid (149/4550 foods in Australia and 101/4950 foods in New Zealand). All other foods recorded as being consumed were assumed not to contain added folic acid. The lists of foods assumed to currently contain added folic acid are detailed in Appendix 3 (Table A3.1 for Australia and Table A3.2 for New Zealand).

If a fortified version of a food was not specifically identified within the NNS, but it is known that a significant proportion of the food category in the market place is now fortified, a folic acid concentration was assigned to the food, and weighted to reflect the proportion of the market for that food that is now believed to be fortified. For example, the Australian NNS does not distinguish between the consumption of folic acid fortified white bread from unfortified white bread. The market share for folic acid fortified bread in Australia was estimated at 15% of all breads, based on sales information for a major bakery retail chain (Bakers Delight, 2006). A value representing 15% of the analysed or labelled concentration of folic acid in fortified breads was assigned to all white breads. Based on available information, fortification of breads with folic acid does not appear to be as common in New Zealand as in Australia.

'Scenario 1 – mandatory folic acid fortification of all breads'

The first step was to determine the level of folic acid that should be added to bread to achieve a similar outcome in terms of efficacy and safety as the addition of folic acid to bread making flour proposed at Draft Assessment. Therefore, a number of bread fortification scenarios were examined, including folic acid concentrations between 100 µg folic acid per 100 g of bread and 170 µg folic acid per 100 g of bread. The folic acid concentration in bread that was determined as giving equivalent outcomes to 200 µg folic acid per 100 g of bread-making flour (as per the Draft Assessment) was 135 µg folic acid per 100 g of bread.

The 'Scenario 1' model estimated dietary folic acid intakes for each population group resulting from mandatory folic acid fortification of all bread in Australia and New Zealand at 135 µg per 100 g of bread.

This model assumes that the introduction of mandatory folic acid fortification of all bread will have no impact on the current uptake of voluntary folic acid permissions by industry, with the exception of existing voluntary folic acid permissions for white, brown, wholemeal, grain and rye breads. Therefore, this model includes 'Baseline' folic acid concentrations for all foods other than bread, and folic acid concentrations for bread as a result of mandatory folic acid fortification at 135 µg per 100 g of bread.

It does not take into account naturally occurring folates in food or folic acid from the use of folic acid supplements or multi-vitamin supplements containing folic acid.

For a summary of folic acid concentration data used for 'Scenario 1 – mandatory folic acid fortification of all bread' see Appendix 3 (Table A3.1 for Australia and Table A3.2 for New Zealand).

1.7 How were the estimated dietary folic acid intakes calculated?

A detailed explanation of how the estimated dietary exposures are calculated can be found in Appendix 1.

2. Assumptions used in the dietary modelling

The aim of the dietary intake assessment is to make as realistic an estimate of dietary folic acid 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 by category.

2.1 Consumer behaviour

- People eat the same gram amount of bread today as they did in 1995/1997, when the NNS data were collected (see section 7 for further information);
- the dietary patterns for females aged 16-44 years are representative of the dietary patterns for pregnant women;
- consumers always select products containing folic acid at the concentrations specified; and

- the consumer consumption patterns reflect the proportions of fortified and non-fortified products currently available within certain food categories (i.e. more consumers now select folic acid fortified products). The current food consumption habits were reflected in the dietary modelling by weighting the folic acid concentration values for these foods groups according to market share data.

2.2 Concentration Data

- Naturally occurring sources of folate have not been included in the dietary intake assessment;
- if there were no Australian folic acid concentration data for specific foods, it was assumed that New Zealand data were representative of these food groups, and vice versa for New Zealand foods;
- if a food was not included in the intake assessment, it was assumed to contain a zero concentration of folic acid;
- a market share weighted folic acid value was assigned to food categories with voluntary permissions to fortify to reflect the proportion of products that have been fortified or, where possible, an analysis or label folic acid concentration was assigned to individual foods using up to date food composition data; and
- there was no contribution to folic acid intake through the use of complementary medicines (Australia) or dietary supplements (New Zealand) for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' models.

2.3 General

- There are no reductions in folic acid concentrations 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).

3. Estimated dietary folic acid intakes from folic acid added to food only

While folic acid intakes were estimated for a broad range of population sub-groups, the focus of the risk assessment was women of child-bearing age. Therefore, the results section of this report is primarily focused on this population sub-group.

3.1 Estimated dietary folic acid intakes for women of child-bearing age

The estimated mean dietary folic acid intakes for Australian and New Zealand women of child-bearing age are shown in Table 1 and Figure 3 for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' models. The incremental increase in folic acid intake from 'Baseline' of 101 µg/day for Australia and 140 µg/day for New Zealand is also shown in Table 1. Full results can be found in Appendix 4 (Table A4.1).

These results show an increase in estimated mean dietary folic acid intakes from 'Baseline' to 'Scenario 1- mandatory fortification of all bread'. Mean estimated folic acid intake from food alone for women of child bearing age did not achieve the desired folic acid intake of 400 µg/day for any of the models.

Further details on the percentage of the target group who have estimated dietary folic acid intakes that meet the 400 µg/day folic acid target can be found in Table 5.

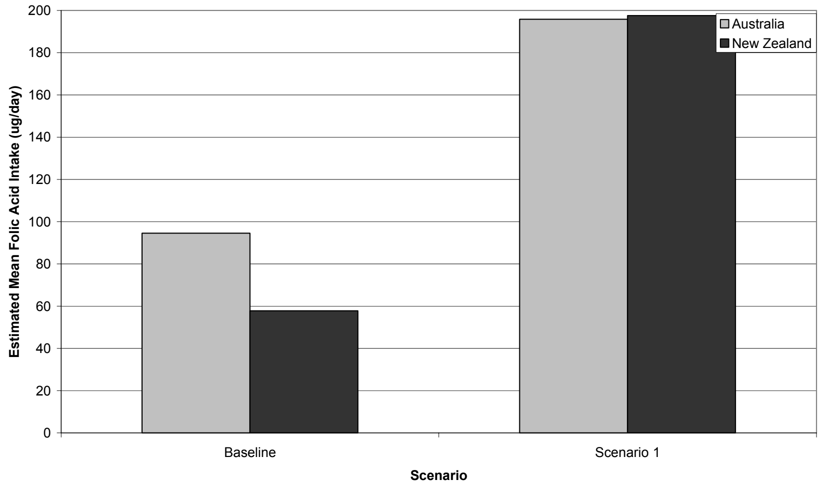
These results also indicate that New Zealand women of child-bearing age have lower baseline folic acid intakes and therefore larger incremental increases in intake as a result of Scenario 1 compared to the same population group for Australia. This is because of the lower baseline folic acid intakes in New Zealand due to fewer voluntary folic acid permissions being taken up by industry in New Zealand.

Table 1: Estimated mean folic acid intakes from food, and increase in folic acid intake from baseline, for Australian and New Zealand women of child-bearing age (16-44 years)#

Scenario	Mean dietary folic acid intake in µg/day (Increase in folic acid intake from baseline in µg/day)	
	Australia	New Zealand
'Baseline'	95	58
'Scenario 1 – mandatory folic acid fortification of all bread'	196 (+101)	198 (+140)

\# Number of respondents aged 16-44 years: Australia = 3,178; New Zealand = 1,509

Figure 3: Estimated mean dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' and for Australian and New Zealand women of child-bearing age (16-44 years)



3.2 Estimated dietary intakes of folic acid for the non-target groups

Dietary folic acid intakes were estimated for the non-target groups to assess the impact that 'Scenario 1 - mandatory folic acid fortification of all bread' would have on public health and safety. Full results for the estimated dietary folic acid intakes for the non-target group are in Appendix 4 (Table A4.2 for Australia and Table A4.3 for New Zealand).

These results show an increase in estimated dietary folic acid intakes for ‘Scenario 1- mandatory folic acid fortification of all bread’. As for women of child-bearing age, non-target groups in New Zealand also have lower baseline folic acid intakes compared to Australia. This could by explained due to the assumption that voluntary folic acid fortification of breads is not as common in New Zealand as in Australia.

3.3 Comparison of the estimated dietary intakes with the Upper Level

In order to determine if the proposed level of addition of folic acid to bread might be a concern to public health and safety, the estimated folic acid dietary intakes were compared with the NRV called an Upper Level (UL). The UL is ‘the highest average daily nutrient intake level likely to pose adverse health effects to almost all individuals in the general population’ (National Health and Medical Research Council 2006). The ULs for folic acid for pregnant and lactating women are 800 μg/day for 16-18 years and 1000 μg/day for 19-44 years.

The estimated dietary intakes for folic acid were determined for each individual and were compared to the relevant UL for the individual’s age group and gender. The proportion of the target group exceeding the UL is shown in Table 2. The table illustrates that less than 1% of this population group exceeds the UL. Full results can be found in Appendix 5 (Table A5.1).

Table 2: Proportion of respondents with folic acid intakes above the Upper Level for Australian and New Zealand women of child-bearing age*#

Scenario	% of respondents with folic acid intakes >UL	
	Australia	**New Zealand**
Baseline	<1	<1
Scenario 1 – mandatory folic acid fortification of all bread	<1	<1

* All females aged 16-44 years
# Number of respondents aged 16-44 years: Australia = 3,178; New Zealand = 1,509

The proportion of each non-target population group exceeding the UL is shown in Table 3 for ‘Baseline’ and ‘Scenario 1 – mandatory folic acid fortification of all bread’ for the Australia and New Zealand populations. Full results can be found in Appendix 5 (Table A5.2 for Australia and Table A5.3 for New Zealand).

For Australia, the results indicate that children aged 2-3 years and 4-8 years are the most likely of the non-target groups to have intakes exceeding the UL if mandatory folic acid fortification of all bread were to be introduced (see Table 3). However, the overall proportion of these age groups exceeding the UL is still very low.

Table 3: Proportion of Australian and New Zealand 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' respondents with folic acid intakes above the Upper Level

Country	Population Group	Upper Level (µg/day)	No. of respondents	% respondents with dietary folic acid intakes >UL	
				Baseline	Scenario 1: Mandatory folic acid fortification of all bread
Australia	2-3 years	300	383	1	6
	4-8 years	400	977	<1	3
	9-13 years	600	913	<1	2
	14-18 years	800	734	<1	1
	19-29 years	1000	2,203	<1	<1
	30-49 years	1000	4,397	<1	<1
	50-69 years	1000	3,019	<1	<1
	70+ years	1000	1,232	0	0
New Zealand	15-18 years	800	246	0	<1
	19-29 years	1000	804	0	0
	30-49 years	1000	1,883	<1	<1
	50-69 years	1000	1,147	0	<1
	70+ years	1000	556	0	0

3.4 Major contributors to folic acid intakes

The major contributors to folic acid intake were calculated for women of child bearing age and the general population for both 'Baseline' and 'Scenario 1- mandatory fortification of all bread' for both Australia and New Zealand. Percent contributors are calculated from data from a single 24-hour recall. The results are shown in Table 4.

Bread is a major contributor (>5%) to folic acid intakes for the population groups assessed at both 'Baseline' and 'Scenario 1- mandatory fortification of all bread', for both Australia and New Zealand. This is because of the large proportion of consumers of bread in both populations and the large amount consumed. This also indicates that bread is a good vehicle for the delivery of folic acid to the target population.

Other major contributors (>5%) to estimated folic acid intakes for Australians and New Zealanders are voluntarily fortified breakfast cereals and yeast extracts.

Table 4: Major contributors (>5%) to folic acid intakes at 'Baseline' and 'Scenario 1- mandatory fortification of all bread' for Australia and New Zealand

Country	Population group	Major contributors	
		Baseline	Scenario 1- mandatory fortification of all bread
Australia	2 years and above	Breakfast cereals (58%) Breads (20%) Yeast extracts (17%)	Breads (60%) Breakfast cereals (29%) Yeast extracts (9%)
	Females 16-44 years	Breakfast cereals (54%) Breads (21%) Yeast extracts (20%)	Breads (62%) Breakfast cereals (26%) Yeast extracts (10%)
New Zealand	15 years and above	Breakfast cereals (65%) Yeast extracts (29%)	Breads (71%) Breakfast cereals (19%) Yeast extracts (9%)
	Females 16-44 years	Breakfast cereals (63%) Yeast extracts (32%)	Breads (71%) Breakfast cereals (18%) Yeast extracts (9%)

4. Additional calculations to estimate folic acid intakes from food and supplements

Currently, women planning pregnancy and pregnant women are advised to take folic acid supplements. Consequently, additional calculations were undertaken by FSANZ to estimate folic acid intakes assuming women of child-bearing age received folic acid from folic acid supplements in addition to receiving folic acid via voluntary and mandatory fortification of foods.

Additional calculations were not conducted for each of the non-target groups due to limited information available on supplement use. Also, there are no specific nutrition policies that specify that members of the population other than the target group should take folic acid supplements.

4.1 How were the folic acid intakes from food and supplements calculated?

Two calculations were made for Australian and New Zealand women of child-bearing age. For Australia, it was assumed that the target group received an additional 200 µg or 500 µg of folic acid a day from supplements. For New Zealand, it was assumed the target group received an additional 200 µg or 800 µg of folic acid a day from supplements. These concentrations were selected because in Australia, folic acid only supplements typically contain 500 µg of folic acid, while New Zealand folic acid supplements typically contain 800 µg of folic acid. The lower concentration of 200 µg was based on recently published results (Bower *et al*., 2005) which found that 28.5% of women in the Western Australian study reported taking 200 µg or more per day from supplements.

To estimate total folic acid intake, the intake of folic acid from supplements was added to the estimated mean folic acid intake from food for this population group at 'Baseline' and for 'Scenario 1 – mandatory folic acid fortification of all bread' to estimate total folic acid intake. It was assumed that all women aged 16-44 years consumed a folic acid supplement. The Australian 1995 NNS indicated 7.6% of females aged 18-24 years and 11.4% of females aged 25-44 years took a folic acid supplement on the day before the NNS survey (Lawrence *et al*., 2001). Naturally occurring folates in food were not taken into account.

4.2 Estimated dietary intakes of folic acid from food and supplements for women of child-bearing age

The estimated total dietary folic acid intakes from food and folic acid supplements for Australian and New Zealand women of child-bearing age are shown in Figure 4A and Figure 4B respectively for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' models.

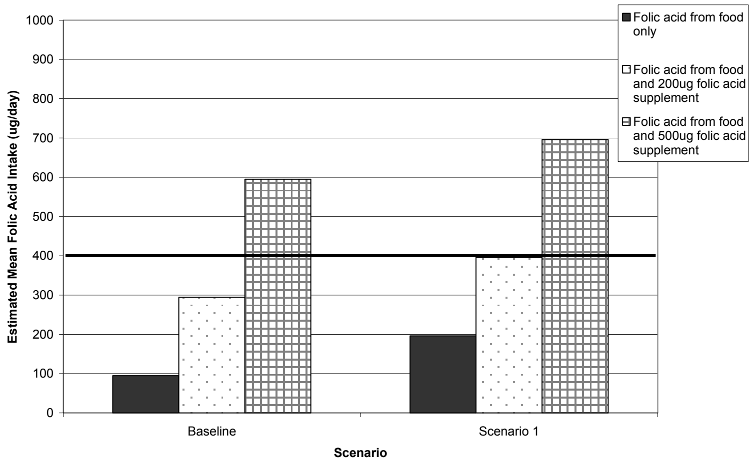
These results show an increase in estimated dietary folic acid intakes from 'Baseline' for 'Scenario 1- mandatory folic acid fortification of all bread' when additional folic acid is consumed from supplements.

The results indicate that, without the consumption of folic acid supplements, under 5% of Australian and New Zealand women of child-bearing age meet the recommended 400 µg folic acid per day for 'Scenario 1 – mandatory folic acid fortification of all bread'. When a 200 µg folic acid per day supplement is considered in conjunction with 'Scenario 1 – mandatory folic acid fortification of all bread', approximately 40% of Australian and New Zealand women of child-bearing age are estimated to meet the recommended amount of folic acid. If a 500 µg or 800 µg folic acid supplement is consumed by all women of child-bearing age, 100% of women of child-bearing age would meet the recommended daily amount of folic acid. Full details can be found in Table 5.

Full results on folic acid intakes from folic acid found in both food and supplements can be found in Appendix 6 (Table A6.1 for Australia and Table A6.2 for New Zealand).

Figure 4: Estimated mean dietary folic acid intakes from food and folic acid supplements for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' assessments for Australian and New Zealand women of child-bearing age (16-44 years)

A: Australia



B: New Zealand

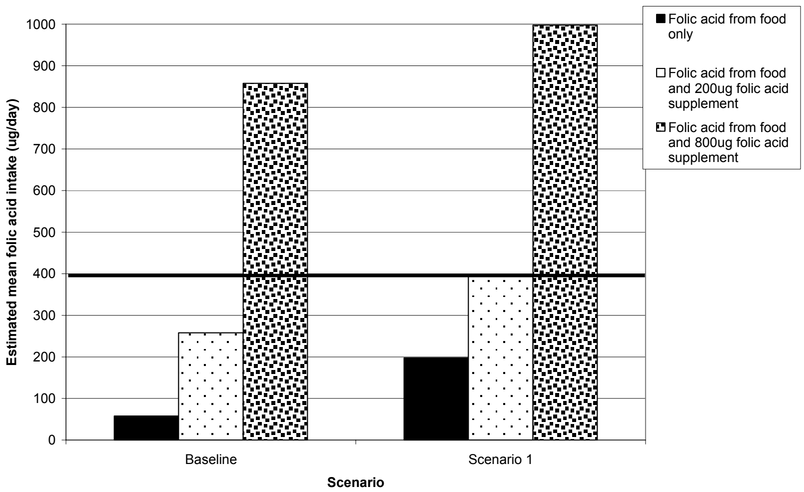


Table 5: Percentage of respondents with folic acid intakes of at least 400 µg/day from food ± supplements for Australian and New Zealand women of child-bearing age*#

Scenario	% of respondents with folic acid intakes of at least 400 µg/day from food ± supplements					
	Australia			New Zealand		
	No Supplement	200µg Supplement	500µg Supplement	No Supplement	200µg Supplement	800µg Supplement
Baseline	2	8	100	<1	3	100
Scenario 1 – mandatory folic acid fortification of all bread	4	38	100	2	40	100

* All females aged 16-44 years.
# Number of respondents aged 16-44 years: Australia = 3,178; New Zealand = 1,509

4.3 Comparison of the estimated dietary intakes from food and supplements with the Upper Level

The results indicate that when Australian and New Zealand women of child-bearing age consume additional folic acid from a supplement, there is likely to be an increase in the proportion of the target group exceeding the UL of 800 µg of folic acid per day for women aged 16-18 years and 1000 µg of folic acid per day for women aged 19-44 years.

The proportion of respondents exceeding the UL increases as the concentration of folic acid in the supplement increases. Due to the high folic acid content of the supplement at 800 µg of folic acid per day, a large proportion of New Zealand women are likely to exceed the UL if folic acid from food is taken into account for 'Scenario 1 – mandatory folic acid fortification of all bread'.

The proportion of the target group exceeding the UL when supplements are taken is shown in Table 6 for Australia and New Zealand. Full results can be found in Table A6.3 and Table A6.4 of Appendix 6.

Table 6: Proportion of respondents with folic acid intakes from food and supplements above the Upper Level for Australian and New Zealand women of child-bearing age*#

Scenario	% of respondents with folic acid intakes from food and supplements > UL			
	Australia		New Zealand	
	200µg Supplement	500µg Supplement	200µg Supplement	800µg Supplement
Baseline	<1	1	<1	9
Scenario 1 – mandatory folic acid fortification of all bread	<1	3	<1	44

* All females aged 16-44 years.
# Number of respondents aged 16-44 years: Australia = 3,178; New Zealand = 1,509

5. Estimated bread consumption and folic acid intakes for different socio-economic groups for Australia only

Australian NNS data were assessed against a socio-economic index for areas (SEIFA index[1]) for the whole population and for women of child bearing age for bread consumption and for folic acid intakes. A second analysis of bread consumption patterns against income was derived from Roy Morgan Single Source Data for 2001-2006 (Roy Morgan, 2006a).

From the Australian NNS, bread consumption amounts were determined in addition to folic acid intakes and proportions of population groups exceeding the UL, and assessed against SEIFA quintiles. Further details and full results can be found in Appendix 7.

There were small variations in bread consumption from the Australian NNS across SEIFA quintiles, particularly for fancy breads, based on data for all survey respondents aged 19 years and over. The amount of regular breads and rolls eaten by consumers of these products only varied by around 6 grams per day with a similar proportion of people consuming these products across all the quintiles (around 78-82%).The amount of fancy bread eaten by consumers varied by around 10 grams per day with a higher proportion of people in the higher socio-economic SEIFA index consuming fancy breads (16% compared to 10-12% in other quintiles), however, the amount eaten by those consuming these products were similar to the amounts eaten by consumers of these products in other quintiles. Data specifically for females 16-44 years had similar findings with less than 10 grams variation in regular bread and rolls consumption across the quintiles. For both population groups assessed, the average proportion of people consuming these breads was 81%.

Analysis of bread consumption by income of individuals from Roy Morgan Single Source data for 2001-2006 show that the proportion of females 16-44 years consuming bread varies depending on income but does not show a consistent pattern based on total household or individual income. The group with the highest income has the highest percentage of bread consumers at around 86%, however the lowest income group and the mean across all incomes is around 78% (Appendix 7, Tables 7.2, 7.3).

Estimated folic acid intakes from the Australian NNS data did not increase or decrease consistently across SEIFA quintiles, and ranged between 85 and 102 µg per day at 'Baseline' and between 184 and 204 µg per day for Scenario 1. Overall increases in folic acid intake varies little from mean 'Baseline' intakes to 'Scenario 1 – mandatory folic acid fortification of all bread' across socio-economic groups; between 99 and 102 µg per day.

[1] The SEIFA index of relative social disadvantage was derived from 1991 Census and it assigns an index to geographic areas based on socio-economic variables. This index describes the characteristics of the area in which a person lives rather than the characteristics of the person and takes into consideration such things including economic resources of households, education, occupation, family structure and ethnicity. Each person who participated in the NNS was allocated an index score based on Collectors District (CD) in which they were enumerated. In most cases this was the usual residence and the score was grouped by quintile. A high quintile score suggests the area has a large number of families with high incomes, training and skilled occupations. A low score indicates the area is more disadvantaged and has fewer families with a high income and the residents have less training and skilled occupations.

The assessment reveals that the NNS SEIFA Index of the respondent made little difference to the amount of bread consumed or folic acid intakes by women of child-bearing age. It appears that mandatory fortification would not discriminate against women in any socio-economic groups, and would be just as effective across all groups.

6. Other fortification options assessed

6.1 Additional estimates of folic acid intakes for New Zealand

FSANZ does not currently hold food consumption data for New Zealand children aged 2-14 years from the 2002 National Children's Nutrition Survey. The New Zealand Food Safety Authority (NZFSA) provided FSANZ with some estimated intakes for New Zealand children (Blakey *et al*., 2006), and some intakes for New Zealanders 15 years and above based on scenarios other than that proposed by FSANZ.

The results are not directly comparable to the results FSANZ produced for Australian children because the New Zealand assessments assumed different proposed levels of fortification, different foods were included (bread consumed as part of a sandwich or burger or as breadcrumbs was not included), different age groups and a different methodology was used. They main difference was that only a single 24 hour recall record was used in the calculation, with no second day adjustment for folic acid intakes. In addition the New Zealand estimates did not include a baseline level of folic acid intakes from voluntary permissions. To provide the best comparison with DIAMOND generated data possible, FSANZ has added a mean baseline folic acid intake to estimated intakes from the various mandatory fortification scenarios account for voluntary permissions for people aged over 15 years derived from DIAMOND calculations. See Appendix 8 for all results.

6.1.1 Estimated folic acid intakes for New Zealand children

Estimated mean folic acid intakes for New Zealand children were based on mandatory fortification of breads only. For the NZ scenario 1 (all breads except sweet buns, hamburger buns and flat breads) mean folic acid intakes were between 120 and 150 µg/day (based on 120 µg/100g bread and 150 µg/100g bread respectively). For the NZ Scenario 2 (wholemeal/wholegrain) intakes were much lower at 23 and 29 µg/day respectively; and for the NZ Scenario 3 (white bread) resulted in intakes of 101 and 127 µg/day respectively. Estimated intakes for New Zealand children were much lower than those for Australia, however the intakes are not directly comparable to intakes from Australian children given the exclusion of baseline folic acid intakes in the New Zealand calculations.

FSANZ was unable to estimate baseline intakes for this population group in the absence of the 2002 Children's Nutrition Survey data. It was inappropriate to use baseline intakes for Australian children and assume it was the same in New Zealand as it has been shown elsewhere for the older age groups that baseline intakes for New Zealand were much lower than Australian intakes due to the uptake of voluntary fortification permissions being different between the countries.

The results for New Zealand children show that at a mandatory fortification level of 120 µg per 100g of bread, 1.4% of children or less exceed the UL. At a fortification level of 150 µg per 100g of bread, 3.3% of children or less exceed the UL. The proportion of New Zealand children exceeding the UL is low.

It should be noted that, the intakes were not second day adjusted, which if undertaken, would result in a lower number of respondents exceeding the UL. On the other hand, they did not include folic acid intakes from voluntary fortification which would mean that a higher proportion of New Zealand children may exceed the UL. However, it is concluded that a similar proportion of New Zealand children 5-14 years are likely to have folic acid intakes above the UL compared to Australian children of the same age.

6.1.2 Estimated intakes for New Zealanders 15 years and above based on alternative fortification scenarios

Additional folic acid intake calculations were performed by New Zealand for various fortification scenarios. A summary of the estimated intakes are found in Table 7 (full results in Appendix 8, Tables A8.4-A8.6).

New Zealand estimated intake from mandatory fortification only. For the purposes of this report, FSANZ added on mean baseline intakes derived from previous DIAMOND estimates for this population to account for voluntary fortification. The mean baseline level was added to both the mean and 95th percentile estimates of folic acid intake submitted to provide an approximate estimate of intake from both mandatory and voluntary fortification for the alternative scenarios. This methodology has some limitations in itself (e.g. double counting of fortified bread in both voluntary and mandatory estimates of intake, adding baseline intakes from second day adjusted models to intakes from mandatory fortification based on single 24-hour recall data, adding mean baseline intake to a 95th percentile mandatory intake as the consuming populations of different foods may be different). The results are also not directly comparable to those from Australia due to the different folic acid concentrations used in the bread and the fact that the 'NZ all bread' scenario included different breads to the FSANZ 'all bread' scenario (excluded bread consumed in sandwiches, burgers, breadcrumbs and other recipes).

Despite the abovementioned limitations, the results generally show that the New Zealand scenario for all bread at a fortification level of 150 μg/100g bread provides similar intakes to the FSANZ proposed option. It is likely that the higher level of fortification assumed (150 μg/100g bread compared to the proposed 135 μg/100g bread) is cancelled out to some extent by the more restricted bread consumption amounts included in these models, therefore giving a similar result. All other New Zealand scenarios do not provide an equivalent level of intake.

Table 7: Summary of folic acid intakes (µg/day) for New Zealand only (mandatory plus voluntary) based on alternative New Zealand scenarios and compared to FSANZ estimates

Scenario	Folic acid concentration in bread	Females 16-44 years		Population 15 years and above	
		Mean	95th percentile	Mean	95th percentile
FSANZ Baseline (voluntary only)	Current levels (various)*	58	177	69	203
FSANZ preferred option – all bread	135 µg/100g	198	344	230	431
NZ Scenario 1 – all bread (excluding hamburger buns, flat breads, sweet buns)	120 µg/100g	108	281	128	323
	150 µg/100g	193	409	228	473
NZ Scenario 2 – wholemeal and wholegrain breads	120 µg/100g	97	231	124	278
	150 µg/100g	107	274	137	330
NZ Scenario 3 – white breads	120 µg/100g	129	312	144	346
	150 µg/100g	147	376	163	416

* See Appendix 3

6.2 Alternative mandatory fortification approaches

Through submissions and consultations alternative options for the mandatory fortification of bread (based on different types of bread) were proposed. Before conducting detailed intake assessments for these options, an assessment of the proportion of the target population (females 16-44 years) who consume foods from each of the four options was assessed (the 'percentage consumption') and compared to the proportion of the target population consuming bread as defined in Section 1.5. This was used to decide which options warranted a more detailed investigation.

The foods included under each of the four alternative options, as well as the preferred option of all bread, are outlined in Figure 5. The estimated 'percentage consumption' by the target population being shown in Table 8. The current voluntary permissions (e.g. for breakfast cereals, fruit juice etc) were not included in these estimations.

Table 8: Percentage of the target group (females aged 16-44 years for Australia and New Zealand) consuming different types of bread products

Proposed mandatory bread fortification options	% consumption for 16-44 year old females	
	Australia	New Zealand
Option 1	29	25
Option 2	77	73
Option 3	80	77
Option 4	NA	79
Proposed option P295 FAR	85	83

NA = not able to be assessed

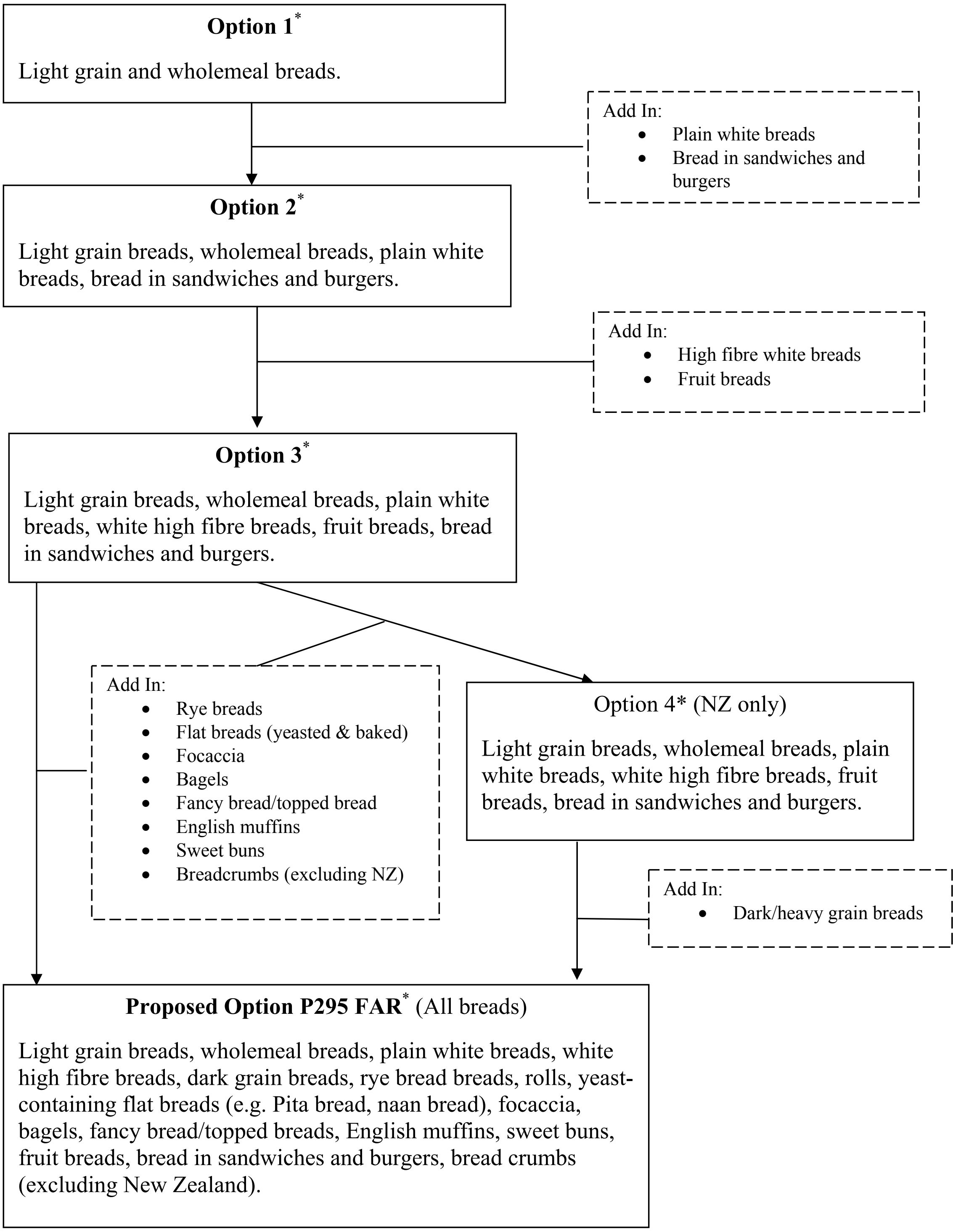
‘Percentage consumption’ for the target population group for both countries, when compared to the preferred option of mandatory fortification for all breads, shows that for:

- Option 1 (including light grain and wholemeal breads), the ‘percentage consumption’ is only around one third of that for the preferred option;
- Option 2 (including plain white breads and breads in sandwiches and burgers in addition to Option 1), the ‘percentage consumption’ is 10% less than the preferred option;
- Option 3 (including high fibre white bread and fruit breads in addition to Option 2), the ‘percentage consumption’ is 6 % less than the preferred option; and
- Option 4 (NZ only - including all bread types apart from dark/heavy grain breads), the ‘percentage consumption’ is 4% less than the preferred option.

Option 4 was only assessed for New Zealand because the NNS food descriptors enabled ‘dark/heavy’ versus ‘light’ grains to be distinguished and therefore were able to be excluded or included separately as the options required. The Australian NNS food descriptors were only defined as ‘grain’ breads and it was therefore not possible to distinguish light from heavy grain bread consumers.

It was determined that alternative mandatory fortification options proposed did not result in as high a proportion of the target population consuming fortified breads in comparison to the FSANZ preferred option. Therefore, as the aim of the fortification program is to target the highest proportion of women of child bearing age further more detailed assessments of folic acid intake based on these alternative options were not conducted. The exclusion of heavy grain breads from Options 1 to 4 makes these options 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 consuming fortified breads.

Figure 5: Foods included in the four options (alternative mandatory fortification of bread) proposed through submissions and consultation



* 'Breads' includes loaves of bread and bread rolls

6.3 Alternative voluntary approach

A submitter suggested a voluntary fortification system with an increased range of foods compared to what is currently voluntarily fortified. Since only voluntary permissions were requested and these were given by brand, FSANZ was unable to estimate 'percentage consumption' for this scenario, therefore dietary folic acid intakes were estimated for the target groups of Australian and New Zealand women aged 16-44 years as an alternative.

FSANZ used currently fortified foods in addition to extra foods and concentrations provided by the submitter. Folic acid intakes were estimated using the FSANZ nutrient intake methodology. FSANZ investigated the increase in folic acid intakes from voluntarily fortified foods from 'Baseline' plus voluntarily fortified high fibre white bread, low and reduced fat natural yoghurts and frozen diet ready-to-eat meals. The market share for breads was assumed to increase from the 15% at 'Baseline' to 20% since the submitter suggested there would be more bread products on the market that would be voluntary fortified under their suggested approach.

This scenario does not take into account naturally occurring folates in food or folic acid from the use of folic acid supplements or multi-vitamin supplements containing folic acid.

6.3.1 Assumptions for alternative voluntary approach

- Breads voluntarily fortified with folic acid are not used for hamburgers and other burgers;
- there is an increase in market share for voluntarily fortified breads from 15% to 20%. There is no change in market share for other foods that are currently folic acid fortified on a voluntary basis;
- 20% of high fibre white bread will be voluntarily fortified with folic acid;
- all low fat and reduced fat natural yoghurt and frozen diet ready to eat meals will be fortified voluntarily;
- frozen low fat and reduced fat yoghurts will not be voluntarily fortified with folic acid;
- frozen diet ready-to-eat meals were not able to be identified in the New Zealand NNS, therefore were not included; and
- the serve size of yoghurt is 100 g, white high fibre bread is 78 g, and 300 g for frozen diet ready-to-eat meals, based on information from food labels.

The estimated mean dietary folic acid intakes from food for Australian and New Zealand women of child-bearing age are shown in Table 9 and Figure 6. The incremental increase in folic acid intake from 'Baseline' is also shown in Table 9. Full results can be found in Table A4.4 in Appendix 4.

These results show that, under the submitter alternative voluntary approach, estimated mean dietary folic acid intakes increase minimally from 'Baseline' for both Australia (8 µg/day) and New Zealand (4 µg/day). Mandatory folic acid fortification of all bread, as proposed by FSANZ, increases the mean dietary folic acid intake by 101 µg/day and 140 µg/day for Australia and New Zealand, respectively.

The small increase could be attributed to the small number of consumers of low fat and reduced fat natural yoghurt, and all frozen diet ready to eat meals, and because of the small increase in the bread market that it was assumed will be effected.

The consumer numbers for the additionally fortified non-bread foods for the target group of females 16-44 years are show in Table 10.

Table 9: Estimated mean folic acid intakes from food for Australian and New Zealand women of child-bearing age (16-44 years)#

Scenario	Mean dietary folic acid intake in µg/day (Increase in folic acid intake from baseline in µg/day)	
	Australia	New Zealand
'Baseline'	95	58
'Scenario 1 – mandatory folic acid fortification of all bread'	196 (+101)	198 (+140)
'Submitter alternative voluntary approach'	103 (+8)	62 (+4)

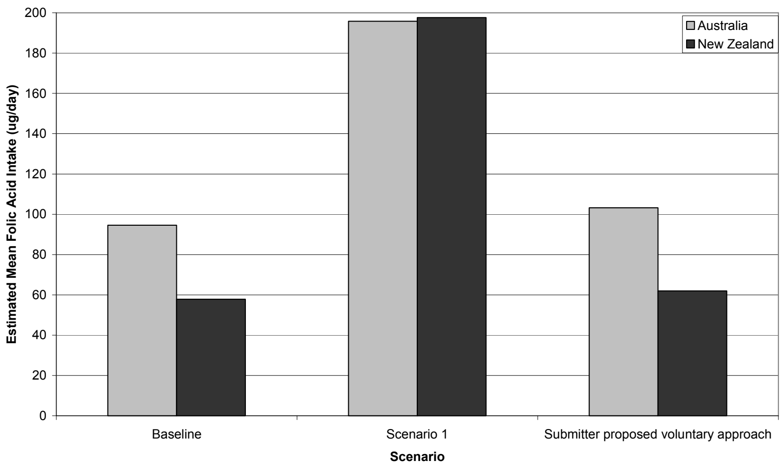
Number of respondents aged 16-44 years: Australia = 3,178; New Zealand = 1,509

Table 10: Number of consumers of foods suggested that may be fortified under the alternative voluntary fortification scenario

Country	Number of respondents in target group*	Number of consumers	
		Low/reduced fat natural yoghurt	Frozen diet ready to eat meals
Australia	3178	31	2
New Zealand	1509	33	0

*Females 16-44 years.

Figure 6: Estimated mean dietary folic acid intakes for 'Baseline', 'Scenario 1 – mandatory folic acid fortification of all bread' and 'Submitter alternative voluntary approach' for Australian and New Zealand women of child-bearing age (16-44 years)



7. Limitations of the dietary modelling

7.1 Bread consumption patterns

Dietary modelling based on 1995 or 1997 NNS food consumption data provides the best estimate of actual consumption of a food and the resulting estimated dietary intake of a nutrient for the population. However, it should be noted that the NNS data does have its limitations. These limitations relate to the age of the data and the changes in eating patterns that may have occurred since the data were collected. Many submitters to Draft Assessment also commented on this issue. Generally, 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*., 2001). It is recognised while the overall amount of bread people consume may not change over time, the type of bread being consumed may vary. 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 remains the same. The uncertainty is 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.

In order to address the issue of older food consumption data, FSANZ has undertaken significant research to find other sources of more recent food consumption data to investigate bread consumption in terms of the proportion of the population who consume bread. New data were found from several sources including consumer research surveys and data from submissions. Some of the data collated were from Roy Morgan research (Single Source and Young Australian data) (Roy Morgan, 2006a; Roy Morgan, 2006b), from the Australian Dairy Corporation (ADC) (Australian Dairy Corporation, 2003), Newspoll in Australia (George Weston Submission, 2006) and a UMR survey from New Zealand (NZFSA submission, 2006). Data on food consumption by clients of various dietetic practices were provided by George Weston Foods in their submission. These data were excluded from this updated analysis as the sample was a selective sample of female clients of urban dietitians and not representative of the target population. A summary of the data that were considered are shown in Table 11. Summary data derived from the 1995 Australian NNS and 1997 New Zealand NNS have been included in the table for comparative purposes.

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. The column headings provide an indication as to the sort of questions that were asked for each survey (e.g. frequency of consumption versus consumed bread in the last 7 days). The table also provides information on the type of method used for the survey, for example some data were from a 7 day survey others from a single day. It is expected that reported levels for consumption 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 data show that the percentage of the population consuming bread has stayed at around 80% over the last few years (Roy Morgan Single Source data for 2001-2006) for Australia and New Zealand, particularly in the target population group.

The ADC survey shows 97% of people consuming bread in the last seven days, however, with out the specific methodology available it is difficult to determine why the Roy Morgan numbers are lower, as both surveys are based on seven day food consumption data. it could be due to a ‘recall’ survey being used by Roy Morgan, which relies on memory, as opposed to a ‘diary’ survey being used where foods are recorded as they are consumed and less likelihood that foods consumed will be forgotten to be identified. It may also be due to different classifications of ‘bread’, for example the Roy Morgan survey only asked questions about regular bread and rolls, toast and bagels whilst the ADC survey specifically included focaccia and other types of bread in their questions. A broader definition will obviously include more foods and therefore pick up more consumers. The number of slices of bread being consumed has also remained about the same (approximately 2 slices per day), but again this is difficult to compare across surveys with some surveys including bread from mixed foods and others not. In terms of the frequency of consumption, around 40-50% of people are ‘daily’ consumers, with between approximately 20-40% never consuming white bread and approximately 20% never consuming grain/wholemeal bread. These updated data of consumer food consumption patterns indicate that the NNS consumption data used to assess folic acid intakes for this proposal are in similar ranges. The NNS data used are the best available data at an individual record level to provide reliable robust estimates of folic acid intakes.

Table 11: Summary of recent estimates of the bread consumption in the population

Survey	Population	Sample size	Date	Methods	Number of slices			Frequency of consumption	Volume consumed for those consuming at least 1x wk (slices)	Bread consumption (consumed in last 7 days)	% usually consuming bread		Mean weight (g/wk) (cons)	% who consumed bread
					Mean/ day (resp)	Mean/ day (cons)	Per wk (resp)				Before school	Lunch		
Roy Morgan Single Source Survey	Australian women aged 16-44 Post-weighted representative sample	32,976	Dec 2001-March 2006	Face-to-face interview and self-completed questionnaire						All Years - 78.4% 2001 [1] – 81.2% 2002 – 79.5% 2003 – 79.2% 2004 – 77.7% 2005 – 75.7% 2006 [2] – 79.6% (refer to [3])				
Roy Morgan Single Source Survey	NZ women aged 16-44 Post-weighted representative sample	17,834	Dec 2001-March 2006	Face-to-face interview and self-completed questionnaire						All years - 85.0% 2001 [1] – 85.0% 2002 – 84.1% 2003 – 83.9% 2004 – 86.1% 2005 – 83.8% 2006 [2] – 87.5% (refer to [3])				
Roy Morgan Young Australians Survey	Australian children aged 6-13 Post-weighted representative sample	12,084	April 2005-March 2006	Self-completed questionnaire							74.8 [4]	86.9 [4]		
George Weston	Recruited from Royal Prince Albert Hospital Allergy Unit and Maternity Ward, Central Sydney Early Childcare Centres and the general public aged 16-45	197	2006	FFQ	2.3									

Survey	Population	Sample size	Date	Methods	Number of slices			Frequency of consumption	Volume consumed for those consuming at least 1x wk (slices)	Bread consumption (consumed in last 7 days)	% usually consuming bread		Mean weight (g/wk) (cons)	% who consumed bread
					Mean/ day (resp)	Mean/ day (cons)	Per wk (resp)				Before school	Lunch		
UMR NZ Commissioned by NZFSA	'Nationally representative' sample of 750 NZs 18-44 years	195	13-16 July 2006	Telephone survey				**White** [5] Everyday: 21% 4-6 d/wk: 15% 1-3 d/wk: 17% 1 x f/n: 9% Less often/never: 38% **Grain/w/m** [5] Everyday: 39% 4-6 d/wk: 16% 1-3 d/wk: 18% 1 x f/n: 6% Less often/never: 20%	**White** [5] 1-2: 16% 3-5: 29% 6-10: 24% 11-15: 11% 16-20: 4% 20+: 11% **Grain/w-m** [5] 1-2: 7% 3-5: 16% 6-10: 33% 11-15: 23% 16-20: 7% 20+: 14%					
Australian Dairy Corporation (ADC)	Australian women aged 16-34	180	Dec 2002-March 2003	7-day self-completed diary						97% [6]			933[6]	
Newspoll Australia Commissioned by George Weston	Australian women aged 18-44 Post weighted sample	241	23-25 June 2006	Telephone survey			Overall: 11 (1.6/d) Multi/w-m: 5 (0.7/d) <5: 27% 6-10: 25% 11-15: 23% 16+: 25%	Everyday: 50% 4-6 d/wk: 20% 1-3 d/wk: 20% <1 d/wk: 10%						
Australian NNS	Australian women aged 16-44	3178	1995	24-hour	2.9 [7]	3.5[7]		**White** [8] Everyday: 44% 1-6 x wk: 27% 1-3 x mth: 9% Less often/never: 17% **Grain/w/m**[8] Everyday: 39% 1-6 x wk: 28% 1-3 x mth: 11% Less often/never: 19%					742[7]	85[9]
NZ NNS	NZ women aged 16-44	1509	1997	24-hour	3.3[10]	4.0[10]								83[9]

[1] December only; [2] Jan-March only; [3] bread/rolls, toast, bagels; [4] toast, sandwiches, bread/rolls; [5] bread, rolls, toast, flat bread, bagels, focaccia; [6] includes white, white high fibre, w/m, grain, rye, rolls, yeast containing flat breads, focaccia, bagels, fancy bread, English muffins, sweet buns, fruit bread, sandwich, burgers, breadcrumbs.

7.2 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. Therefore, the nutrient databases from the NNSs used for dietary modelling may not be entirely representative of the nutrient levels in some foods that are now on the market. 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. For the purposes of the dietary intake assessment for this Proposal, folic acid concentrations have been assigned to foods to take this into account and therefore should reflect current concentrations and foods fortified (e.g. to 15% of breads currently being fortified, as explained under Section 1.6.2 – Dietary modelling scenarios for assessing folic acid intakes).

There are a number of limitations associated with the folic acid concentration data. Analytical values used may not fully reflect actual levels due to variation in folic acid concentrations between batches of foods and because the technique used to measure folic acid (microbiological assay) is subject to significant uncertainty (Thomson 2005). Data generated from label values has not been adjusted to take into account potential extra addition of folic acid (overages). For 'Baseline' concentrations, a major limitation is that market share information, used to weight folic acid concentration in breads and juices according to the proportion of the category observed to be fortified, may not fully reflect actual fortification practices. For scenario concentrations, a major limitation relates to the assumptions about the proportion of bread used in different foods (e.g. in hamburgers and sandwiches).

A limitation of estimating dietary intake over a period time using information from food recalls 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.

FSANZ does not currently hold food consumption data for New Zealand children aged 2-14 years. Therefore, FSANZ received estimated folic acid intakes for this population group 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 all bread with folic acid 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.

Intake of folic acid from dietary supplements was considered for the target group using simple techniques to estimate the intake, as described previously.

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 Islanders 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.

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Appendix 1

How were the estimated dietary folic acid intakes from fortified food calculated?

Folic acid 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 folic acid for an individual food by the amount of the food that an individual consumed in order to estimate the intake of folic acid from each food. Once this has been completed for all of the foods specified to contain folic acid, the total amount of folic acid consumed from all foods is summed for each individual. Adjusted nutrient intakes are first calculated (see below) and population statistics (such as mean and high percentile nutrient intakes) are then derived from the individuals' ranked adjusted intakes.

1.1 Adjusting nutrient intakes

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

1.1.1 Calculating adjusted nutrient intakes

To calculate usual daily nutrient intakes, more than one day of food consumption data are 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 estimate more usual nutrient intakes using both days of food consumption data, an adjustment is made to each respondent's folic acid intake based on the first day of food consumption data from the NNS. The adjustment takes 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 A1.1 below. For more information on the methodology of adjusting for second day nutrient intakes, see the Technical Paper on the National Nutrition Survey: Confidentialised Unit Record File (Australian Bureau of Statistics, 1998).

Figure A1.1: Calculating adjusted nutrient intakes

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

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)

Not all foods consumed in the NNSs were assigned a folic acid concentration as not all foods are permitted to, or take up, voluntary fortification. Therefore not all NNS respondents are consumers of folic acid based on day one food consumption records only.

However, after nutrient intake adjustments have been made based on a second day of food consumption data, all respondents have a folic acid intake as a function of how the adjusted intakes are calculated. This doesn't mean that there will be 100% of respondents consuming bread over 2 days. The intake assessments are based on other foods in addition to bread and it is simply a function of the second day adjustment methodology.

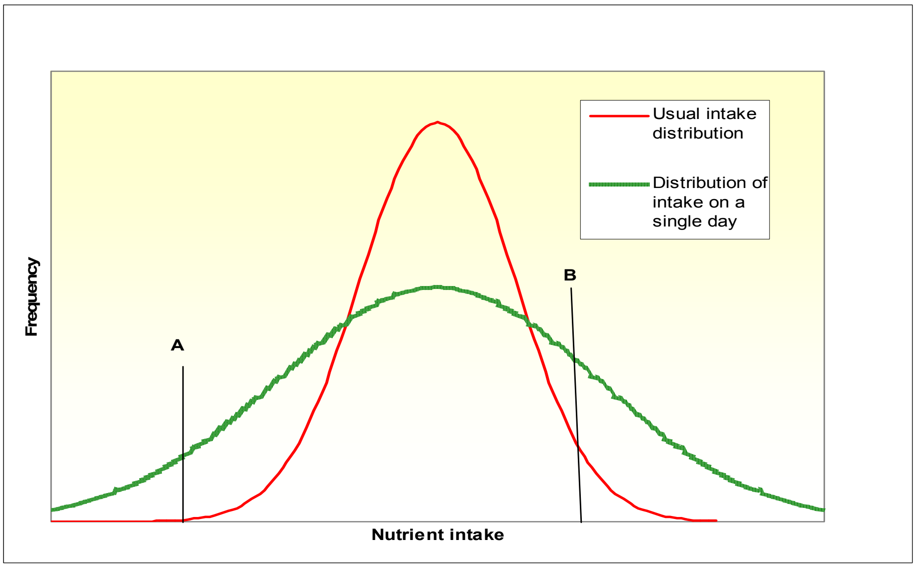
As a part of the two-day adjustment methodology, each individual below the mean in a folic acid intake distribution for day one will have an addition made to their folic acid intakes in order to calculate the adjusted intake over two days, as every individual's intakes are brought towards the mean. This applies to the folic acid intakes from respondents which are zero for day one. Whilst this may not represent the correct usual intakes at the bottom end of the usual folic acid intake distribution, this is unlikely to be a major issue for the risk assessment because the proportion of the population below the EAR for dietary folate equivalents (DFEs), which uses the lower end of the adjusted nutrient intake distribution, was not required to be determined. For this risk assessment, the concern is related to the proportion of respondents with intakes that exceed the upper safe reference health standard (the UL for folic acid), which would be the folic acid intakes at the upper end of the intake distribution. The people in the upper end of the intake distribution would have consumed foods containing folic acid. Therefore the adjusted folic acid intakes in the upper end of the distribution accurately reflect the usual population intakes.

The benefit in being able to more accurately estimate 'usual intake' by using the two day adjustment factor outweighs the possible over estimation of nutrient intakes for low consumers for risk assessment purposes.

1.1.2 Comparison of one day and usual nutrient intake distributions

The range of nutrient intakes from respondents is broader based on a single day of food consumption data than the range of usual intakes (Figure A1.2) as the latter takes into consideration the day-to-day variation in intakes within each person as well as the difference between each person.

Figure A1.2: Comparison of one day and usual nutrient intake distributions



Using adjusted nutrient intakes provides better information for risk characterisation purposes. 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 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.

1.1.3 Comparison of nutrient intakes with NRVs

Comparison of nutrient intakes based on a single day of food consumption data with NRVs such as EAR would result in a larger proportion of the population having intakes below a specified level (e.g. Figure A1.2, point A), which may overestimate the level of deficiency or inadequate intakes. A broader distribution from a single day of data also means a greater proportion of a population would exceed an upper cut off level, such as an upper level (e.g. Figure A1.2, point B), which overestimates the level of risk to this group of the population.

Note that where estimated nutrient intakes are expressed as a percentage of the Upper Level (UL), each individual's total adjusted intake is calculated as a percentage of the UL (using the total intakes in units per day) corresponding to their age and gender, the results are then ranked, and population statistics derived.

1.2 Calculation of foods contributing to folic acid intakes

Folic acid 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 folic acid for an individual food by the amount of the food that an individual consumed in order to estimate the intake of folic acid from each food. Once this has been completed for all of the foods specified to contain folic acid, the total amount of folic acid consumed from all foods is summed for each individual. This is based on a singe 24-hour recall only. Percentage contributions from individual foods are then calculated for food groups. Population statistics are then derived from the individuals' results.

1.3 Estimated consumption of bread and folic acid intakes based on socio-economic group (Australia only)

Assessments based on socio-economic status were only conducted for Australia because the socio-economic indicators were not loaded into DIAMOND for New Zealand.

Using the data from the 1995 NNS:

- Women were categorised according to their SEIFA index of relative socio-economic disadvantage, based on the 1995 NNS (Table A7.1 and Graph A7.1).
- Women were grouped into age classifications including 16-18 years, 19-44 years, 16-44 years and all females aged ≥2 years (Table A7.2). The data regarding women of child bearing age, aged 16-44 years, were analysed in the most detail.
- The consumption amounts of bread across different socio-economic groups were compared between the various data sets including:

  - 1995 NNS data for all people aged 19 years – breakdown for SEIFA quintiles;
  - 1995 NNS data for females aged 16-44 years as calculated by DIAMOND and displayed per SEIFA quintile; and

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- Females age 16-44 years based on household income and individual recipient income over the 7 day period prior to July 2001 as calculated by Roy Morgan Single Source January 2001 – March 2006 (Roy Morgan, 2006a).

- The mean intake of folic acid at 'Baseline' and for 'Scenario 1 – mandatory folic fortification of all bread' was calculated for women aged 16-18 years, 19-44 years and 16-44 years for each of the SEIFA Quintiles (Table A7.2, Graph A7.2a).
- The mean intake of folic acid for all SEIFA groups across all ages was compared with the National Health and Medical Research Councils (NHMRC) Nutrient Reference Values of Upper Levels of Intake (UL) for Australian population groups. The percentage of respondents in various age categories and SEIFA Quintiles exceeding the UL were determined. From this it was determined whether a relationship existed between SEIFA quintile and proportion of the population group exceeding the UL (Table A7.3).

Appendix 2

Relationship between the dietary intake increments described in this document and the 2006 NHMRC/NZMoH 'Nutrient Reference Values for Use in Australia and New Zealand'

In 2006, 'Nutrient Reference Values for Use in Australia and New Zealand' replaced the 1991 NHMRC document 'Recommended Dietary Intakes in Australia'. In addition to other changes, several NRVs are given for each nutrient (e.g. Estimated Average Requirement, Recommended Dietary Intake, Upper Level) for each physiological group (National Health and Medical Research Council 2006) whereas previously, only the Recommended Dietary Intake had been defined (National Health and Medical Research Council, 2001). The appropriate use of the various different levels is described elsewhere (Institute of Medicine, 2000; Institute of Medicine, 2003).

An additional important change for folate was the change in the units in which the levels are expressed. Previously, the Recommended Dietary Intake had been expressed in µg with the assumption that 1 µg dietary folate = 1 µg folic acid. However, this assumption is incorrect because supplemental folic acid has higher bioavailability than dietary folate. Following the American lead (Institute of Medicine, 1998) the difference in bioavailability was acknowledged and new units for folate were developed: micrograms of DFEs such that

1 ug DFE = 1 µg folate from dietary sources
= 0.6 µg folic acid used to fortify food
= 0.5 µg folic acid taken on an empty stomach

(Note that this makes the generalisation that folate from all dietary sources has the same bioavailability, which is probably not true).

The recently released NHMRC publication indicates that the correct units for the UL for folate are µg supplementary or fortification folic acid, not µg DFE, because the UL is derived from studies using supplementary folic acid.

The dietary modelling work described in the current document therefore used concentrations in foods and supplements expressed as µg folic acid, not µg DFE, because all the studies examining the relationship of folic acid to the reduction of NTDs used supplemental folic acid and the UL is expressed in these units. It is not clear if enough dietary folate can be consumed to achieve the same outcomes.

From the above relationship, the change in total intake expressed as DFEs can be easily calculated from the described changes in folic acid intakes. For example, the uptake of the current voluntary fortification provisions is estimated to have increased folic acid intakes by an average of 95 µg for Australian women aged 16-44 years which means an increased total intake of 158 µg DFE (i.e. 95/0.6) over that obtainable from natural sources. Under mandatory fortification of all bread, average folic acid intakes are estimated to increase by 101 µg/day above the current situation, equivalent to an additional 168 µg DFE per day.

Appendix 3

Summary of concentration data used for various foods for dietary modelling purposes

Table A3.1: Concentration data for main Australian products assumed to contain folic acid

Food	Origin of baseline concentration data	Folic acid concentration (µg/100 g)	
		Baseline	Scenario 1 – mandatory folic acid fortification of all bread
White bread	Label and analytical, with 15% market share weighting	29	135
Multigrain bread	Label and analytical, market share weighted	20	135
Wholemeal bread	Label and analytical, market share weighted	27	135
Fruit breads	Label, with 15% market share weighting	23	135
Maize flake style breakfast cereal	Analytical	415	415
Puffed rice style breakfast cereal	Analytical	157	157
Extruded & sweetened breakfast cereal	Label and analytical depending on brand	108 – 442^	108 - 442^
Bran & fruit style breakfast cereal	Label and analytical depending on brand	108 – 178^	108 - 178^
Wheat biscuit style breakfast cereal	Analytical	333	333
Nut-based breakfast cereal	Analytical	167	167
Orange juice	Analytical with 30% market share weighting	9	9

Food	Origin of baseline concentration data	Folic acid concentration (µg/100 g)	
		Baseline	Scenario 1 – mandatory folic acid fortification of all bread
Soy beverage, unflavoured	Analytical	61	61
Yeast-based spreads	Label and analytical	2100	2100
Pizza		0	0
Hamburger with meat, bread, other ingredients		0	30-69^
Bun, sweet, various types		20	135
Scone, various types		0	0
Hot dog in bun		0	58
Pancakes and pikelets		0	0
Doughnuts, yeast type		0	0
Crumbed meat, chicken and fish		0	26-41^
Stuffing, bread based		0	68-73^
Sandwiches, various		18	35-80^
Meal replacement powders	Label and analytical depending on brand	310 – 660^	310 - 660^

^ Denotes range of values for category, individual products within these broad food categories were assigned a single folic acid concentration
Note: This is not a complete list of folic acid concentrations used in the dietary modelling to assess folic acid intakes.

Table A3.2: Concentration data for main New Zealand products assumed to contain folic acid

Food	Origin of baseline concentration data	Folic acid concentration (µg/100 g)	
		Baseline	Scenario 1 – mandatory folic acid fortification of all bread
White bread	Label and analytical, depending on type recorded in NNS	0 – 120^	135
Multigrain bread	Analytical depending on type recorded in NNS	0 – 120^	135
Wholemeal bread	Analytical depending on type recorded in NNS	0 – 120^	135
Fruit breads	Label, with 15% market share weighting	0	135
Maize flake style breakfast cereal	Analytical depending on type recorded in NNS	326 – 439^	326 - 439^
Puffed rice style breakfast cereal	Analytical	290	290
Extruded & sweetened breakfast cereal	Analytical	199	199
Bran & fruit style breakfast cereal	Label and analytical, depending on type recorded in NNS	222 – 470^	222 - 470^
Wheat biscuit style breakfast cereal	Analytical	313	313
Nut-based breakfast cereal	Analytical	167	167
Orange juice	Analytical with 25% market share weighting	11	11
Soy beverage, unflavoured	Analytical	61	61
Yeast-based spreads	Label and analytical, depending on type recorded in NNS	2100 – 2200^	2100 – 2200^

Food	Origin of baseline concentration data	Folic acid concentration (µg/100 g)	
		Baseline	Scenario 1 – mandatory folic acid fortification of all bread
Pizza		0	0
Hamburger with meat, bread, other ingredients		0	21-65^
Bun, sweet, various types		0	135
Scone, various types		0	0
Pancakes and pikelets		0	0
Doughnuts, yeast type		0	0
Crumbed meat, chicken and fish		0	9-31^
Croutons		0	135
Stuffing, bread based		0	86
Sandwiches, various		0	36-103^
Meal replacement powders	Label and analytical depending on brand	40 – 90^	40 - 90

^ Denotes range of values for category, individual products within these broad food categories were assigned a single folic acid concentration

Note: This is not a complete list of folic acid concentrations used in the dietary modelling to assess folic acid intakes.

Appendix 4

Complete information on dietary intake assessment results

Table A4.1: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' for Australian and New Zealand women of child-bearing age

Country	Target Group	No. of respondents	Mean Folic Acid Intake (µg/day)		95th Percentile Folic Acid Intake (µg/day)	
			Baseline	Scenario 1 – mandatory folic acid fortification of all bread	Baseline	Scenario 1 – mandatory folic acid fortification of all bread
Australia	16-18 years	218	102	210	251	384
	19-44 years	2,960	94	195	257	385
	16-44 years	3,178	95	196	257	385
New Zealand	16-18 years	95	51	196	152	339
	19-44 years	1,414	58	198	178	345
	16-44 years	1,509	58	198	177	344

Table A4.2: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' models for various Australian population non-target sub-groups

Country	Target Group	Gender	No. of respondents	Mean Folic Acid Intake (µg/day)		95th Percentile Folic Acid Intake (µg/day)	
				Baseline	Scenario 1 – mandatory folic acid fortification of all bread	Baseline	Scenario 1 – mandatory folic acid fortification of all bread
Australia	Whole population	All	13,858	115	231	313	480
	2-3 years	All	383	112	199	207	309
		M	170	123	217	242	349
		F	213	103	185	198	298
	4-8 years	All	977	123	222	243	364
		M	513	138	246	272	404
		F	464	106	196	210	292
	9-13 years	All	913	144	254	337	464
		M	474	173	295	357	518
		F	439	112	209	278	372
	14-18 years	All	734	144	271	348	539
		M	378	185	333	414	679
		F	356	101	206	248	381
	19-29 years	All	2,203	129	255	327	541
		M	1,014	159	315	395	622
		F	1,189	103	205	256	395

Country	Target Group	Gender	No. of respondents	Mean Folic Acid Intake (μg/day)		95th Percentile Folic Acid Intake (μg/day)	
				Baseline	Scenario 1 – mandatory folic acid fortification of all bread	Baseline	Scenario 1 – mandatory folic acid fortification of all bread
Australia	30-49 years	All	4,397	106	228	310	497
		M	2,080	126	271	328	551
		F	2,317	88	189	268	390
	50-69 years	All	3,019	103	216	324	474
		M	1,442	119	251	352	544
		F	1,577	89	183	298	399
	70+ years	All	1,232	108	212	310	425
		M	545	115	236	288	445
		F	687	102	193	367	411

Table A4.3: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' for various New Zealand population sub-groups

Country	Target Group	Gender	No. of respondents	Mean Folic Acid Intake (µg/day)		95th Percentile Folic Acid Intake (µg/day)	
				Baseline	Scenario 1 – mandatory folic acid fortification of all bread	Baseline	Scenario 1 – mandatory folic acid fortification of all bread
New Zealand	15 years and above	All	4,636	69	230	203	431
	15-18 years	All	246	75	249	180	444
		M	109	104	313	240	565
		F	137	51	198	158	339
	19-29 years	All	804	69	232	185	430
		M	286	101	305	212	539
		F	518	51	192	158	339
	30-49 years	All	1,883	70	236	211	451
		M	787	80	285	230	517
		F	1,096	62	201	195	355
	50-69 years	All	1,147	70	225	214	421
		M	538	79	261	248	487
		F	609	63	194	197	339
	70+ years	All	556	66	210	184	363
		M	207	67	233	186	391
		F	349	65	196	173	316

Table A4.4: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline', 'Scenario 1 – mandatory folic acid fortification of all bread' and 'Submitter proposed voluntary approach' for Australian and New Zealand women of child-bearing age*

Country	Target Group	No. of respondents	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
			Baseline	Scenario 1 – mandatory folic acid fortification of all bread	Submitter proposed voluntary approach	Baseline	Scenario 1 – mandatory folic acid fortification of all bread	Submitter proposed voluntary approach
Australia	16-44 years	3,178	95	196	103	257	385	265
New Zealand	16-44 years	1,509	58	198	62	177	344	190

* All women aged 16-44 years

Appendix 5

Complete information on risk characterisation

Table A5.1: Percentage of respondents with folic acid intakes above the Upper Level at 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' for Australian and New Zealand women of child-bearing age

Country	Target Group	No. of respondents	% respondents with dietary folic acid intakes > Upper Level	
			Baseline	Scenario 1 – mandatory folic acid fortification of all bread
Australia	16-18 years	218	0	<1
	19-44 years	2,960	<1	<1
	16-44 years	3,178	<1	<1
New Zealand	16-18 years	95	0	0
	19-44 years	1,414	<1	<1
	16-44 years	1,509	<1	<1

Table A5.2: Percentage of respondents with folic acid intakes above the Upper Level at 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' for various Australian population sub-groups

Population Group	Gender	No. of respondents	% respondents with dietary folic acid intakes > Upper Level	
			Baseline	Scenario 1 – mandatory folic acid fortification of all bread
2-3 years	All	383	1	6
	M	170	2	8
	F	213	<1	5
4-8 years	All	977	<1	3
	M	513	<1	5
	F	464	<1	<1
9-13 years	All	913	<1	2
	M	474	1	3
	F	439	<1	<1
14-18 years	All	734	<1	1
	M	378	1	2
	F	356	0	<1
19-29 years	All	2,203	<1	<1
	M	1,014	<1	1
	F	1,189	<1	<1
30-49 years	All	4,397	<1	<1
	M	2,080	<1	<1
	F	2,317	<1	<1
50-69 years	All	3,019	<1	<1
	M	1,442	<1	<1
	F	1,577	<1	<1
70+ years	All	1,232	0	0
	M	545	0	0
	F	687	0	0

Table A5.3: Percentage of respondents with folic acid intakes above the Upper Level at 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread' for various New Zealand population sub-groups

Population Group	Gender	No. of respondents	% respondents with dietary folic acid intakes > Upper Level	
			Baseline	Scenario 1 – mandatory folic acid fortification of all bread
15-18 yrs	All	246	0	<1
	M	109	0	2
	F	137	0	0
19-29 yrs	All	804	0	0
	M	286	0	0
	F	518	0	0
30-49 yrs	All	1,883	<1	<1
	M	787	0	0
	F	1,096	<1	<1
50-69 yrs	All	1,147	0	<1
	M	538	0	<1
	F	609	0	0
70+ yrs	All	556	0	0
	M	207	0	0
	F	349	0	0

Complete information of folic acid intakes from food and supplements

Table A6.1: Estimated folic acid intakes from folic acid added to food and supplements for Australian women of child-bearing age*#

Scenario	Folic acid intake from folic acid in food and supplements (µg/day)			
	Mean Intake + 200 µg	Mean Intake + 500 µg	95th %tile + 200 µg	95th %tile + 500 µg
'Baseline'	295	595	457	757
'Scenario 1 – mandatory folic acid fortification of all bread	396	696	585	885

* All females aged 16-44 years.
# Number of respondents aged 16-44 years: Australia = 3,178

Table A6.2: Estimated folic acid intakes from folic acid added to food and supplements for New Zealand women of child-bearing age*#

Scenario	Folic acid intake from folic acid in food and supplements (µg/day)			
	Mean Intake + 200 µg	Mean Intake + 800 µg	95th %tile + 200 µg	95th %tile + 800 µg
'Baseline'	258	858	377	977
'Scenario 1 – mandatory folic acid fortification of all bread	398	998	544	1,144

* All females aged 16-44 years.
# Number of respondents aged 16-44 years: New Zealand = 1,509

Table A6.3: Percentage of respondents with folic acid intakes above the Upper Level from folic acid added to food and supplements for Australian women of child-bearing age*#

Scenario	% respondents with folic acid intakes from diet and supplements > UL	
	Mean intake + 200 µg	Mean intake + 500 µg
'Baseline'	<1	1
'Scenario 1 – mandatory folic acid fortification of all bread	<1	3

* All females aged 16-44 years.
# Number of respondents aged 16-44 years: Australia = 3,178

Table A6.4: Percentage of respondents with folic acid intakes above the Upper Level from folic acid added to food and supplements for New Zealand women of child-bearing age*#

Scenario	% of respondents with folic acid intakes from diet and supplements > UL	
	Individual's mean intake + 200 μg	Individual's mean intake + 800 μg
'Baseline'	<1	9
'Scenario 1 – mandatory folic acid fortification of all bread	<1	44

* All females aged 16-44 years.
\# Number of respondents aged 16-44 years: New Zealand = 1,509

Appendix 7

Complete information on bread consumption and folic acid intakes by socio-economic groups for Australia

Assessments based on socio-economic status were only conducted for Australia because the socio-economic indicators were not loaded into DIAMOND for New Zealand.

7.1 Background

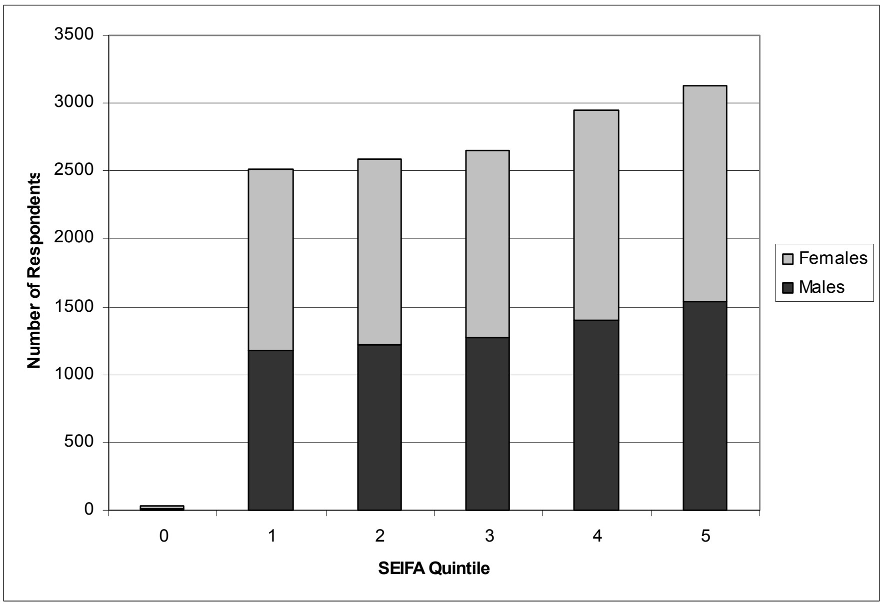
The SEIFA index (socio-economic indexes for areas) of relative social disadvantage that was used in the 1995 NNS was derived from 1991 Census and assigns an index to geographic areas based on socio-economic variables. This index describes the characteristics of the area in which a person lives rather than the characteristics of the person and takes into consideration factors such as economic resources of households, education, occupation, family structure and ethnicity. Each person on the file was allocated an index score based on Collectors District (CD) in which they were enumerated. In most cases this was the usual residence and the score was grouped by quintile. A high quintile score suggests the area has a large number of families with high incomes, training and skilled occupations. A low score indicates the area is more disadvantaged and has fewer families with a high income and the residents have less training and skilled occupations. Further details regarding this index can be found in the 1991 Census: *Socio-economic indexes for areas (Cat. No. 2912.0)*.

A total of 13,858 people took part in the NNS and just over half of these participants were females. Slightly more than half of each SEIFA quintile was composed of females. SEIFA quintile zero was for people who had not been allocated an Index score during the collection process of the NNS. The fewest respondents were present in the first SEIFA quintile and the number of respondents increased consistently up the Indexes with a difference of 620 respondents between SEIFA quintiles one and five. Refer to Table A7.1 and Figure A7.1 for further information.

Table A7.1: Number of Respondents in each SEIFA Quintile for Australia

SEIFA Index number	No. of Respondents			% females in each SEIFA quintile
	Males and Females	Males Only	Females Only	
0	32	15	17	53
1	2,512	1,178	1,334	53
2	2,587	1,216	1,371	53
3	2,650	1,275	1,375	52
4	2,945	1,396	1,549	53
5	3,132	1,536	1,596	51
All quintiles	13,858	6,616	7,242	52

Figure A7.1: Number of respondents in each SEIFA quintile



Only 6.9 percent of women of child-bearing age were between the ages of 16-18 years. For this age group, there were no respondents in SEIFA quintile zero and less respondents in SEIFA quintiles one and two compared to the higher SEIFA quintiles. A quarter of this population group were in the fifth SEIFA quintile indicating they come from a more socially advantaged environment. A similar trend was shown in the age group 19-44 years where the number of respondents increased through the SEIFA quintiles, although for this age group there were the highest number of participants in SEIFA quintile four. Refer to Table A7.2 for further information.

7.2 Bread consumption based on socio-economic group

National Nutrition Survey data

For Australians aged 19 years and above, the mean consumption of regular breads and rolls was higher than the average for SEIFA quintiles three and four and the consumption of fancy style breads was significantly higher in SEIFA quintile five when compared to SEIFA quintiles one and two. The median consumption of regular breads and rolls was similar for all SEIFA quintiles from two to five and the median consumption of fancy style breads was highest in SEIFA quintile one. These results also showed that an average of 80.5 percent of respondents from the 1995 NNS consumed regular bread daily with very little difference in consumption between people in the five SEIFA quintiles. An average of 12.4% of respondents consumed fancy breads with a much higher number of these respondents in the fifth SEIFA quintile. Further details can be found in Table A7.2.

Analysis of the data from the NNS using DIAMOND revealed that 80.5% of women between the ages of 16-44 consumed bread, a result that is consistent with the findings for the total population aged 19 years and over.

The results displayed using this method showed that the respondents with the highest mean consumption of bread were those in SEIFA quintile two followed by those in SEIFA quintiles three and four, however, the overall difference in bread consumption between all quintiles from one to five was small at only 9.1 grams per day (Table A7.3).

Table A7.2: Actual consumption amounts of bread for people aged 19 years and over for each SEIFA quintile of relative social disadvantage from the 1995 National Nutrition Survey

		SEIFA quintile of relative social disadvantage					
	Food	**1**	**2**	**3**	**4**	**5**	**All quintiles**
Mean daily consumption (average grams per person)	Regular breads and rolls	88.1	90.2	94.4	94.2	89.7	91.3
	Fancy breads, flat breads, English style muffins and crumpets	8.3	9.0	10.8	9.3	14.0	10.4
Median daily consumption (grams per consumer)	Regular breads and rolls	91.0	96.0	96.0	97.0	97.0	96.0
	Fancy breads, flat breads, English style muffins and crumpets	74.0	63.0	67.0	67.0	63.0	65.4
Persons consuming foods (percent)	Regular breads and rolls	78.6	79.9	82.4	81.5	80.0	80.5
	Fancy breads, flat breads, English style muffins and crumpets	10.2	10.5	12.8	11.3	16.3	12.4

Source: (McLennan and Podger, 1999)

Table A7.3: Number and percentage of consumers and mean consumption of bread* for females aged 16-44 years from the 1995 National Nutrition Survey, as calculated by DIAMOND dietary modelling system, and displayed per SEIFA quintile

	SEIFA index number						
	0	**1**	**2**	**3**	**4**	**5**	**All quintiles**
no. respondents	5	572	593	642	690	676	3,178
no. consumers	4	450	470	526	549	568	2,567
% of consumers to respondents	80	79	79	82	80	84	81
Consumer mean consumption (grams)	**64.5**	**99.4**	**108.0**	**103.3**	**100.6**	**98.9**	**96**

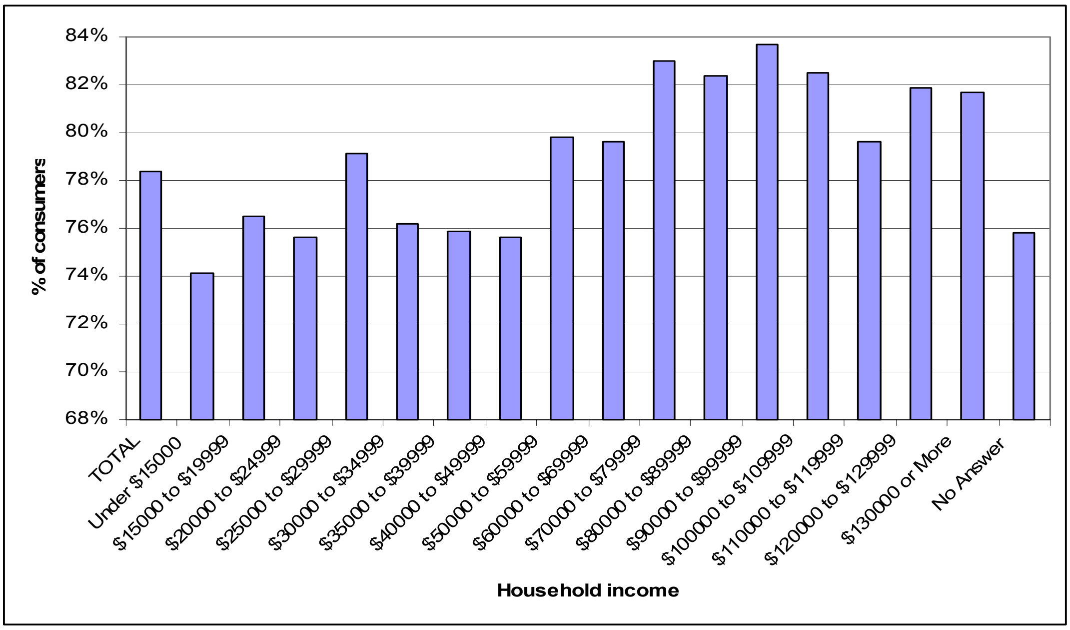
* Includes food codes 122 regular breads and rolls, 1241 English style muffins, 1243 flat breads and 1244 fancy breads (e.g. focaccia). Excludes food codes 1242 crumpets and 1245 tortilla.

Roy Morgan Single Source data 2001-2006

The Roy Morgan Single Source survey interviews approximately 55 000 people aged 15 years and over each year in Australia using face to face interviews, with representative sampling based on electoral rolls. Respondents are left a longer mail back survey to answer extra questions, with approximately half of the respondents completing this part of the survey.

Analysis of bread consumption patterns against income from the Roy Morgan Single Source data revealed that consumers between the ages of 16-44 years who most regularly consumed bread were those with household incomes between $70,000 and $109,999, and the fewest consumers of bread were present in households with an income less than $15,000 (Figure A7.2). It also showed that the consumption of bread for this age group was highest in those who had individual earnings between $50,000 and $79,999 or greater than $110,000 (Figure A7.3).

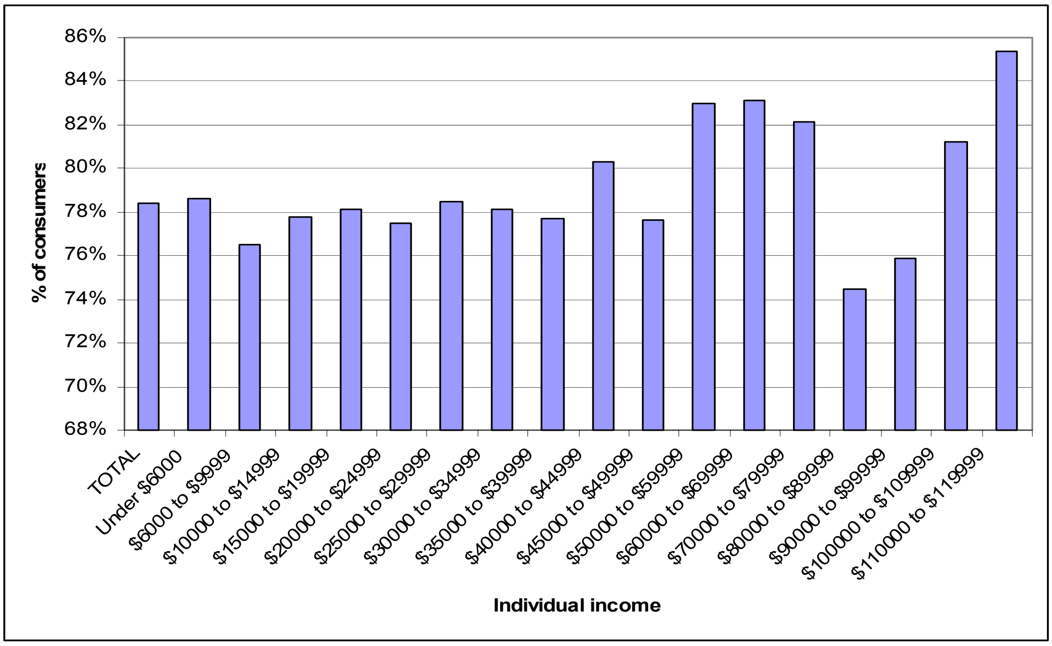
*Figure A7.2: Percentage of women of child bearing age who consumed bread in the previous 7 day period (at time of survey) based on total household income**



*Source: Roy Morgan Single Source: January 2001 – March 2006 (Roy Morgan, 2006a)

No consistent trends in bread consumption across income groups were observed. The same was true for bread consumption against individual rather than household income.

*Figure A7.3: Per cent of women of child bearing age who consumed bread in the previous 7 day period (at time of survey) based on individual income**



*Source: Roy Morgan Single Source: January 2001 – March 2006

7.3 Estimated folic acid intakes based on socio-economic group

For women aged 16-18 years, the lower 'Baseline' intakes were within SEIFA quintiles one and five and the higher 'Baseline' intakes were in SEIFA quintiles two and three. This trend was also observed for 'Scenario 1 - mandatory fortification of all breads'. Women in SEIFA quintile two were estimated to have the greatest increase in intake of all female SEIFA sub-groups of +123µg/day (see Table A7.4 and Figures A7.4 & A7.5).

For women aged 19-44 years, the quintiles of zero, one, three and five all had a mean intake at 'Baseline' and at 'Scenario 1 – mandatory fortification of all bread' very close to or less than the means for all age groups assessed, including those aged 16-18 years. Women in SEIFA quintiles two and four had higher dietary folic acid intakes and the estimated average increase in intake for all SEIFA quintiles was between +98 and +101 µg/day (see Table A7.4 and Figures A7.4 & A7.5).

Table A7.4: Estimated mean and 95th percentile dietary folic acid intakes and increase in mean dietary folic acid intakes after mandatory folic acid fortification of all bread for females in various SEIFA quintiles

Population Group	SEIFA quintile	No. of respondents	Estimated dietary intake of folic acid (µg/day)				
			Mean			95th percentile	
			Baseline	Scenario 1 - mandatory fortification of all bread	Increase from Baseline to Scenario 1	Baseline	Scenario 1 - mandatory fortification of all bread
16-18 years	0	0	0	0	0	0	0
	1	33	97	195	+ 98	190	301
	2	34	116	239	+ 123	294	417
	3	47	112	224	+ 112	277	392
	4	48	106	218	+ 112	206	368
	5	56	85	183	+ 98	192	307
	All quintiles	**218**	**102**	**210**	**+ 108**	**234**	**383**
19-44 years	0	5	56	139	+ 83	117	179
	1	539	85	183	+ 98	217	337
	2	559	101	202	+ 101	270	412
	3	595	89	191	+ 102	242	376
	4	642	100	200	+ 100	271	420
	5	620	94	196	+ 102	263	373
	All quintiles	**2,960**	**94**	**195**	**+ 101**	**257**	**385**
16-44 years	0	5	56	139	+ 83	117	179
	1	572	85	184	+ 99	216	336
	2	593	102	204	+ 102	274	415
	3	642	91	193	+ 102	252	383
	4	690	101	201	+ 100	268	410
	5	676	94	195	+ 101	255	370
	All quintiles	**3,178**	**95**	**196**	**+ 101**	**256**	**385**

Population Group	SEIFA quintile	No. of respondents	Estimated dietary intake of folic acid (µg/day)				
			Mean			95th percentile	
			Baseline	Scenario 1 - mandatory fortification of all bread	Increase from Baseline to Scenario 1	Baseline	Scenario 1 - mandatory fortification of all bread
>2 years	0	17	75	157	+ 82	193	258
	1	1,334	87	183	+ 96	230	343
	2	1,371	98	196	+ 98	278	394
	3	1,375	96	195	+ 99	276	388
	4	1,549	100	198	+ 98	290	399
	5	1,596	97	194	+ 97	285	378
	All quintiles	**7,242**	**96**	**193**	**+ 97**	**274**	**383**

Figure A7.4: Estimated mean dietary folic acid intake (µg/day) at 'Baseline' and for Scenario 1' for Australian women of childbearing age by SEIFA quintiles

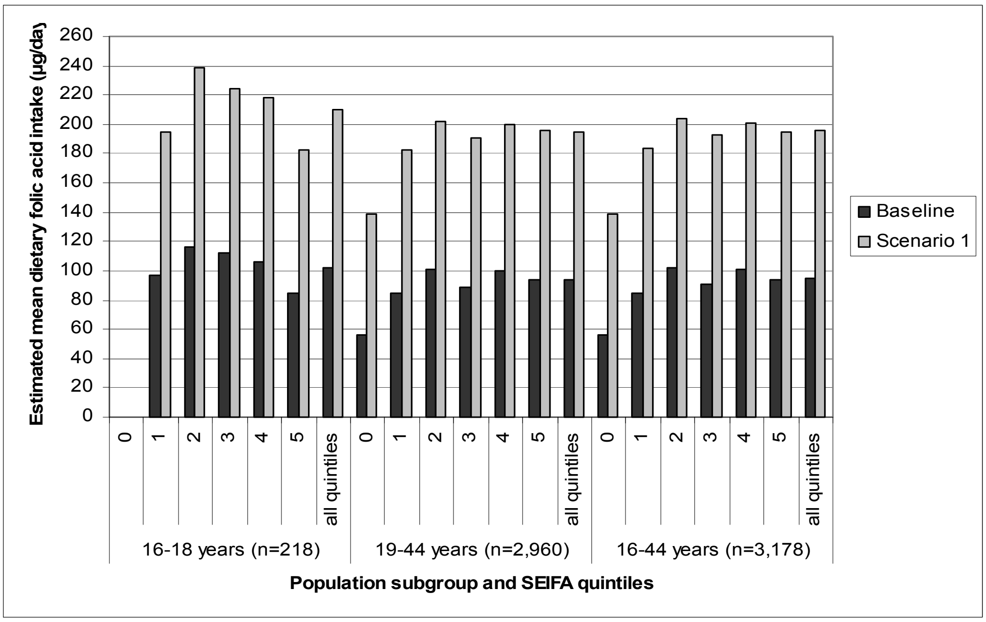
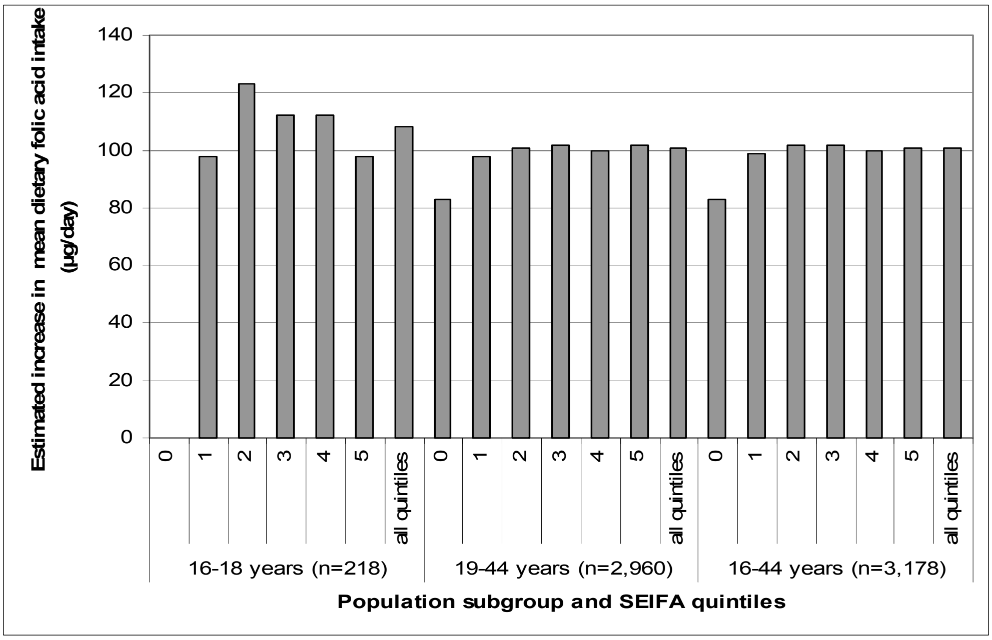


Figure A7.5: Estimated increase in mean dietary folic acid intake for women of child bearing age and various SEIFA quintiles between 'Baseline' and 'Scenario 1 – mandatory fortification of all bread'



7.4 Comparison of folic acid intakes with the UL based on socio-economic groups

The UL for folic acid varies across age groups and genders (as shown in Table A7.5). Males between the ages of 4 and 30 are more likely than females between these ages to exceed the UL both at 'Baseline' and 'Scenario 1 – mandatory fortification of all bread'. Children aged 2-3, particularly males, are at the highest risk of any of the population groups assessed to exceed the UL for folic acid. It was estimated that 6% of 2-3 year old children (male and female) could exceed the UL under 'Scenario 1 – mandatory fortification of all bread'. The age group next at risk is those aged 4-8 years with 3% of this population group estimated to exceeding the UL under 'Scenario 1 – mandatory fortification of all bread'. For all age groups for children, the SEIFA Index of the child does not appear to influence the likelihood of the child exceeding his/her UL value. The overall percentage of the children exceeding the UL is very small (Table A7.5).

Table A7.5: Percentage of 'Baseline' and 'Scenario 1 - mandatory folic acid fortification of all bread' respondents in various age categories and SEIFA quintiles with intakes above the Upper Level

Population Group	Upper Limit (µg/day)	Gender	No. of respondents	% of respondents with dietary folic acid intakes > Upper Level													
				Baseline							Scenario 1 - mandatory fortification of all bread						
					SEIFA Quintile							SEIFA Quintile					
				All quintiles	0	1	2	3	4	5	All quintiles	0	1	2	3	4	5
2-3 years	300	All	383	**1**	0	<1	0	0	<1	<1	**6**	0	<1	1	2	1	1
		M	170	**2**	0	<1	0	0	1	<1	**8**	0	2	<1	2	2	1
		F	213	**<1**	0	0	0	0	0	<1	**5**	0	0	1	1	<1	1
4-8 years	400	All	977	**<1**	0	0	<1	<1	<1	<1	**3**	0	<1	<1	<1	<1	1
		M	513	**<1**	0	0	<1	<1	<1	<1	**5**	0	<1	<1	1	1	2
		F	464	**<1**	0	0	0	<1	0	<1	**<1**	0	0	0	<1	0	<1
9-13 years	600	All	913	**<1**	0	<1	<1	<1	<1	<1	**2**	0	<1	<1	<1	<1	<1
		M	474	**1**	0	0	0	<1	<1	<1	**3**	0	<1	<1	<1	<1	1
		F	439	**<1**	0	<1	<1	0	0	0	**<1**	0	<1	<1	0	0	0
14-18 years	800	All	734	**<1**	0	0	<1	<1	<1	0	**1**	0	0	<1	<1	<1	<1
		M	378	**1**	0	0	<1	<1	<1	0	**2**	0	0	<1	<1	<1	<1
		F	356	**0**	0	0	0	0	0	0	**<1**	0	0	<1	0	0	0

Population Group	Upper Limit (µg/day)	Gender	No. of respondents	% of respondents with dietary folic acid intakes > Upper Level													
				Baseline							Scenario 1 - mandatory fortification of all bread						
				SEIFA Quintile							SEIFA Quintile						
				All quintiles	0	1	2	3	4	5	**All quintiles**	0	1	2	3	4	5
19-29 years	1,000	All	2,203	**<1**	0	<1	<1	<1	0	<1	**<1**	0	<1	<1	<1	<1	<1
		M	1,014	**<1**	0	<1	<1	<1	0	<1	**1**	0	<1	<1	<1	<1	<1
		F	1,189	**<1**	0	0	<1	0	0	0	**0**	0	0	<1	0	0	0
30-49 years	1,000	All	4,397	**<1**	0	<1	<1	<1	<1	0	**<1**	0	<1	<1	<1	<1	<1
		M	2,080	**<1**	0	<1	<1	<1	0	0	**<1**	0	<1	<1	<1	<1	<1
		F	2,317	**<1**	0	0	<1	0	<1	0	**<1**	0	0	<1	<1	<1	0
50-69 years	1,000	All	3,019	**<1**	0	<1	<1	0	<1	<1	**<1**	0	<1	<1	0	<1	<1
		M	1,442	**<1**	0	<1	0	0	<1	0	**<1**	0	<1	<1	0	<1	<1
		F	1,577	**<1**	0	0	<1	0	0	<1	**<1**	0	0	<1	0	0	<1
70+ years	1,000	All	1,232	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	0
		M	545	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	0
		F	687	**0**	0	0	0	0	0	0	**0**	0	0	0	0	0	0

Appendix 8

Additional estimates of folic acid intake for New Zealand

(Adapted from: Blakey CW, Parnell WR, Wilson NC, (2006). Folic Acid Fortification. Report No. 2006.135. LINZ® Applied Research Unit, Dunedin, New Zealand: University of Otago).

NZFSA provided FSANZ with estimated intakes of folic acid for New Zealand Children and for the population group aged 15 years and above based on scenarios different to those conduced by FSANZ.

8.1 Modelling scenarios and data used

Three scenarios were modeled at two fortification levels of folic acid:

- NZ Scenario 1 - All bread. (Does not include sweet buns, hamburger buns or flat breads);
- NZ Scenario 2 - All wholemeal and wholegrain bread and bread rolls; and
- NZ Scenario 3 - All white bread and bread rolls. (Does not include sweet buns or fruit breads but does include flat breads except pizza bases).

Two levels of fortification were assessed. The fortification levels were:

- 120 µg per 100g of bread; and
- 150 µg per 100g of bread.

The folic acid concentration used by FSANZ to model the preferred approach of all bread was 135 µg per 100g of bread.

The 2002 New Zealand Children's Nutrition Survey data were used for the assessment for children. This survey included 3275 children aged 5-14 years and used a 24-hour recall methodology.

The folic acid intakes estimated for New Zealanders 15 years and above were from the 1997 National Nutrition Survey, which was also used by FSANZ.

The percent of respondents above the UL has been calculated based on the individual folic acid intakes for each respondent and using the UL appropriate to their age/gender. Percent above the ULs were not able to be calculated when the folic acid intakes were summed from voluntary and proposed mandatory permissions because these calculations were not based on intakes of individuals.

8.2 Limitations

The authors noted that the estimated folic acid intakes from mandatory fortification only presented in the tables below are approximately a 10% underestimate. The reason for this was that when a recipe was nutrient matched as an entity (rather than as separate components), e.g. a McDonalds burger, a folic acid level could not easily be assigned to that item.

This can be achieved if the weight of the bread portion of that item is separated out and assigned a value. However, for this report, this step was not included. Such recipes were comparatively small in number and the authors concluded that they would comprise about 10% of the bread consumed.

The estimated 95th percentiles may be overestimated based on the intakes being derived from a single 24-hour recall.

The proportion of the population with intakes above the UL is also likely to be an overestimate due to the intakes being derived from a single 24-hour recall.

Folic acid intakes from voluntarily fortified foods were not included in the estimates of intake provided by New Zealand. Therefore, a calculation of total folic acid intakes from voluntary and mandatory fortification was conducted for the population group aged 15 years and above. This was done by adding mean folic acid intakes from baseline as estimated by FSANZ, i.e. from currently voluntarily fortified foods, to the estimated folic acid intakes submitted by New Zealand for mandatorily fortified breads at the mean and 95th percentile. There will be some 'double counting' of folic acid intakes from breads that were included in the baseline calculations there were also assumed to be fortified in the mandatory bread scenarios. This method also means the baseline intakes derived from a second day adjusted model are added to intakes from a single 24-hour recall. Whilst they are not the same methodology, mean intakes from adjusted assessment versus a single day do not tend to differ too much (as indicated in Appendix 1), therefore, this shouldn't effect the calculations to a great extent. The proportion of respondents exceeding the UL from both mandatory and voluntary fortification for this population group could not be assessed based on this methodology as intakes from individuals were not used.

FSANZ was unable to estimate baseline intakes for New Zealand children in the absence of the 2002 Children's Nutrition Survey data. It was inappropriate to use baseline intakes for Australian children and assume it was the same in New Zealand as it had been shown elsewhere for the older age groups that baseline intakes for New Zealand were much lower than Australian intakes due to the uptake of voluntary fortification permissions being different between the countries.

Folic acid from supplements were not included in the assessments.

8.3 Results

The estimated intakes for New Zealand children aged 5-14 years are shown in Table A8.1 for NZ scenario 1, Table A8.2 for NZ scenario 2 and Table A8.3 for NZ scenario 3. These estimated intakes do not include any intakes from voluntary fortification.

The folic acid intakes estimated by LINZ were based on single 24-hour recall. The estimates of individuals above the UL are usually an overestimated based on this methodology (as discussed in Appendix 1). However, the intakes have likely been underestimated (as noted above) and intakes from voluntary fortification have not been included in the estimates. Therefore, it is concluded that New Zealand children 5-14 years would show a similar proportion of respondents with folic acid intakes above the UL compared to Australian children of the same age. The proportion of New Zealand children exceeding the UL is low.

Estimated intakes for New Zealanders aged 15 years and above are shown in Table A8.4 for NZ scenario 1, Table A8.5 for NZ scenario 2 and Table A8.6 for NZ scenario 3. The estimated intakes are shown for mandatory fortification only, and when mean baseline intakes from voluntary fortification are added on.

Table A8.1: Daily intakes of folic acid (µg) - Scenario 1 – 'All bread'

			Folic Acid @ 120 µg /100g			Folic Acid @ 150 µg /100g		
			Mean	%>UL*	95th	Mean	%>UL*	95th
New Zealand children (5-14 years)			120		359	150		449
	Males	5-8	117	1.4	360	146	3.3	450
		9-14	142	0.6	399	177	1.4	499
	Females	5-8	105	1.0	300	132	3.0	375
		9-14	109	0.1	349	137	0.2	436

* Upper Limit (µg /day): 5-8 years 400, 9-13 years 600, 14 years 800

Table A8.2: Daily intakes of folic acid (µg) - Scenario 2 – Wholemeal and wholegrain bread

			Folic Acid @ 120 µg /100g			Folic Acid @ 150 µg /100g		
			Mean	%>UL*	95th	Mean	%>UL*	95th
New Zealand children (5-14 years)			23		154	29		192
	Males	5-8	27	0.0	159	33	0.1	199
		9-14	27	0.0	188	34	0.1	235
	Females	5-8	19	0.0	113	23	0.0	141
		9-14	19	0.0	129	24	0.0	162

* Upper Limit (µg /day): 5-8 years 400, 9-13 years 600, 14 years 800

Table A8.3: Daily intakes of folic acid (µg) - Scenario 3 – White bread

			Folic Acid @ 120 µg /100g			Folic Acid @ 150 µg /100g		
			Mean	%>UL*	95th	Mean	%>UL*	95th
New Zealand children (5-14 years)			101		342	127		428
	Males	5-8	94	1.4	348	118	2.9	435
		9-14	119	0.6	384	148	1.1	480
	Females	5-8	93	1.0	288	113	2.5	360
		9-14	95	0.1	343	118	0.2	429

* Upper Limit (µg /day): 5-8 years 400, 9-13 years 600, 14 years 800

Table A8.4: Daily intakes of folic acid (µg) - Scenario 1 – 'All bread'

				Folic Acid @ 120 µg /100g bread					Folic Acid @ 150 µg /100g bread				
			Mean Intake voluntary#	Mandatory only			Mandatory plus voluntary		Mandatory only			Mandatory plus voluntary	
				Mean	95th	%>UL*	Mean	95th	Mean	95th	%>UL*	Mean	95th
New Zealand Population (15 years+)			69	128	323	NA	197	392	159	404	NA	228	473
	Males	15-18	104	129	408	0.0	223	512	162	510	0.0	266	614
		19-29	101	147	400	0.0	248	501	183	500	0.2	284	601
		30-49	80	167	407	0.0	247	487	209	509	1.0	289	589
		50-69	79	137	346	0.0	216	425	171	432	0.0	250	511
		70+	67	124	306	0.0	191	373	155	382	0.0	222	449
	Females	15-18	51	112	274	0.0	163	325	140	343	0.0	191	394
		19-29	51	99	275	0.0	150	326	124	344	0.2	175	395
		30-49	62	112	284	0.0	174	346	141	356	0.0	203	418
		50-69	63	101	231	0.0	164	294	127	289	0.0	190	352
		70+	65	112	232	0.0	177	297	140	290	0.0	205	355
		16-18	51	115	288	0.0	166	339	144	361	0.0	195	412
		19-44	58	108	280	0.0	166	338	134	351	0.1	192	409
		16-44	58	108	281	0.0	166	339	135	351	0.1	193	409

* Upper Limit (µg /day): 15-18 years 800, 19+ years 1000
# Baseline intakes as estimated by FSANZ based on current voluntary fortification.
NA = Not assessed.

Table A8.5: Daily intakes of folic acid (µg) - Scenario 2 – Wholemeal and wholegrain bread

				Folic Acid @ 120 µg /100g bread					Folic Acid @ 150 µg /100g bread				
			Mean Intake voluntary#	Mandatory only			Mandatory plus voluntary		Mandatory only			Mandatory plus voluntary	
				Mean	95th	%>UL*	Mean	95th	Mean	95th	%>UL*	Mean	95th
New Zealand Population (15 years+)			69	55	209	NA	124	278	68	261	NA	137	330
	Males	15-18	104	36	234	0.0	140	338	44	292	0.0	148	396
		19-29	101	43	235	0.0	144	336	54	294	0.2	155	395
		30-49	80	63	271	0.0	143	351	79	339	0.6	159	419
		50-69	79	76	278	0.0	155	357	95	348	0.0	174	427
		70+	67	70	254	0.0	137	321	87	318	0.0	154	385
	Females	15-18	51	30	164	0.0	81	215	37	204	0.0	88	255
		19-29	51	31	163	0.0	82	214	39	204	0.0	90	255
		30-49	62	49	180	0.0	111	242	61	225	0.0	123	287
		50-69	63	61	198	0.0	124	261	76	248	0.0	139	311
		70+	65	76	184	0.0	141	249	95	230	0.0	160	295
		16-18	51	32	148	0.0	83	199	40	186	0.0	91	237
		19-44	58	40	173	0.0	98	231	50	216	0.0	108	274
		16-44	58	39	173	0.0	97	231	49	216	0.0	107	274

* Upper Limit (µg /day): 15-18 years 800, 19+ years 1000
\# Baseline intakes as estimated by FSANZ based on current voluntary fortification.
NA = Not assessed.

Table A8.6: Daily intakes of folic acid (µg) - Scenario 3 – White bread

				Folic Acid @ 120 µg /100g bread					Folic Acid @ 150 µg /100g bread				
			Mean Intake voluntary#	Mandatory only			Mandatory plus voluntary		Mandatory only			Mandatory plus voluntary	
				Mean	95th	%>UL*	Mean	95th	Mean	95th	%>UL*	Mean	95th
New Zealand Population (15 years+)			69	75	277	NA	144	346	94	347	NA	163	416
	Males	15-18	104	94	370	0.0	198	474	118	462	0.0	222	566
		19-29	101	108	378	0.0	209	479	135	473	0.0	236	574
		30-49	80	106	354	0.0	186	434	133	443	0.1	213	523
		50-69	79	63	246	0.1	142	325	79	308	0.1	158	387
		70+	67	55	221	0.0	122	288	69	277	0.0	136	344
	Females	15-18	51	82	274	0.0	133	325	103	343	0.0	154	394
		19-29	51	71	260	0.0	122	311	89	325	0.2	140	376
		30-49	62	69	240	0.0	131	302	82	300	0.0	144	362
		50-69	63	41	175	0.0	104	238	52	219	0.0	115	282
		70+	65	37	175	0.0	102	240	46	219	0.0	111	284
		16-18	51	83	288	0.0	134	339	105	361	0.0	156	412
		19-44	58	70	254	0.0	128	312	88	318	0.1	146	376
		16-44	58	71	254	0.0	129	312	89	318	0.1	147	376

* Upper Limit (µg /day): 15-18 years 800, 19+ years 1000
# Baseline intakes as estimated by FSANZ based on current voluntary fortification.
NA = Not assessed.

Attachment 7b

Methodology and Results of Dietary Modelling at Draft Assessment

CONTENTS

EXECUTIVE SUMMARY

A dietary intake assessment was conducted to assess the potential impact the introduction of mandatory fortification of food with folic acid in Australia and New Zealand would have on:

- folic acid intakes among the target group, women of child-bearing age; and
- folic acid intakes among the general population

The aim was to determine a level of fortification that maximised folic acid intake for the target group to assist in achieving their recommended intake of 400 μg of folic acid a day, whilst preventing a significant proportion of people in the target and non-target groups exceeding upper safe levels of intake.

The dietary intake assessment was conducted for females aged 16-44 years who were assumed to represent the target group of women of child-bearing age and also for the age and gender groups specified in the National Health and Medical Research Councils (NHMRC) Nutrient Reference Values for Australia and New Zealand document for easy comparison of estimated folic acid intakes against the upper levels of intake. Two dietary intake assessments for women of child bearing age were considered, folic acid intakes from food alone and folic acid intakes from food and supplement use.

In considering mandatory fortification of food with folic acid, bread making flour was selected as the food vehicle, based on a high percentage of women of child-bearing age consuming products containing bread-making flour and international experience. Bread-making flour was assumed to be used as an ingredient in commercially produced plain, fancy, sweet and flat breads and bread rolls, English-style muffins, crumpets, scones, pancakes, pikelets, crepes, yeast donuts, pizza bases and crumbed products. Two scenarios were assessed as the potential vehicles for providing added folic acid from foods: all wheat bread-making flour (white and wholemeal) and white wheat bread-making flour only.

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

- current folic acid intakes from food alone (**Baseline**) based on the current uptake by industry of voluntary folic acid permissions outlined in Standard 1.3.2 of the *Australia New Zealand Food Standards Code* (the Code) for each relevant food category;
- folic acid intakes from food alone for 'Baseline' (except bread) and the introduction of mandatory fortification of all bread-making flour at 100 μg, 200 μg and 300 μg of folic acid per 100 g of bread-making flour (**Scenario 1**[2]); and
- folic acid intakes from 'Baseline' (except bread) and the introduction of mandatory fortification of white bread-making flour at 100 μg, 200 μg and 300 μg of folic acid per 100 g of bread-making flour (**Scenario 2**).

[2] All estimated dietary folic acid intakes reported are based on the assumption that the calculated folic acid concentration in the fortified product relates to a final folic acid concentration of 100 μg, 200 μg or 300 μg in the bread making flour component of each product. Losses in folic acid due to cooking and storage were not considered here but will be taken into account in setting the permission to add folic acid to bread making flour. For example, the permitted amount of folic acid in bread making flour may need to be higher than 200 μg/100g to allow for these losses and still achieve the desired folic acid level based on 200 μg/100g in the bread making flour component of the final product.

These dietary modelling scenarios did not take into account naturally occurring folates in food or folic acid from folic acid supplements or multivitamins containing folic acid.

The dietary modelling results indicated that fortification up to 200 µg folic acid/100g bread making flour maximised folic acid intakes from food for the target group without resulting in undesirably high levels of folic acid intake for the general population. Specifically it should be noted that:

- Current folic acid intake from food by the target group is low.
- New Zealand has lower baseline folic acid intakes from food for all age groups considered due to a lower level of uptake of voluntary folic acid permissions by industry.
- The introduction of mandatory fortification of all bread-making flour or white bread-making flour resulted in an increase in mean folic acid intakes for each population group assessed, which increased further as the amount of folic acid added to bread-making flour increased.
- Despite these increases folic acid intakes from food for the target group are still well below the recommended 400 µg per day.
- The selection of either all bread-making flour or white bread-making flour makes only a modest difference in mean folic acid intakes for the target group.
- Children aged 2-8 years are the most likely population group to exceed the upper level if mandatory fortification of either all bread-making flour or white bread-making flour were to be introduced, with the greatest number exceeding the UL when 300 µg of folic acid/100g is added to bread making flour.
- At the fortification levels modelled, only a small proportion of respondents exceeded the UL for all other Australian and New Zealand population groups assessed (including the target group).

The dietary modelling detailed above only considered folic acid added to food. Additional calculations were made to account for the possibility that both Australian and New Zealand women of child-bearing age may receive additional folic acid from supplements. These calculations assumed women of child-bearing age received an additional 200 µg or 500 µg of folic acid a day from supplements in Australia, and an additional 200 µg or 800 µg of folic acid a day from supplements in New Zealand, based on current supplement use and the recommended amount in each country.

Women of child-bearing age would receive the recommended 400 µg of folic acid a day when mandatory fortification of all bread-making flour occurs at 200 µg of folic acid per 100 g of bread-making flour and an additional 200 µg of folic acid from a supplement is taken. The additional folic acid from supplements does not result in intakes over the Upper Level, except for New Zealand women of child-bearing age who consumed an additional 800 µg of folic acid from supplements.

1. Dietary Modelling conducted to estimate folic acid intake from food only

1.1 What is dietary modelling?

Dietary modelling is a tool used to estimate intakes of food chemicals from the diet as part of the FSANZ risk assessment process. To estimate dietary intake of food chemicals records of what foods people have eaten are needed and reports of how much of the food chemical of interest is in each food. The accuracy of these intake estimates depend on the quality of the data used in the dietary models. Sometimes all the data needed are not available or the 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 intake estimates, however, each modelling process requires decisions to be made about how to set the model up and what assumptions to make; a different decision may result in a different answer. 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.

1.2 Dietary modelling approach

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

Dietary Intake = food chemical concentration x food consumption

The intake was estimated by combining usual patterns of food consumption, as derived from NNS data, with current levels of fortification based on the uptake of voluntary fortification permissions by industry and proposed levels of folic acid in foods if mandatory folic acid fortification is introduced (see Figure 1 for an overview of the dietary modelling approach). More details of each step in the process are given below.

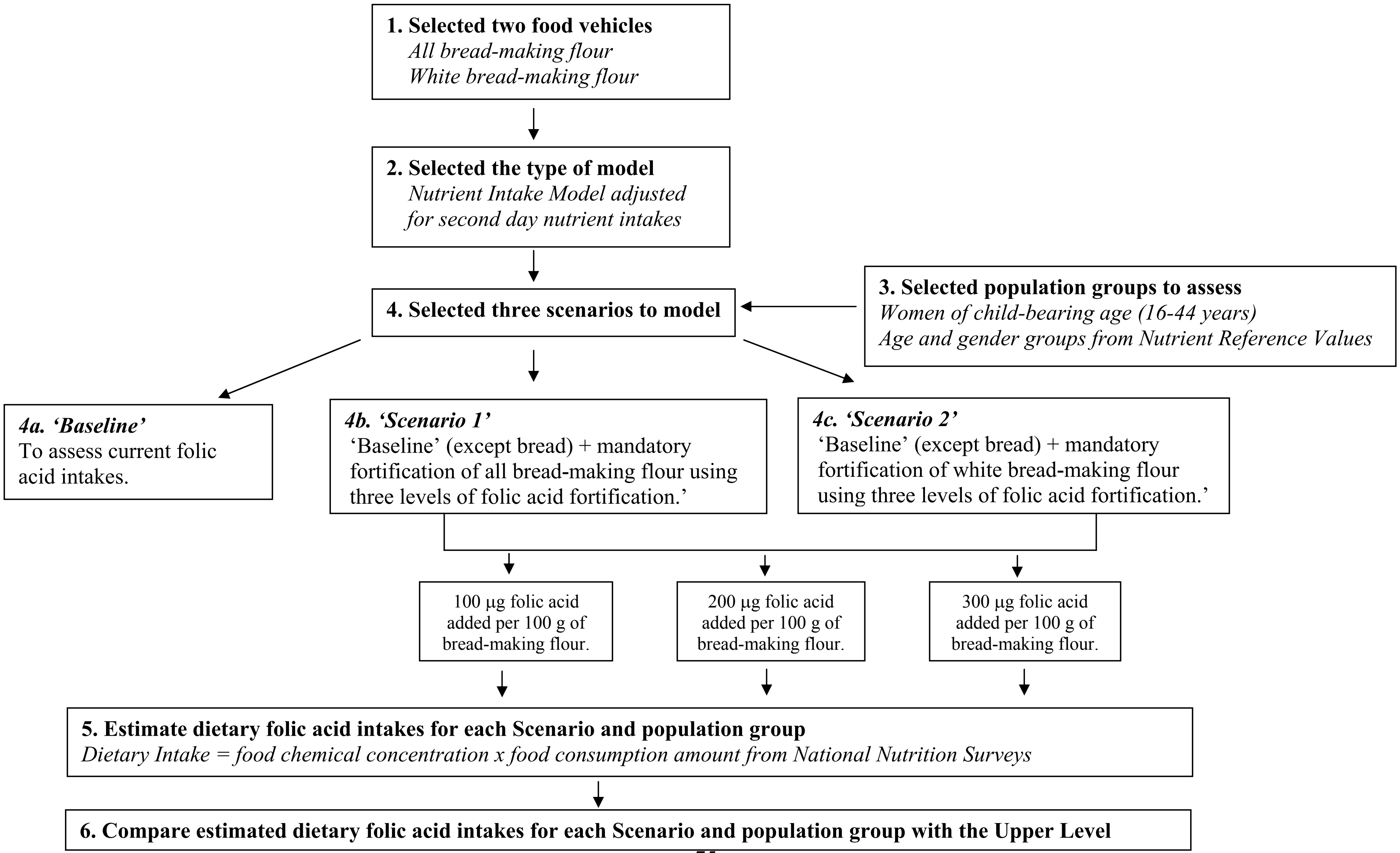
1.3 Dietary survey data

DIAMOND contains dietary survey data for both Australia and New Zealand; the 1995 NNS from Australia that surveyed 13,858 people aged 2 years and above, and the 1997 New Zealand NNS that 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 collected on a subset of respondents in both surveys. Standard methodologies were used to estimate intake from a single 24 hour record (day one) and to adjust these records to estimate 'usual intake' by including information from a second 24 hour record (day two) (see Appendix 1*: How were the estimated dietary intakes estimated*).

It is recognised that these survey data have several limitations. For a complete list of limitations see section 5*: Limitations*.

Figure 1: Dietary Modelling approach used for assessing folic acid intakes from food for Australia and New Zealand



1.4 Population groups assessed

The dietary intake assessment was conducted separately for Australia and New Zealand population sub-groups.

Females 16-44 years were assessed for both Australia and New Zealand to determine the impact of mandatory fortification in the target group, women of child-bearing age. The NHMRC Nutrient Reference Values for Australia and New Zealand (NRVs) (NHMRC 2006) was used as a guide in selecting the other age groups to assess. As different NRVs were given to different age and gender groups for folate, conducting the dietary modelling based on the NRV age groups allows for easy comparison of the estimated intakes with the relevant NRV for risk assessment purposes.

As the Australian 1995 NNS was conducted on people aged 2 years and above, the following age groups were modelled: the whole population 2 years and above, 2-3 years, 4-8 years, 9-13 years, 14-18 years 19-29 years, 30-49 years, 50-69 years and 70 years and above, all split by gender. The New Zealand NNS was conducted on people aged 15 years and above so the following age groups were also assessed: the whole population 15 years and above, 15-18 years 19-29 years, 30-49 years, 50-69 years and 70 years and above, all split by gender.

1.5 Food vehicle

In considering mandatory fortification with folic acid, all wheat bread-making flour and white wheat bread-making flour were selected as the potential vehicle for incorporating folic acid into foods due to the high consumption of products assumed to contain bread-making flour as an ingredient by the target group. According to the NNSs, approximately 83% of Australian and 81% of New Zealand women of child-bearing age are likely to consume bread-based foods containing bread-making flour. White wheat bread-making flour was investigated to allow for consumer choice should they wish to avoid added folic acid in foods by selecting other types of products containing bread-making flour.

In practical terms, bread-making flour was also considered a feasible option due to the existing mandatory fortification permissions of these products with thiamin in Australia and it is consistent with international experience and the way mandatory folic acid fortification has been introduced in other countries, particularly the United States, Canada and more recently the United Kingdom.

To determine the range of foods that would be likely to contain added folic acid it was therefore necessary to determine which foods contain bread-making flour. In Australia, flour for ‘bread-making’ must contain added thiamin. For the purposes of dietary modelling, foods were assumed to contain bread-making flour if Australian products were labelled as containing added thiamin (see Figure 2). Breakfast cereals, although often contain added thiamin, were not considered to be made from bread-making flour.

Figure 2: Definition of all bread-making flour and white bread-making flour for dietary modelling purposes

All bread-making flour: includes all white and wholemeal wheat flour used as an ingredient in commercially produced plain, fancy, sweet and flat breads and bread rolls, English-style muffins, crumpets, scones, pancakes, pikelets, crepes, yeast donuts, pizza bases and crumbed products.

White bread-making flour: includes all white wheat flour used as an ingredient in commercially produced plain, fancy, sweet and flat breads and bread rolls, English-style muffins, crumpets, scones, pancakes, pikelets, crepes, yeast donuts, pizza bases and crumbed products.

1.6 Scenarios and folic acid concentration data

Three scenarios were modelled for the purpose of this Proposal.

3. '**Baseline**' to estimate current folic acid intakes from food alone based on current uptake of voluntary folic acid permissions by industry;
4. '**Scenario 1**' to estimate folic acid intakes from food alone from 'Baseline' (except bread) and the introduction of mandatory fortification of all bread-making flour at 100 µg, 200 µg and 300 µg of folic acid per 100 g of bread-making flour; and
5. '**Scenario 2**' to estimate folic acid intakes from food alone from 'Baseline' (except bread) and the introduction of mandatory fortification of white bread-making flour at 100 µg, 200 µg and 300 µg of folic acid per 100 g of bread-making flour.

The calculations based on these scenarios assume the introduction of mandatory folic acid fortification will have no impact on the current uptake of voluntary folic acid permissions by industry, with the exception of existing voluntary folic acid permissions for white, brown, wholemeal and rye breads. These calculations do not take into account naturally occurring folates from the diet or folic acid from supplement intake.

All estimated dietary folic acid intakes reported are based on the assumption that the calculated folic acid concentration in the fortified product relates to a final folic acid concentration of 100 µg, 200 µg or 300 µg in the bread making flour component of each product. Losses in folic acid due to cooking and storage were not considered here but will be taken into account in setting the permission to add folic acid to bread making flour. For example, the permitted amount of folic acid in bread making flour may need to be higher than 200 µg/100g to allow for these losses and still achieve the desired folic acid level based on 200 µg/100g in the bread making flour component of the final product.

'Baseline'

This model represents current estimated folic acid intakes for each population group assessed before mandatory folic acid fortification permissions are given in Australia and New Zealand.

This model only considers where voluntary folic acid permissions outlined in Standard 1.3.2 of the *Australia New Zealand Food Standards Code* (the Code) have been taken up by industry, as evidenced by products available on the supermarket shelves.

It does not include all foods or food groups where voluntary fortification of folic acid is permitted in the Code but has not been taken up by industry. It does not take into account naturally occurring folates in food or folic acid from the use of folic acid supplements or multi-vitamin supplements containing folic acid.

Baseline concentrations for foods voluntarily fortified with folic acid were derived from four major sources:

- unpublished FSANZ analytical data for samples purchased in Australia in 1997, 2005 and 2006; samples included in these analyses included a number of different types of common breakfast cereals, fortified breakfast juice and white bread;
- analytical data for samples purchased in New Zealand in 2003 and 2004 (Thomson, 2005); samples included in these analyses included breakfast cereals, juice, bread and food drinks;
- current label data for foods where no analytical values were available, without adjustment for potential under- or overages of folic acid; and
- recipe calculation for foods that contain a folic acid fortified food as one of their ingredients (e.g. chocolate crackles that contain fortified puffed rice breakfast cereal).

Information from these four sources was matched against the 1995 and 1997 Australian and New Zealand NNS food codes for all those foods identified as being fortified with folic acid (149/4550 foods in Australia and 101/4950 foods in New Zealand). All other foods recorded as being consumed were assumed not to contain added folic acid. For a list of foods assumed to currently contain added folic acid see Table 3A.1 for Australia and Table 3A.2 for New Zealand in Appendix 3.

For foods where a fortified version of the food was not specifically identified within the NNS, but where it is known that a significant proportion of the food category in the market place is now fortified, a folic acid concentration was assigned to the food, and weighted to reflect the proportion of the market for that food that is now believed to be fortified. For example, the Australian NNS does not distinguish consumption of folic acid fortified white bread from regular white bread. The market share for folic acid fortified bread in Australia was estimated at 15% of all breads, based on sales information for a major bakery retail chain. A value representing 15% of the analysed or labelled concentration of folic acid in fortified breads was assigned to all white breads. Based on available information, fortification of breads with folic acid does not appear to be as common in New Zealand as in Australia.

'Scenario 1 – mandatory folic acid fortification of all bread-making flour'

This model was conducted to estimate dietary folic acid intakes for each population group where mandatory folic acid fortification of all bread-making flour (wheat only) is permitted in Australia and New Zealand at 100 μg, 200 μg or 300 μg per 100 g of bread-making flour.

This model assumes that the introduction of mandatory folic acid fortification of all bread-making flour will have no impact on the current uptake of voluntary folic acid permissions by industry, with the exception of existing voluntary folic acid permissions for white, brown, wholemeal and rye breads.

Therefore, this model includes 'Baseline' folic acid concentrations for all foods other than bread, and folic acid concentrations for bread and bread products assumed to contain bread-making flour as a result of mandatory folic acid fortification of all bread-making flour at 100 µg, 200 µg or 300 µg per 100 g of bread-making flour.

It does not take into account naturally occurring folates in food or folic acid from the use of folic acid supplements or multi-vitamin supplements containing folic acid.

Folic acid concentrations were estimated based on the proportion of bread-making flour a food contains and on the final concentration of folic acid assumed to be delivered in the bread-making flour. For example for white bread, the folic acid concentrations were calculated as follows:

Proportion of bread-making flour in bread	60%
Final concentration of folic acid in flour after baking	200 µg/100 g
Folic acid concentration in bread	0.6 x 200 µg = 120 µg/100 g

These estimates do not take into account potential losses of folic acid during cooking and storage[1]. Proportions of bread-making flour in foods were estimated based on recipe information from the 1997 New Zealand NNS or from recipe information in the FSANZ dietary modelling computer program, DIAMOND.

For a summary of folic acid concentration data used for 'Scenario 1' see Table 3A.1 for Australia and Table 3A.2 for New Zealand in Appendix 3.

'Scenario 2 – mandatory folic acid fortification of white bread-making flour'

This model was conducted to estimate dietary folic acid intakes for each population group where mandatory folic acid fortification of white bread-making flour (wheat only) is permitted in Australia and New Zealand at 100 µg, 200 µg or 300 µg per 100 g of white bread-making flour.

As for Scenario 1, this model assumes that the introduction of mandatory folic acid fortification of white bread-making flour will have no impact on the current uptake of voluntary folic acid permissions by industry, with the exception of existing voluntary folic acid permissions for white, brown, wholemeal and rye breads.

Therefore, this model includes 'Baseline' folic acid concentrations for all foods other than bread, and folic acid concentrations for bread and bread products assumed to contain white bread-making flour as a result of mandatory folic acid fortification of white bread-making flour at 100 µg, 200 µg and 300 µg per 100 g of white bread-making flour[1].

It does not take into account naturally occurring folates in food or folic acid from the use of folic acid supplements or multi-vitamin supplements containing folic acid.

Folic acid concentrations were estimated as for 'Scenario 1' above.

1.7 How were the estimated dietary folic acid intakes calculated?

A detailed explanation of how the estimated dietary exposures are calculated can be found in Appendix 1.

2. Assumptions used in the dietary modelling

The aim of the dietary intake assessment is to make as realistic an estimate of dietary folic acid 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 NNS represent current food consumption amounts;
- the dietary patterns for females aged 16-44 years are representative of the dietary patterns for pregnant women;
- consumers always select products containing folic acid at the concentrations specified; and
- consumers have altered their food consumption habits compared to the NNS records to reflect the proportions of fortified and non-fortified products currently available within certain food categories.

Concentration Data

- Naturally occurring sources of folate have not been included in the dietary intake assessment;
- where there were no Australian folic acid 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 folic acid;
- a market share weighted folic acid value is assigned to food categories with voluntarily permissions to fortify to reflect the proportion of products that have been fortified or where possible, a analyses or label folic acid concentration is assigned to individual foods using up to date food composition data; and
- there is no contribution to folic acid intake through the use of complementary medicines (Australia) or dietary supplements (New Zealand) for 'Baseline', 'Scenario 1' and 'Scenario 2' models.

Food Vehicles

- Bread-making flour was assumed to be used as an ingredient in all plain, fancy, sweet, and flat breads and bread rolls, English muffins, crumpets, scones, pancakes, pikelets, crepes, yeast donuts, pizza bases and crumbed products;

- bread-making flour was assumed not to include folic acid where the flour was used as a coating on food such as on the top of a take-away bun or to batter fish;
- only white bread-making flour was assumed to be used to make crumbed products;
- grain breads were assumed to contain white bread-making flour only (grains are added as a separate ingredient);
- sandwiches, hamburgers and pizzas were assumed to be made from white bread-making flour unless wholemeal was specifically stated;
- for Australia, wholemeal breads and bread rolls (including fruit and topped), wholemeal bagels, wholemeal muffins, wholemeal flat breads and wholemeal pancakes were assumed to contain wholemeal flour only and were therefore not assigned a folic acid concentration in Scenario 2 models;
- for Australia, rye, black and pumpernickel breads, wholemeal crumpets and wholemeal scones were assumed to contain both white and wholemeal flour and were therefore assigned a folic acid concentration for the white bread-making flour component only in Scenario 2 models;
- for New Zealand wholemeal pita bread and wholemeal scones were assumed to contain wholemeal flour only and these foods were therefore not assigned a folic acid concentration in Scenario 2 models; and
- for New Zealand wholemeal breads and bread rolls (including fruit and topped), rye and pumpernickel breads, wholemeal bagels, wholemeal muffins and wholemeal sandwiches were assumed to contain both white and wholemeal flour and were therefore assigned a folic acid concentration for the white bread-making flour component only in Scenario 2 models.

General

- All folic acid present in food is absorbed by the body;
- there are no reductions in folic acid concentrations from cooking and storage[1]; 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).

3. Estimated dietary folic acid intakes from folic acid added to food only

While folic acid intakes were estimated for a broad range of population sub-groups, the focus of the risk assessment is women of child-bearing age. Therefore, the results section of this report is primarily focused on this population sub-group.

All estimated dietary folic acid intakes in this Attachment are based on 'residual' folic acid, i.e. the amount consumed. The amount that must be added to the raw ingredients to allow for cooking and storage losses will be considered in a different part of the Draft Assessment Report (see Section 2).

3.1 Estimated dietary folic acid intakes for women of child-bearing age

The estimated mean dietary folic acid intakes for Australian and New Zealand women of child-bearing age are shown in Table 1 and Figure 3A for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' models and Figure 3B for 'Baseline' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' models.

The incremental increase in folic acid intake from 'Baseline' is also shown in Table 2. Full results can be found in Table A4.1 and Table A4.4 in Appendix 4.

These results show an increase in estimated dietary folic acid intakes from baseline for both 'Scenario 1- mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 - mandatory folic acid fortification of white bread-making flour'. Further increases in estimated dietary folic acid intakes can be seen in each scenario model as the amount of folic acid added to all bread-making flour or white bread-making flour increases from 100 µg of folic acid per 100 g of bread-making flour to 300 µg of folic acid per 100 g of bread-making flour. The selection of either all bread-making flour or white bread-making flour makes only a modest difference in the overall increase in estimated mean folic acid intakes from 'Baseline' intakes. Estimated folic acid from food alone for women of child bearing age did not achieve the desired folic acid intake of 400 µg/day for any of the models.

These results also indicate New Zealand women of child-bearing age have lower baseline folic acid intakes and therefore larger incremental increases in intake compared to the same population group for Australia. This is because of the lower baseline folic acid intakes in New Zealand due to fewer voluntary folic acid permissions take up by industry.

Table 1: Estimated mean folic acid intakes from food for Australian and New Zealand women of child-bearing age (16-44 years)

Model	Added Folic Acid in bread making flour (µg/100g)	Mean folic acid intake (µg/day)	
		Australia	New Zealand
'Baseline'		95	58
'Scenario 1'			
All bread making flour	100	135	123
	200	195	189
	300	254	254
'Scenario 2'			
All white bread making flour	100	125	115
	200	175	173
	300	225	231

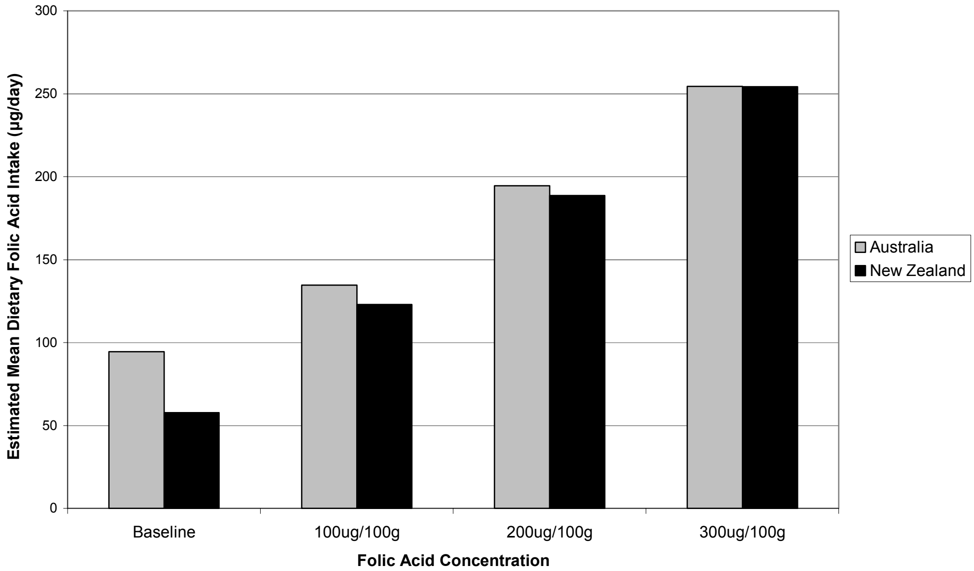
Table 2: Actual increase in folic acid intake for women of child-bearing age* due to the introduction of mandatory folic acid fortification of all bread-making flour and white bread-making flour

Model	Added Folic Acid in bread making flour (µg/100g)	Increase in folic acid intake from 'Baseline' (µg/day)	
		Australia	New Zealand
'Scenario 1'			
All bread making flour	100	+40	+65
	200	+100	+131
	300	+159	+196
'Scenario 2'			
All white bread making flour	100	+30	+57
	200	+80	+115
	300	+130	+173

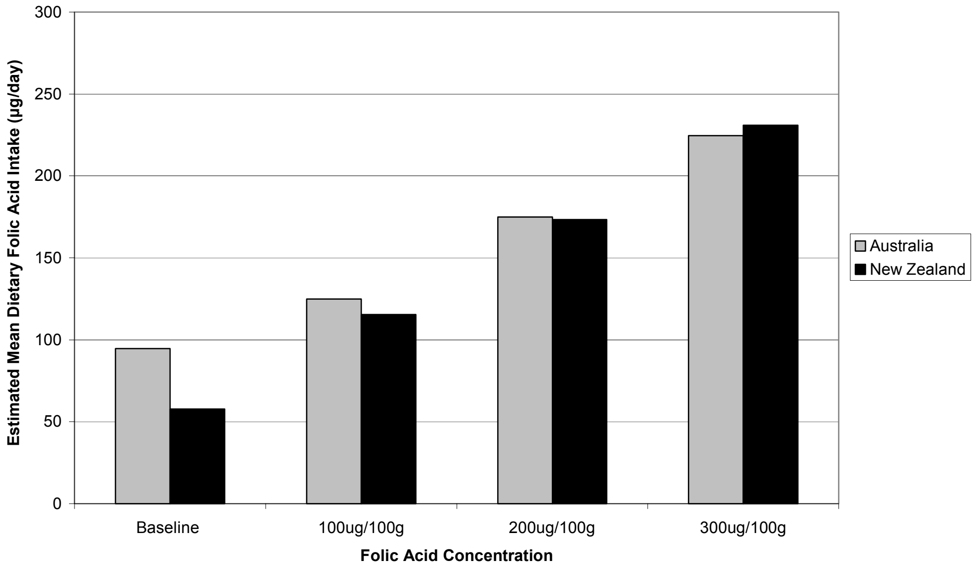
* All women aged 16-44 years

Figure 3: Estimated mean dietary folic acid intakes for 'Baseline' and both Scenario assessments for Australian and New Zealand women of child-bearing age (16-44 years)

A: 'Scenario 1 – mandatory fortification of all bread-making flour'



B: 'Scenario 2 – mandatory fortification of white bread-making flour'



3.2 Estimated dietary intakes of folic acid for the non-target groups

Dietary folic acid intakes were estimated for the non-target groups to assess the impact 'Scenario 1 - mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' at various folic acid concentrations would have on public health and safety.

Full results for the estimated dietary folic acid intakes of these Australian and New Zealand non-target groups can be found in Table A4.2, Table A4.3, Table A4.5 and Table A4.6 in Appendix 4.

These results show an increase in estimated dietary folic acid intakes for both 'Scenario 1- mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 - mandatory folic acid fortification of white bread-making flour'. As expected, increases in estimated dietary folic acid intakes can be seen for each scenario model as the amount of folic acid added to all bread-making flour and white bread-making flour increases from 100 µg to 300 µg of folic acid per 100 g or bread-making flour.

As for women of child-bearing age, non-target groups in New Zealand also have lower baseline folic acid intakes compared to Australia. This could by explained due to the assumption that voluntary folic acid fortification of breads is not as common in New Zealand as in Australia.

3.3 Comparison of the estimated dietary intakes with the Upper Level

In order to determine if the proposed level of addition of folic acid to bread making flour will be a public health and safety concern, the estimated folic acid dietary intakes were compared with the NRV called an Upper Level (UL).

The UL is 'the highest average daily intake level of a nutrient that is likely to pose no risk of adverse health effects to almost all individuals in the general population' (Institute of Medicine 1998).

The estimated dietary intakes for folic acid were determined for each individual and were compared to the relevant UL for their age group and gender. The proportion of each population group exceeding the UL are shown in Table 3A for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' and Table 3B for 'Baseline' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' for the Australian and New Zealand non-target groups assessed. The proportion of the target group exceeding the UL is shown in Table 4. Full results can be found in Table A5.1 to Table A5.6 of Appendix 5.

Table 3: Per cent of Australian and New Zealand 'Baseline' and both Scenario respondents with folic acid intakes above the Upper Level

A: 'Baseline' and 'Scenario 1 – mandatory fortification of all bread-making flour'

Country	Population Group	Upper Level (μg/day)	No. of respondents	Baseline (% > UL)	Scenario 1: Mandatory folic acid fortification of all bread-making flour (% > UL)		
					100μg/100g	200μg/100g	300μg/100g
Australia	2-3 years	300	383	1	2	6	20
	4-8 years	400	977	0.6	1	3	9
	9-13 years	600	913	0.8	1	2	3
	14-18 years	800	734	0.5	0.8	2	3
	19-29 years	1000	2,203	0.2	0.4	0.6	1
	30-49 years	1000	4,397	0.3	0.3	0.3	0.5
	50-69 years	1000	3,019	0.1	0.2	0.2	0.3
	70+ years	1000	1,232	0	0	0	0.1
New Zealand*	15-18 years	800	246	0	0	0.4	0.8
	19-29 years	1000	804	0	0	0	0.1
	30-49 years	1000	1,883	0.1	0.1	0.1	0.3
	50-69 years	1000	1,147	0	0	0.1	0.3
	70+ years	1000	556	0	0	0	0

* Data for New Zealand children 2-14 years were not available

B: 'Baseline' and 'Scenario 2 – mandatory fortification of white bread-making flour'

	Population Group	Upper Level (µg/day)	No. of respondents	Baseline (% > UL)	Scenario 2: Mandatory folic acid fortification of white bread making flour (% > UL)		
					100µg/100g	**200µg/100g**	**300µg/100g**
Australia	2-3 yrs	300	383	1	2	5	15
	4-8 yrs	400	977	0.6	1	3	8
	9-13 yrs	600	913	0.8	1	2	3
	14-18 yrs	800	734	0.5	0.8	1	2
	19-29 yrs	1000	2,203	0.2	0.3	0.5	0.9
	30-49 yrs	1000	4,397	0.3	0.3	0.3	0.4
	50-69 yrs	1000	3,019	0.1	0.1	0.1	0.2
	70+ yrs	1000	1,232	0	0	0	0
New Zealand*	15-18 yrs	800	246	0	0	0	0.8
	19-29 yrs	1000	804	0	0	0	0
	30-49 yrs	1000	1,883	0.1	0.1	0.1	0.2
	50-69 yrs	1000	1,147	0	0	0.1	0.1
	70+ yrs	1000	556	0	0	0	0

* Data for New Zealand children 2-14 years were not available

Table 4: Per cent of respondents with folic acid intakes above the Upper Level for Australian and New Zealand women of child-bearing age

Model	Added Folic Acid in bread making flour (µg/100g)	Per cent above the UL	
		Australia	**New Zealand**
Baseline		0.2	0.1
'Scenario 1'			
All bread making flour	100	0.2	0.1
	200	0.2	0.1
	300	0.2	0.2
'Scenario 2'			
All white bread making flour	100	0.2	0.1
	200	0.1	0.1
	300	0.2	0.2

* All females aged 16-44 years

For Australia, the results indicate children 2-3 years and children 4-8 years are the most likely of the non-target groups to have people exceed the UL if mandatory folic acid fortification of either all bread-making flour or white bread-making flour were to be introduced (see Figures 4 and 5).

The number of respondents exceeding the UL increases as the amount of folic acid added to either all bread making flour or white bread-making flour increases, with the largest relative increase between the addition of 200 μg and 300 μg folic acid per 100 g of bread-making flour for both scenarios.

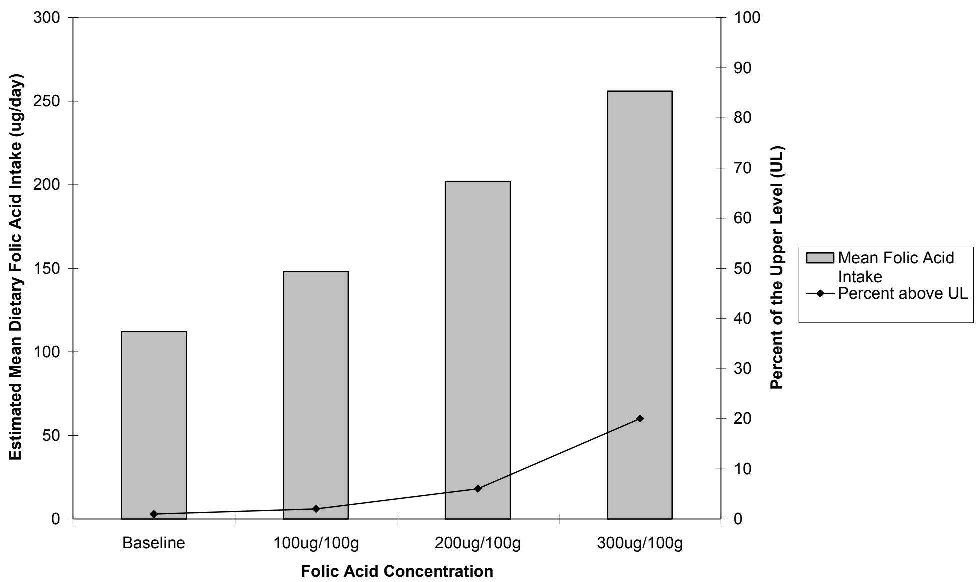
There appears to be a modest difference in the proportion of respondents exceeding the UL between 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour'.

As FSANZ does not currently hold food consumption data for New Zealand children 2-14 years from the 2002 National Children's Nutrition Survey, the estimated dietary folic acid intakes for Australian children aged 2-14 were considered representative of this New Zealand age group. Therefore, it is assumed that New Zealand children 2-3 years and 4-8 years would show a similar proportion of respondents with folic acid intakes above the UL.

Only small proportions of respondents exceeding the UL can be seen for the other Australian and New Zealand non-target groups assessed at all levels of added folic acid considered.

Figure 4: Estimated mean dietary folic acid intakes and per cent of Australian children 2-3 years with 'Baseline' and both 'Scenario' folic acid intakes above the Upper Level

A: 'Scenario 1 – mandatory fortification of all bread-making flour'



B: 'Scenario 2 – mandatory fortification of white bread-making flour'

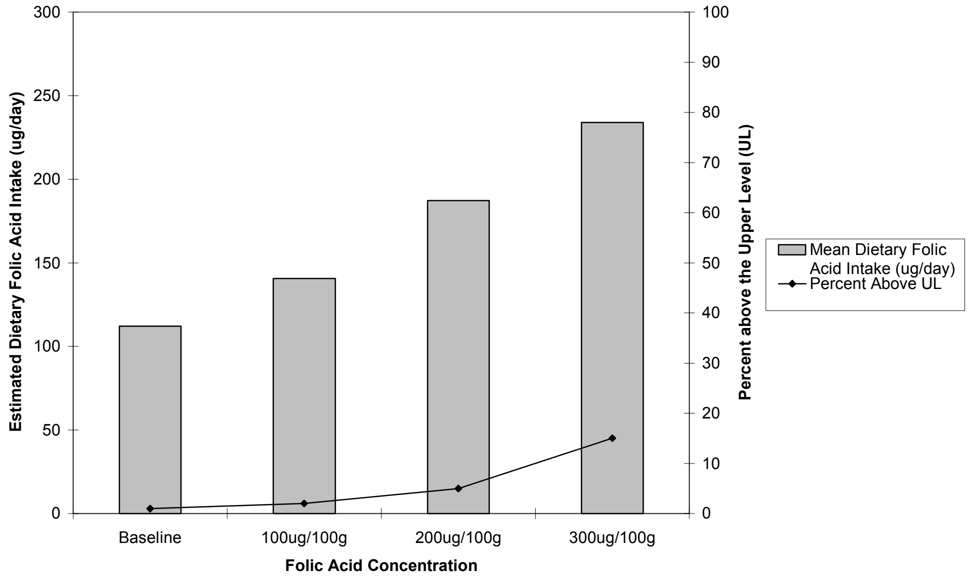
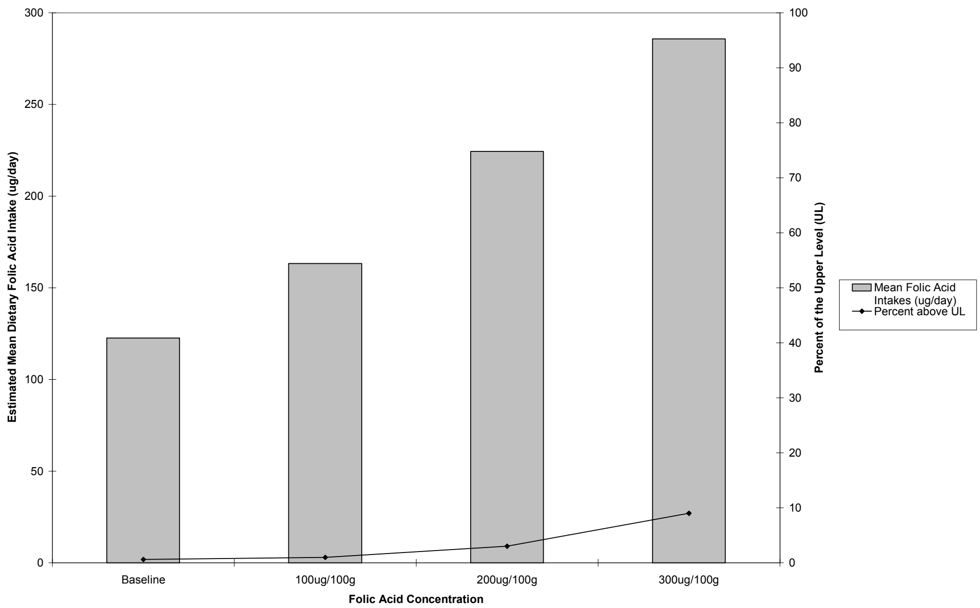
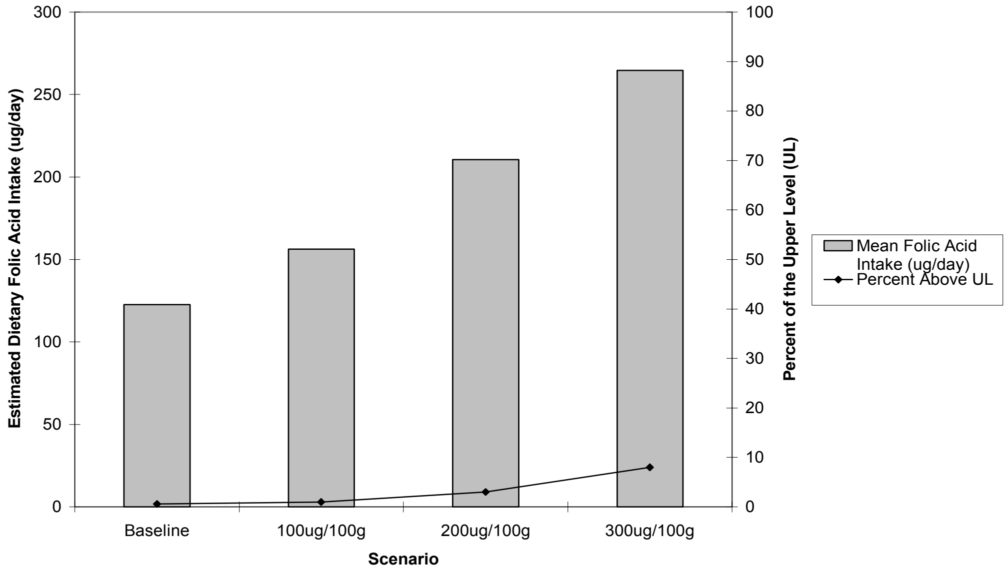


Figure 5: Estimated mean dietary folic acid intakes and per cent of Australian children 4-8 years with 'Baseline' and both 'Scenario' folic acid intakes above the Upper Level

'Scenario 1 – mandatory fortification of all bread-making flour'



'Scenario 2 – mandatory fortification of white bread-making flour'



4. Additional calculations to estimate folic acid intakes from food and supplements

Currently women planning pregnancy and pregnant women are advised to take folic acid supplements. Consequently, additional calculations were made to estimate folic acid intakes assuming women of child-bearing age received folic acid from folic acid supplements in addition to receiving folic acid via voluntary and mandatory fortification of foods.

Additional calculations were not conducted for each of the non-target groups due to limited information available on supplement use.

4.1 How were the folic acid intakes from food and supplements calculated?

Two calculations were made for Australian and New Zealand women of child-bearing age. For Australia it was assumed the target group received an additional 200 µg or 500 µg of folic acid a day from supplements. For New Zealand it was assumed the target group received an additional 200 µg or 800 µg of folic acid a day from supplements.

These concentrations were selected because in Australia, folic acid only supplements typically contain 500 µg of folic acid, while New Zealand folic acid supplements typically contain 800 µg of folic acid. The lower concentration of 200 µg was based on recently published results by Bower *et al*. (2005) which found that 28.5% of women in the Western Australian study reported taking 200 µg or more per day from supplements.

The intake of folic acid from supplements was added to the estimated mean folic acid intake from food for this population group at baseline, and for each scenario as outlined above to estimate total folic acid intake. It was assumed that all women aged 16-44 years consumed a folic acid supplement.

Although, the Australian 1995 NNS indicated 7.6% of females aged 18-24 years and 11.4% of females aged 25-44 years took a folic acid supplement on the day before the NNS survey (Lawrence *et al*., 2001). Naturally occurring folates in food were not taken into account.

4.2 Estimated dietary intakes of folic acid from food and supplements for women of child-bearing age

The estimated total dietary folic acid intakes from food and folic acid supplements for Australian and New Zealand women of child-bearing age are shown in Figure 6A and Figure 6B respectively for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' models and Figure 7A and Figure 7B respectively for 'Baseline' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' models.

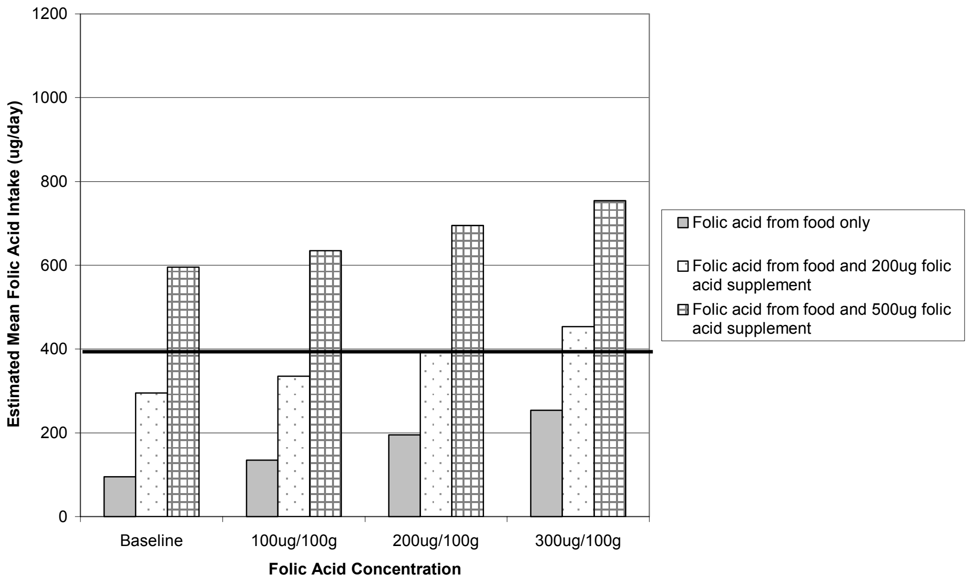
These results show an increase in estimated dietary folic acid intakes from baseline for both 'Scenario 1- mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 - mandatory folic acid fortification of white bread-making flour' when additional folic acid is consumed from supplements. Further increases in estimated dietary folic acid intakes can be seen in each scenario model as the amount of folic acid added to all bread-making flour or white bread-making flour increases from 100 µg to 300 µg of folic acid per 100 g or bread-making flour.

The results indicate that an additional 200 µg of folic acid a day from folic acid supplements to mean folic acid intakes from food will result in women of child-bearing age having intakes just below the recommended 400 µg of folic acid a day, or just over if 300 µg of folic acid is added to all bread-making flour in 'Scenario 1' and white bread-making flour in 'Scenario 2' for both Australia and New Zealand.

Full results on folic acid intakes from both folic acid found in food and supplements can be found in Table A6.1 and Table A6.2 of Appendix 6.

Figure 6: Estimated mean dietary folic acid intakes from food and folic acid supplements for 'Baseline' and 'Scenario 1' (all bread-making flour) assessments for Australian and New Zealand women of child-bearing age (16-44 years)

A: Australia



B: New Zealand

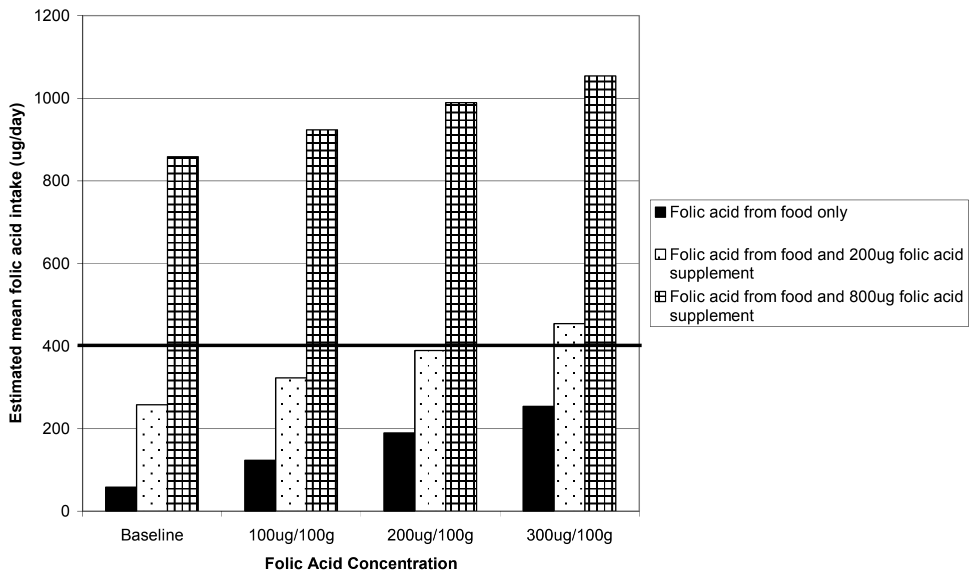
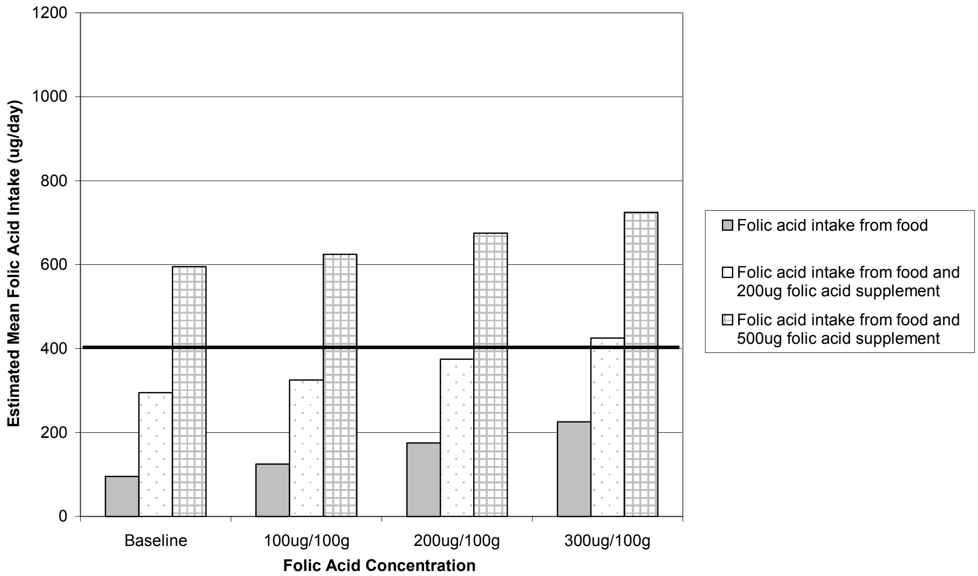
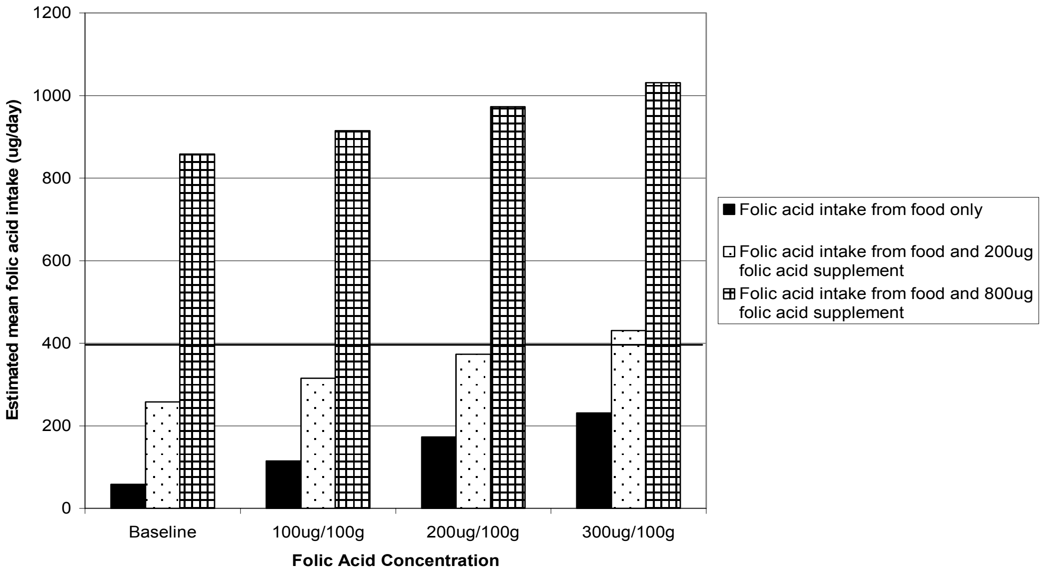


Figure 7: Estimated mean dietary folic acid intakes from food and folic acid supplements for 'Baseline' and 'Scenario 2' (white bread-making flour) assessments for Australian and New Zealand women of child-bearing age (16-44 years)

A: Australia



B: New Zealand



4.3 Comparison of the estimated dietary intakes from food and supplements with the Upper level

The results indicate that when Australian and New Zealand women of child-bearing age consume additional folic acid from a supplement there is likely to be an increase in the number of the target group exceeding the UL of 800 µg of folic acid a day for women 16-18 years and 1000 µg of folic acid a day for women 19-44 years.

Similar to above, the number of respondents exceeding the UL increases as the amount of folic acid added to either all bread-making flour or white bread-making flour increases and as the concentration of folic acid in the supplement increases.

There appears to be little difference in the per cent of respondents exceeding the UL between 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' when additional folic acid from supplements is consumed. However, due to the high folic acid content of the supplement at 800 µg of folic acid a day, a large proportion of New Zealand women are likely to exceed the UL if folic acid from food is taken into account.

The proportion of the target group exceeding the UL when supplements are taken is shown in Table 5 for Australia and New Zealand. Full results can be found in Table A6.3 and Table A6.4 of Appendix 6.

Table 5: Per cent of respondents with folic acid intakes from food and supplements above the Upper Level for Australian and New Zealand women of child-bearing age*

Model		Per cent of respondents with folic acid intakes from food and supplements above the UL (%)			
		Australia		New Zealand	
		200µg Supplement	500µg Supplement	200µg Supplement	800µg Supplement
Baseline		0.3	2	0.07	9
Scenario 1 All bread making flour	100	0.3	2	0.07	15
	200	0.4	4	0.2	40
	300	0.8	6	0.5	70
Scenario 2 White bread making flour	100	0.2	2	0.07	15
	200	0.3	3	0.2	35
	300	0.7	5	0.4	60

* All females aged 16-44 years.

5. Limitations of the dietary modelling

Dietary modelling based on 1995 or 1997 NNS food consumption data provides the best estimate of actual consumption of a food and the resulting estimated dietary intake of a nutrient for the population. However, it should be noted that the NNS data does have its limitations.

These limitations relate to the age of the data and the changes in eating patterns that may have occurred since the data were collected. Generally, 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*., 2001). It is recognised while the overall amount of bread products people consume may not change over time, the type of bread products being consumed may vary. 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 products remains the same. The uncertainty is 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.

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. Therefore, the nutrient databases from the NNSs used for dietary modelling may not be entirely representative of the nutrient levels in some foods that are now on the market. 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. For the purposes of the dietary intake assessment for this Proposal, folic acid concentrations have been assigned to foods to take this into account and therefore should reflect current concentrations and foods fortified (e.g. to 15% of breads currently being fortified, as explained above).

A limitation of estimating dietary intake over a period time using food recalls 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, by adjusting intakes based on two days of food consumption data accounts for some variation both within individuals and between individuals.

FSANZ does not currently hold food consumption data for New Zealand children aged 2-14 years. Therefore, at the present time FSANZ can not assess current folic acid intakes for this group or the impact the introduction of mandatory fortification of either all bread-making flour or white bread-making flour with folic acid might have. For the purpose of this assessment it was assumed New Zealand children 2-14 years have similar intakes to Australian children the same age.

Although some data on the use of complementary medicines (Australia) or dietary supplements (New Zealand) was collected in the NNSs, it was either not in a robust enough format to include in DIAMOND or has 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. Intake of folic acid from dietary supplements was considered for the target group using simple techniques to estimate the intake, as described previously.

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 in order to make the data representative of the population. Maori and Pacific Islanders 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.

There are a number of limitations associated with the folic acid concentration data. Analytical values used may not fully reflect actual levels due to variation in folic acid concentrations between batches of foods and because the technique used to measure folic acid (microbiological assay) is subject to significant uncertainty (Thomson, 2005). Data generated from label values has not been adjusted to take into account potential extra addition of folic acid (overages). For baseline concentrations, a major limitation is that market share information, used to weight folic acid concentration in breads and juices according to the proportion of the category observed to be fortified, may not fully reflect actual fortification practices. For scenario concentrations, a major limitation of the study relates to the assumptions about the proportion of bread-making flour used in different foods.

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Appendix 1

How were the estimated dietary folic acid intakes from fortified food calculated?

Folic acid 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 folic acid for an individual food by the amount of the food that an individual consumed in order to estimate the intake of folic acid from each food. Once this has been completed for all of the foods specified to contain folic acid, the total amount of folic acid consumed from all foods is summed for each individual. Adjusted nutrient intakes are first calculated (see below) and population statistics (such as mean and high percentile 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 the 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 are 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 is made to each respondent's folic acid intake based on the first day of food consumption data from the NNS. The adjustment takes 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 A1.1 below. (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 (ABS, 1998).

Figure A1.1: Calculating adjusted nutrient intakes

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

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: ABS, 1998

Not all foods consumed in the NNSs were assigned a folic acid concentration. Therefore not all NNS respondents are consumers of folic acid based on day one food consumption records only. However, after nutrient intake adjustments have been made based on a second day of food consumption data, all respondents have a folic acid intake as a function of how the adjusted intakes are calculated.

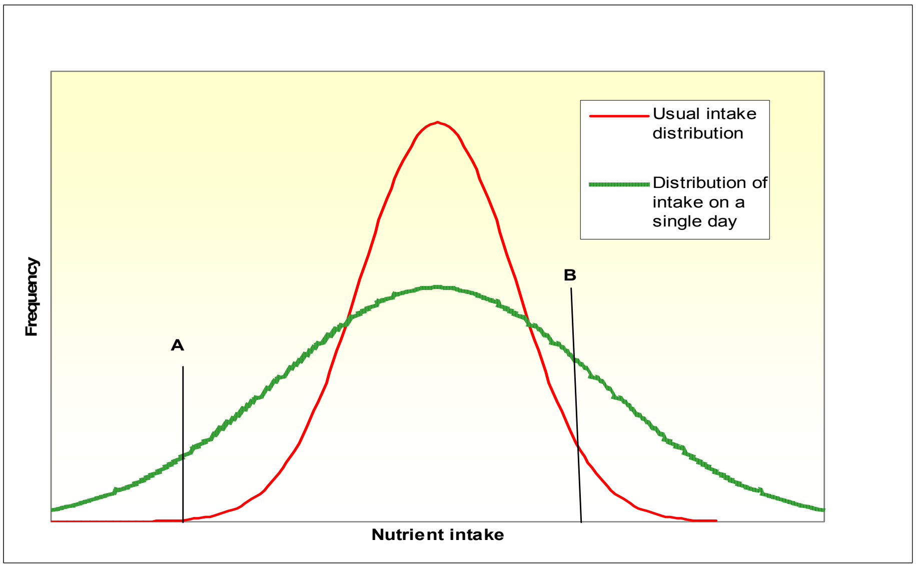
As a part of the two-day adjustment methodology, each individual below the mean in an intake distribution for day one will have an addition made to their folic acid intakes in order to calculate the adjusted intake over two days, as every individual's intakes are brought towards the mean. This applies to the intakes from respondents which are zero for day one.

Whilst this may not represent the correct usual intakes at the bottom end of the usual folic acid intake distribution, this is unlikely to be a major issue for the risk assessment because the proportion of the population below the EAR, which uses the lower end of the adjusted nutrient intake distribution, was not required to be determined. For this risk assessment, the concern is related to the proportion of respondents with intakes that exceed the upper safe reference health standard (the UL), which would be the intakes at the upper end of the intake distribution. The people in the upper end of the intake distribution would have consumed foods containing folic acid. Therefore the adjusted intakes in the upper end of the distribution accurately reflect the usual population intakes.

The benefit in being able to more accurately estimate their 'usual intake' by using the two day adjustment factor outweighs the possible over estimation of intakes for low consumers for risk assessment purposes.

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 A1.2) as the latter takes into consideration the day-to-day variation in intakes within each person as well as the difference between each person.

Figure A1.2: Comparison of one day and usual intake distributions



Using adjusted intakes provides better information for risk characterisation purposes. 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 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.

Comparison of intakes with NRVs

Comparison of intakes based on a single day of food consumption data with NRVs such as EAR would result in a larger proportion of the population having intakes below a specified level (e.g. Figure A1.1, point A), which may overestimate the level of deficiency or inadequate intakes. A broader distribution from a single day of data also means a greater proportion of a population would exceed an upper cut off level, such as an upper level (e.g. Figure A1.1, point B), which overestimates the level of risk to this group of the population.

Note that where estimated intakes are expressed as a percentage of the Upper Level (UL), each individual's total adjusted intake is calculated as a percentage of the UL (using the total intakes in units per day) corresponding to their age and gender, the results are then ranked, and population statistics derived.

Appendix 2

Relationship between the dietary intake increments described in this document and the 2006 NHMRC/NZMoH 'Nutrient Reference Values for Use in Australia and New Zealand'

In 2006, 'Nutrient Reference Values for Use in Australia and New Zealand' replaced the 1991 NHMRC document 'Recommended Dietary Intakes in Australia'.

In addition to other changes, several NRVs are given for each nutrient (e.g. Estimated Average Requirement, Recommended Dietary Intake, Upper Level) for each physiological group (NHMRC 2006) whereas previously only the Recommended Dietary Intake had been defined (NHMRC 2001). The appropriate use of the various different levels is described elsewhere (Institute of Medicine, 2000b; 2003).

An additional important change for folate was the change in the units in which the levels are expressed. Previously, the Recommended Dietary Intake had been expressed in μg with the assumption that 1 μg dietary folate = 1 μg folic acid. However this assumption is incorrect because supplemental folic acid has higher bioavailability than does dietary folate. Following the American lead (Institute of Medicine, 1998) the difference in bioavailability was acknowledged and new units for folate were developed: micrograms of Dietary Folate Equivalents (DFEs) such that

1 ug DFE = 1 μg folate from dietary sources
= 0.6 μg folic acid used to fortify food
= 0.5 μg folic acid taken on an empty stomach

(Note that this makes the generalisation that folate from all dietary sources has the same bioavailability, which is probably not true).

The recently released NHMRC publication indicates that the correct units for the UL for folate are μg supplementary or fortification folic acid, not μg DFE, because the UL is derived from studies using supplementary folic acid.

The dietary modelling work described in the current document therefore used concentrations in foods and supplements expressed as μg folic acid, not μg DFE, because all the studies examining the relationship of folic acid to the reduction of NTDs used supplemental folic acid and the UL is expressed in these units. It is not clear if enough dietary folate can be consumed to achieve the same outcomes.

From the above relationship, the change in total intake expressed as DFEs can be easily calculated from the described changes in folic acid intakes. For example, the uptake of the current voluntary fortification provisions is estimated to have increased folic acid intakes by 94 μg which means an increased total intake of 157 μg DFE (i.e. 94/0.6) over that obtainable from natural sources. Similarly, if folic acid intake in women aged 16-44 years would increase by an average of 100 μg under mandatory fortification of all bread-making flour to a residual level of 200 μg /100 g flour compared to the current voluntary fortification situation, then total folate intake will increase by a further 167 μg DFE on average.

Appendix 3

Summary of Concentration data used for various foods for dietary modelling purposes

Table A3.1: Concentration data for main Australian products assumed to contain folic acid

Food	Baseline folic acid concentration data		Bread making flour content – (%)	Scenario: folic acid concentrations in food product (µg/100g)#		
	Folic acid concentration (µg/100 g)	Origin of baseline concentration data		100 ug of folic acid added per 100g of BMF*	200 ug of folic acid added per 100g of BMF*	300 ug of folic acid added per 100g of BMF*
White bread	29	Label and analytical, with 15% market share weighting.	64	64	128	192
Multigrain bread	20	Label and analytical, market share weighted.	48	48	96	144
Wholemeal bread	27	Label and analytical, market share weighted.	‘Scenario 1’ - 64 ‘Scenario 2’ - 0	'Scenario 1' - 64 'Scenario 2' - 0	'Scenario 1' - 128 'Scenario 2' - 0	'Scenario 1' - 192 'Scenario 2' - 0
Fruit breads	23	Label, with 15% market share weighting.	51	51	102	153
Maize flake style breakfast cereal	415	Analytical	0	415	415	415
Puffed rice style breakfast cereal	157	Analytical	0	157	157	157
Extruded & sweetened breakfast cereal	108 – 442^	Label and analytical depending on brand.	0	108 - 442	108 - 442	108 - 442
Bran & fruit style breakfast cereal	108 – 178^	Label and analytical depending on brand.	0	108 - 178	108 - 178	108 - 178
Wheat biscuit style breakfast cereal	333	Analytical	0	333	333	333
Nut-based breakfast cereal	167	Analytical	0	167	167	167
Orange juice	9	Analytical with 30% market share weighting.	0	9	9	9
Soy beverage, unflavoured	61	Analytical	0	61	61	61
Yeast-based spreads	2100	Label and analytical.	0	2100	2100	2100

Food	Baseline folic acid concentration data		Bread making flour content – (%)	Scenario: folic acid concentrations in food product (µg/100g)[#]		
	Folic acid concentration (µg/100 g)	Origin of baseline concentration data		100 ug of folic acid added per 100g of BMF[*]	200 ug of folic acid added per 100g of BMF[*]	300 ug of folic acid added per 100g of BMF[*]
Pizza	0		20 – 45 depending on the type of crust and topping	20 – 45	40 -90	60 - 135
Hamburger with meat, bread, other ingredients	0		20			
Bun, sweet, various types	20		38	38	76	114
Scone, various types	0		60	60	120	180
Hot dog in bun	0		30	30	60	90
Pancakes and pikelets	0		25	25	50	75
Doughnuts, yeast type	0		40	40	80	120
Crumbed meat, chicken and fish	0		15 - 20 depending on type	15 - 20	30 – 40	45 - 60
Soups with croutons	0		4	4	8	12
Stuffing, bread based	0		35	35	70	105
Sandwiches, various	18		25 – 40 depending on type	25 – 40	50 – 80	75 - 120
Meal replacement powders	310 – 660^	Label and analytical depending on brand.	0	310 - 666	310 - 666	310 - 666

[#] Concentrations listed apply to both ‘Scenario 1 – mandatory folic acid fortification of all bread-making flour’ and ‘Scenario 2 – mandatory folic acid fortification of white bread-making flour’ unless specifically stated.
* BMF refers to bread-making flour which was assumed to be used as an ingredient in all plain, fancy, sweet, and flat breads and bread rolls, English muffins, crumpets, scones, pancakes, pikelets, crepes, yeast donuts, pizza bases and crumbed products.
^ Denotes range of values for category, individual products within these broad food categories were assigned a single folic acid concentration
Note: This is not a complete list of folic acid concentrations used in the dietary modelling to assess folic acid intakes.

Table A3.2: Concentration data for main New Zealand products assumed to contain folic acid

Food	Baseline folic acid concentration data		Bread making flour content – (%)	Scenario: folic acid concentrations in food product (µg/100g)[#]		
	Folic acid concentration (µg/100 g)	Origin of baseline concentration data		100ug of folic acid added per 100g of BMF*	200 ug of folic acid added per 100g of BMF*	300 ug of folic acid added per 100g of BMF*
White bread	0 – 120^	Label and analytical, depending on type recorded in NNS.	60	60	120	180
Multigrain bread	0 – 120^	Analytical depending on type recorded in NNS	Scenario 1' - 50 'Scenario 2' - 40	Scenario 1' - 50 'Scenario 2' - 40	Scenario 1' - 100 'Scenario 2' - 80	Scenario 1' - 150 'Scenario 2' - 120
Wholemeal bread	0 – 120^	Analytical depending on type recorded in NNS	Scenario 1' - 60 'Scenario 2' - 20	Scenario 1' - 60 'Scenario 2' - 0	Scenario 1' - 120 'Scenario 2' - 0	Scenario 1' - 180 'Scenario 2' - 0
Fruit breads	0	Label, with 15% market share weighting.	'Scenario 1' - 55 'Scenario 2' – 20	55	110	165
Maize flake style breakfast cereal	326 – 439^	Analytical depending on type recorded in NNS	0	326 - 439	326 - 439	326 - 439
Puffed rice style breakfast cereal	290	Analytical	0	290	290	290
Extruded & sweetened breakfast cereal	199	Analytical	0	199	199	199
Bran & fruit style breakfast cereal	222 – 470^	Label and analytical, depending on type recorded in NNS.	0	222 - 470	222 - 470	222 - 470
Wheat biscuit style breakfast cereal	313	Analytical	0	313	313	313
Nut-based breakfast cereal	167	Analytical	0	167	167	167
Orange juice	11	Analytical with 25% market share weighting	0	11	11	11
Soy beverage, unflavoured	61	Analytical	0	61	61	61

Food	Baseline folic acid concentration data		Bread making flour content – (%)	Scenario: folic acid concentrations in food product (µg/100g)[#]		
	Folic acid concentration (µg/100 g)	Origin of baseline concentration data		100ug of folic acid added per 100g of BMF[*]	200 ug of folic acid added per 100g of BMF[*]	300 ug of folic acid added per 100g of BMF[*]
Yeast-based spreads	2100 – 2200^	Label and analytical, depending on type recorded in NNS.	0	2100 – 2200	2100 – 2200	2100 – 2200
Pizza	0		20 – 35 depending on crust and topping type	20 - 35	40 - 70	60 - 105
Hamburger with meat, bread, other ingredients	0		15 - 25 depending on type	15	30	45
Bun, sweet, various types	0		40 - 65 depending on type	40 - 65	80 - 130	120 - 195
Scone, various types	0		50	50	100	150
Pancakes and pikelets	0		30	30	60	90
Doughnuts, yeast type	0		35	35	70	105
Crumbed meat, chicken and fish	0		6 - 15 depending on type	6-15	12-30	18-45
Croutons	0		55	55	110	165
Stuffing, bread based	0		40	40	80	120
Sandwiches, various	0		25 - 40 depending on type	25 – 40	50 – 80	75 - 120
Meal replacement powders	40 – 90^	Label and analytical depending on brand	0	40 - 90	40 - 90	40 - 90

[#] Concentrations listed apply to both 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' unless specifically stated.
[*] BMF refers to bread-making flour which was assumed to be used as an ingredient in all plain, fancy, sweet, and flat breads and bread rolls, English muffins, crumpets, scones, pancakes, pikelets, crepes, yeast donuts, pizza bases and crumbed products.
^ Denotes range of values for category, individual products within these broad food categories were assigned a single folic acid concentration

Note: This is not a complete list of folic acid concentrations used in the dietary modelling to assess folic acid intakes.

Complete information on dietary intake assessment results

Table A4.1: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' models for Australian and New Zealand women of child-bearing age

			Baseline Folic Acid Intake (µg/day)		Scenario 1: Mandatory folic acid fortification of all bread making flour					
Country	Target Group	No. of respondents	Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
Australia	16-18 years	218	103	261	145	210	274	310	376	474
	19-44 years	2,960	94	271	134	193	253	324	396	478
	16-44 years	3,178	95	271	135	195	254	322	394	477
New Zealand	16-18 years	95	51	152	121	191	260	252	354	396
	19-44 years	1,414	58	178	123	188	254	245	323	410
	16-44 years	1,509	58	177	123	189	254	245	323	408

Table A4.2: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' models for various Australian population sub-groups

			Baseline Folic Acid Intake (µg/day)		Scenario 1: Mandatory folic acid fortification of all bread making flour					
					Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
Population Group	Gender	No. of respondents	Mean	95th percentile	100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
2 years and above	All	13,858	115	314	161	231	301	374	474	582
2-3 years	All	383	112	207	148	202	256	250	309	381
	M	170	123	242	163	222	281	276	347	413
	F	213	103	198	135	186	237	231	293	340
4-8 years	All	977	123	243	163	224	286	293	361	450
	M	513	138	272	183	250	317	318	411	503
	F	464	106	210	142	196	251	244	290	366
9-13 years	All	913	144	337	190	258	325	385	461	555
	M	474	173	357	224	300	376	408	517	617
	F	439	112	278	152	212	271	306	370	436
14-18 years	All	734	147	357	201	280	360	430	546	669
	M	378	189	424	254	349	443	569	677	811
	F	356	102	257	144	207	270	300	369	471
19-29 years	All	2,203	131	337	185	264	343	423	555	688
	M	1,014	163	406	231	332	432	508	667	819
	F	1,189	104	266	145	205	266	322	418	490
30-49 years	All	4,397	104	314	151	223	295	372	485	594
	M	2,080	122	331	179	264	350	406	542	681
	F	2,317	87	281	127	186	245	330	392	471

			Baseline Folic Acid Intake (µg/day)		Scenario 1: Mandatory folic acid fortification of all bread making flour					
Population Group	Gender	No. of respondents	Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
50-69 years	All	3,019	104	309	146	212	279	357	446	535
	M	1,442	119	342	169	247	325	409	509	617
	F	1,577	89	283	125	180	236	316	376	442
70+ years	All	1,232	108	300	147	210	272	340	416	505
	M	545	116	281	162	234	306	325	418	538
	F	687	101	347	136	190	245	371	413	456

Table A4.3: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' models for various New Zealand population sub-groups

			Baseline Folic Acid Intake (µg/day)		Scenario 1: Mandatory folic acid fortification of all bread making flour					
Population Group	Gender	No. of respondents	Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
15 years and above	All	4,636	69	203	143	218	292	296	409	537
15-18 years	All	246	75	180	159	243	326	324	449	606
	M	109	104	240	204	305	406	390	551	744
	F	137	51	158	122	193	263	236	310	401
19-29 years	All	804	69	185	147	226	305	292	438	575
	M	286	101	212	200	300	400	345	539	725
	F	518	51	158	118	185	252	232	311	396
30-49 years	All	1,883	70	211	146	223	299	309	427	557
	M	787	80	230	175	269	363	343	484	624
	F	1,096	62	195	125	189	253	259	333	419
50-69 years	All	1,147	70	214	139	210	281	292	390	488
	M	538	79	248	161	245	330	344	429	561
	F	609	63	197	120	179	238	245	317	390
70+ years	All	556	66	184	129	195	261	255	336	417
	M	207	67	186	140	218	296	269	361	463
	F	349	65	173	122	181	240	225	302	376

Table A4.4: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 2 – Mandatory folic acid fortification of white bread-making flour' models for Australian and New Zealand women of child-bearing age

Country	Target Group	No. of respondents	Baseline Folic Acid Intake (µg/day)		Scenario 2: Mandatory folic acid fortification of white bread making flour					
			Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
Australia	16-18 years	218	103	261	137	192	248	308	375	474
	19-44 years	2,960	94	271	124	174	223	319	382	453
	16-44 years	3,178	95	271	125	175	225	316	381	453
New Zealand	16-18 years	95	51	152	116	179	243	250	341	382
	19-44 years	1,414	58	178	115	173	230	236	305	384
	16-44 years	1,509	58	177	115	173	231	236	305	383

Table A4.5: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 2 – Mandatory folic acid fortification of white bread-making flour' models for various Australian population sub-groups

			Baseline Folic Acid Intake (µg/day)		Scenario 2: Mandatory folic acid fortification of white bread making flour					
Population Group	Gender	No. of respondents	Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
2 years and above	All	13,858	115	314	149	207	265	359	449	545
2-3 years	All	383	112	207	141	187	234	244	290	357
	M	170	123	242	155	205	255	274	344	408
	F	213	103	198	129	173	218	227	275	324
4-8 years	All	977	123	243	156	210	265	287	357	440
	M	513	138	272	175	234	292	317	400	485
	F	464	106	210	136	185	234	239	283	356
9-13 years	All	913	144	337	183	244	306	384	454	550
	M	474	173	357	217	286	355	406	522	608
	F	439	112	278	146	200	253	302	364	429
14-18 years	All	734	147	357	192	263	334	420	527	635
	M	378	189	424	245	331	417	555	639	751
	F	356	102	257	136	191	246	298	368	461
19-29 years	All	2,203	131	337	175	245	314	407	531	652
	M	1,014	163	406	221	311	402	485	621	762
	F	1,189	104	266	136	188	240	316	396	476

			Baseline Folic Acid Intake (µg/day)		Scenario 2: Mandatory folic acid fortification of white bread making flour					
Population Group	Gender	No. of respondents	Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
30-49 years	All	4,397	104	314	139	199	258	359	453	555
	M	2,080	122	331	166	239	311	387	494	629
	F	2,317	87	281	115	163	210	326	383	432
50-69 years	All	3,019	104	309	130	181	231	337	414	493
	M	1,442	119	342	152	213	274	385	465	537
	F	1,577	89	283	110	151	192	300	351	413
70+ years	All	1,232	108	300	128	172	217	323	371	437
	M	545	116	281	143	197	251	311	375	450
	F	687	101	347	117	153	190	337	367	404

Table A4.6: Estimated mean and 95th percentile dietary folic acid intakes for 'Baseline' and 'Scenario 2 – Mandatory folic acid fortification of white bread-making flour' models for various New Zealand population sub-groups

			Baseline Folic Acid Intake (µg/day)		Scenario 2: Mandatory folic acid fortification of white bread making flour					
Population Group	Gender	No. of respondents	Mean	95th percentile	Mean Folic Acid Intake (µg/day)			95th Percentile Folic Acid Intake (µg/day)		
					100 µg/100 g	200 µg/100 g	300 µg/100 g	100 µg/100 g	200 µg/100 g	300 µg/100 g
15 years and above	All	4,636	69	203	133	197	261	278	374	486
15-18 years	All	246	75	180	151	227	303	292	407	530
	M	109	104	240	195	286	378	345	516	653
	F	137	51	158	116	181	244	229	297	388
19-29 years	All	804	69	185	140	212	283	279	402	529
	M	286	101	212	191	282	373	318	503	641
	F	518	51	158	112	173	234	228	297	380
30-49 years	All	1,883	70	211	135	201	267	286	386	503
	M	787	80	230	162	244	325	324	447	561
	F	1,096	62	195	116	171	225	243	311	387
50-69 years	All	1,147	70	214	127	185	243	276	355	430
	M	538	79	248	147	218	288	322	387	506
	F	609	63	197	108	156	204	231	289	347
70+ years	All	556	66	184	116	168	222	239	304	379
	M	207	67	186	125	189	254	256	323	398
	F	349	65	173	110	156	203	213	269	339

Appendix 5

Complete information on risk characterisation

Table A5.1: Number and per cent of 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' respondents with folic acid intakes above the Upper Level for Australian and New Zealand women of child-bearing age

Country	Target Group	No. of respondents	Baseline		Scenario 1: Mandatory folic acid fortification of all bread making flour					
					100 µg/100g		200 µg/100g		300 µg/100g	
			Number	%	Number	%	Number	%	Number	%
Australia	16-18 years	218	0	0	0	0	1	0.5	1	0.5
	19-44 years	2,960	5	0.2	5	0.2	4	0.1	5	0.2
	16-44 years	3,178	5	0.2	5	0.2	5	0.2	6	0.2
New Zealand	16-18 years	95	0	0	0	0	0	0	0	0
	19-44 years	1,414	1	0.1	1	0.1	1	0.1	3	0.2
	16-44 years	1,509	1	0.1	1	0.1	1	0.1	3	0.2

Table A5.2: Number and per cent of 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' respondents with folic acid intakes above the Upper Level for various Australian population sub-groups

Population Group	Gender	No. of respondents	Baseline		Scenario 1: Mandatory folic acid fortification of all bread making flour					
					100 µg/100g		200 µg/100g		300 µg/100g	
			Number	%	Number	%	Number	%	Number	%
2-3 years	All	383	5	1	8	2	22	6	73	20
	M	170	4	2	7	4	15	9	46	25
	F	213	1	0.5	1	0.5	7	3	27	15
4-8 years	All	977	6	0.6	13	1	32	3	85	9
	M	513	4	0.8	10	2	29	6	76	15
	F	464	2	0.4	3	0.6	3	0.6	9	2
9-13 years	All	913	7	0.8	9	1	15	2	31	3
	M	474	5	1	6	1	12	3	26	6
	F	439	2	0.5	3	0.7	3	0.7	5	1
14-18 years	All	734	4	0.5	6	0.8	13	2	22	3
	M	378	4	1	6	2	12	3	21	6
	F	356	0	0	0	0	1	0.3	1	0.3
19-29 years	All	2,203	5	0.2	8	0.4	14	0.6	23	1
	M	1,014	4	0.4	7	0.7	13	1	22	2
	F	1,189	1	0.1	1	0.1	1	0.1	1	0.1
30-49 years	All	4,397	11	0.3	13	0.3	15	0.3	22	0.5
	M	2,080	6	0.3	8	0.4	11	0.5	18	0.9
	F	2,317	5	0.2	5	0.2	4	0.2	4	0.2
50-69 years	All	3,019	4	0.1	5	0.2	6	0.2	10	0.3
	M	1,442	2	0.1	3	0.2	4	0.3	8	0.6
	F	1,577	2	0.1	2	0.1	2	0.1	2	0.1
70+ years	All	1,232	0	0	0	0	0	0	1	0.1
	M	545	0	0	0	0	0	0	1	0.2
	F	687	0	0	0	0	0	0	0	0

Table A5.3: Number and per cent of 'Baseline' and 'Scenario 1 – mandatory folic acid fortification of all bread-making flour' respondents with folic acid intakes above the Upper Level for various New Zealand population sub-groups

			'Baseline'		Scenario 1: Mandatory folic acid fortification of all bread making flour					
Population Group	Gender	No. of respondents			100 µg/100g		200 µg/100g		300 µg/100g	
			Number	%	Number	%	Number	%	Number	%
15-18 years	All	246	0	0	0	0	1	0.4	2	0.8
	M	109	0	0	0	0	1	0.9	2	2
	F	137	0	0	0	0	0	0	0	0
19-29 years	All	804	0	0	0	0	0	0	1	0.1
	M	286	0	0	0	0	0	0	1	0.3
	F	518	0	0	0	0	0	0	0	0
30-49 years	All	1,883	1	0.1	1	0.1	1	0.1	6	0.3
	M	787	0	0	0	0	0	0	3	0.4
	F	1,096	1	0.1	1	0.1	1	0.1	3	0.3
50-69 years	All	1,147	0	0	0	0	1	0.1	3	0.3
	M	538	0	0	0	0	1	0.2	2	0.4
	F	609	0	0	0	0	0	0	1	0.2
70+ years	All	556	0	0	0	0	0	0	0	0
	M	207	0	0	0	0	0	0	0	0
	F	349	0	0	0	0	0	0	0	0

Table A5.4: Number and per cent of 'Baseline' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' respondents with folic acid intakes above the Upper Level for Australian and New Zealand women of child-bearing age

Country	Target Group	No. of respondents	Baseline		Scenario 2: Mandatory folic acid fortification of white bread making flour					
					100 µg/100g		200 µg/100g		300 µg/100g	
			Number	%	Number	%	Number	%	Number	%
Australia	16-18 years	218	0	0	0	0	0	0	1	0.5
	19-44 years	2,960	5	0.2	5	0.2	4	0.1	5	0.2
	16-44 years	3,178	5	0.2	5	0.2	4	0.1	6	0.2
New Zealand	16-18 years	95	0	0	0	0	0	0	0	0
	19-44 years	1,414	1	0.1	1	0.1	1	0.1	3	0.2
	16-44 years	1,509	1	0.1	1	0.1	1	0.1	3	0.2

Table A5.5: Number and per cent of 'Baseline' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' respondents with intakes above the Upper Level for various Australian population sub-groups

Population Group	Gender	No. of respondents	Baseline		Scenario 2: Mandatory folic acid fortification of white bread making flour					
					100 µg/100g		200 µg/100g		300 µg/100g	
			Number	%	Number	%	Number	%	Number	%
2-3 years	All	383	5	1	8	2	18	5	52	15
	M	170	4	2	7	4	13	8	33	20
	F	213	1	0.5	1	0.5	5	2	19	9
4-8 years	All	977	6	0.6	12	1	29	3	73	8
	M	513	4	0.8	9	2	26	5	67	15
	F	464	2	0.4	3	0.6	3	0.6	6	1
9-13 years	All	913	7	0.8	9	1	16	2	30	3
	M	474	5	1	6	1	13	3	26	6
	F	439	2	0.5	3	0.7	3	0.7	4	0.9
14-18 years	All	734	4	0.5	6	0.8	9	1	16	2
	M	378	4	1	6	2	9	2	15	4
	F	356	0	0	0	0	0	0	1	0.3
19-29 years	All	2,203	5	0.2	7	0.3	11	0.5	19	0.9
	M	1,014	4	0.4	6	0.6	10	1	18	2
	F	1,189	1	0.1	1	0.1	1	0.1	1	0.1
30-49 years	All	4,397	11	0.3	13	0.3	13	0.3	17	0.4
	M	2,080	6	0.3	8	0.4	9	0.4	13	0.6
	F	2,317	5	0.2	5	0.2	4	0.2	4	0.2
50-69 years	All	3,019	4	0.1	4	0.1	4	0.1	6	0.2
	M	1,442	2	0.1	2	0.1	2	0.1	4	0.3
	F	1,577	2	0.1	2	0.1	2	0.1	2	0.1
70+ years	All	1,232	0	0	0	0	0	0	0	0
	M	545	0	0	0	0	0	0	0	0
	F	687	0	0	0	0	0	0	0	0

Table A5.6: Number and per cent of 'Baseline' and 'Scenario 2 – mandatory folic acid fortification of white bread-making flour' respondents with intakes above the Upper Level for various New Zealand population sub-groups

Population Group	Gender	No. of respondents	Baseline		Scenario 2: Mandatory folic acid fortification of white bread making flour					
					100 µg/100g		200 µg/100g		300 µg/100g	
			Number	%	Number	%	Number	%	Number	%
15-18 years	All	246	0	0	0	0	0	0	2	0.8
	M	109	0	0	0	0	0	0	2	2
	F	137	0	0	0	0	0	0	0	0
19-29 years	All	804	0	0	0	0	0	0	0	0
	M	286	0	0	0	0	0	0	0	0
	F	518	0	0	0	0	0	0	0	0
30-49 years	All	1,883	1	0.1	1	0.1	1	0.1	4	0.2
	M	787	0	0	0	0	0	0	1	0.1
	F	1,096	1	0.1	1	0.1	1	0.1	3	0.3
50-69 years	All	1,147	0	0	0	0	1	0.1	1	0.1
	M	538	0	0	0	0	1	0.2	1	0.2
	F	609	0	0	0	0	0	0	0	0
70+ years	All	556	0	0	0	0	0	0	0	0
	M	207	0	0	0	0	0	0	0	0
	F	349	0	0	0	0	0	0	0	0

Appendix 6

Complete information of folic acid intakes from food and supplements

Table A6.1: Estimated folic acid intakes from folic acid added to food and supplements for Australian women of child-bearing age*

Model	Added Folic Acid (μg/100g)	Folic acid intake from folic acid in food and supplements (μg/day)			
		Mean Intake + 200 μg	Mean Intake + 500 μg	95th %tile + 200 μg	95th %tile + 500 μg
'Baseline'		295	595	471	771
'Scenario 1'					
All bread-making flour	100	335	635	522	822
	200	395	695	594	894
	300	454	754	677	977
'Scenario 2'					
White bread-making flour	100	325	625	516	816
	200	375	675	581	881
	300	425	725	653	953

* All females aged 16-44 years.

Table A6.2: Estimated folic acid intakes from folic acid added to food and supplements for New Zealand women of child-bearing age*

Model	Added Folic Acid (μg/100g)	Folic acid intake from folic acid in food and supplements (μg/day)			
		Mean Intake + 200 μg	Mean Intake + 800 μg	95th %tile + 200 μg	95th %tile + 800 μg
'Baseline'		258	858	377	977
'Scenario 1'					
All bread-making flour	100	323	923	445	1045
	200	389	989	523	1123
	300	454	1054	608	1208
'Scenario 2'					
White bread-making flour	100	315	915	436	1036
	200	373	973	505	1105
	300	431	1031	583	1183

* All females aged 16-44 years.

Table A6.3: Per cent (number) of respondents with folic acid intakes from folic acid added to food and supplements above the Upper Level for Australian women of child-bearing age*

Model	Added Folic Acid (μg/100g)	Per cent (number) of respondents with folic acid intakes from diet and supplements above the UL (%)	
		Individual's mean intake + 200μg	Individual's mean intake + 500μg
'Baseline'		0.3 (9)	2 (54)
'Scenario 1'			
All bread-making flour	100	0.3 (8)	2 (65)
	200	0.4 (13)	4 (112)
	300	0.8 (24)	6 (196)
'Scenario 2'			
White bread-making flour	100	0.2 (6)	2 (66)
	200	0.3 (10)	3 (102)
	300	0.7 (23)	5 (170)

* All females aged 16-44 years.

Table A6.4: Per cent (number) of respondents with folic acid intakes from folic acid added to food and supplements above the Upper Level for New Zealand women of child-bearing age*

Model	Added Folic Acid (μg/100g)	Per cent (number) of respondents with folic acid intakes from diet and supplements above the UL (%)	
		Individual's mean intake + 200μg	Individual's mean intake + 800μg
'Baseline'		0.07 (1)	9 (135)
'Scenario 1'			
All bread-making flour	100	0.07 (1)	15 (244)
	200	0.2 (3)	40 (604)
	300	0.5 (7)	70 (1042)
'Scenario 2'			
White bread-making flour	100	0.07 (1)	15 (231)
	200	0.2 (3)	35 (492)
	300	0.4 (6)	60 (885)

* All females aged 16-44 years.