Australian Government
Australian Institute of Health and Welfare

Folic acid & iodine fortification

Web report | Last updated: **28 Jun 2016** | Topic: Food & nutrition | Media release

Summary

Mandatory folic acid and iodine fortification of bread resulted in increased levels of folic acid and iodine in the food supply, increased folic acid and iodine intakes, a decreased rate of neural tube defects in Australia, and improved iodine status in the general populations in Australia and New Zealand.

Cat. no: WEB 134

Findings from this report:

- Neural tube defects fell by 14% following mandatory folic acid fortification of bread in Australia
- Neural tube defects in Indigenous women fell by 74% following mandatory folic acid fortification of bread in Australia
- Iodine intakes in women aged 16–44 increased by 52% following mandatory iodine fortification of bread in Australia
- Iodine intakes in children aged 2–3 increased by 29% following mandatory iodine fortification of bread in Australia

Folic acid is a B group vitamin that helps prevent neural tube defects such as spina bifida in infants.

Iodine is a nutrient needed for the development and functioning of the thyroid gland, brain and nervous system, especially in infants and young children.

For more information see *Monitoring the health impacts of mandatory folic acid and iodine fortification 2016*

Mandatory fortification of bread with folic acid (in Australia only) and iodine (in both Australia and New Zealand) was introduced from September 2009 under the Australia New Zealand Food Standards Code. Folic acid is added to wheat flour for bread-making purposes to reduce the incidence of neural tube defects. Iodine is added to bread (as iodised salt) to address the re-emergence of iodine deficiency in Australia and New Zealand. Bread labelled as organic is exempt from mandatory fortification with folic acid and iodine.

The Australian Institute of Health and Welfare (AIHW) has undertaken a review of the health impacts of mandatory folic acid and iodine fortification.

Summary

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Mandatory folic acid fortification in Australia has increased the level of folic acid in the food supply, and thereby increased folic acid intakes and folate status among women of child-bearing age (the target population) (Table 1). The rate of neural tube defects has decreased following mandatory folic acid fortification by 14.4%, in line with predictions. The decrease in neural tube defects has been most substantial for teenagers and Aboriginal and Torres Strait Islander women.

Table 1: Key mandatory folic acid fortification outcomes in Australia

Key monitoring question and measurement	Pre-mandatory fortification	Post-mandatory fortification	Further details	Outcome
Has the level of folic acid in our food supply increased? *Mean folic acid level of bread*	20–29 µg/100 g	134–200 µg/100 g	The predicted post-fortification estimate was 120 µg/100 g in bread.	✔
Are the food industries adequately complying with the mandatory fortification standards?	Not applicable	Mills and baking businesses have systems in place to ensure compliance.		✔
Have folic acid intakes of women of child-bearing age increased? *Mean folic acid intakes in women aged 16–44*	102 µg/day	247 µg/day (145 µg/day increase; 142%)	The predicted post-fortification predicted increase was 100 µg/day.	✔
Has the folate status of women of child-bearing age improved? *Mean red blood cell and serum folate*	Serum folate data are available for limited assessment. No adequate red blood cell folate baseline data are available.	**Red blood cell folate** All women aged 16–44: 1,647 nmol/L Pregnant women aged 16–44: 1,958 nmol/L Breastfeeding women aged 16–44: 1,775 nmol/L	Mean serum folate levels post-fortification were higher than at baseline; however, results must be interpreted with caution because different methodologies were used (see Section 2.4).	●●

Has the incidence of neural tube defects (NTDs) decreased? *NTD incidence per 10,000 conceptions that resulted in a birth*	Total study population All women: 10.2 Indigenous women: 19.6 Teenagers: 14.9 Population omitting NSW residents(a) All women: 12.8 Indigenous women: 22.8 Teenagers: 18.6	Total study population All women: 8.7 (14.4% decrease) Indigenous women: 5.1 (74.2% decrease) Teenagers: 6.7 (54.8% decrease) Population omitting NSW residents(a) All women: 11.2 (12.5% decrease) Indigenous women: 4.5 (80.2% decrease) Teenagers: 7.0 (62.6% decrease)	The predicted post-fortification predicted average decrease in NTDs was 14%. Ongoing monitoring of NTDs is required to confirm whether these reductions will be sustained.	✔
Does mandatory folic acid fortification result in adverse health effects for the population? *Proportion of the population with folic acid intakes above the upper level of intake (UL)*	Women aged 16–44: 0% Persons aged 19 and over: 0% Children aged 4–8: 3% Children aged 2–3: 5%	Women aged 16–44: 0% Persons aged 19 and over: <1% Children aged 4–8: 15% Children aged 2–3: 21%	Minimal change in adults exceeding the UL. A higher proportion of children aged 2–16 exceeded the UL but is not considered a health risk. The UL incorporates a fivefold safety margin and is based on an end point for high intakes in older adults.	●●
Cancer and all-cause mortality		No increase in cancer or all-cause mortality can be directly associated with increase in folic acid intakes in adults.		✔

✔ **Desired** outcome achieved

≈ **Partial** achievement

●● **Not applicable:** data did not support an overall assessment or a rating was not appropriate.

µg microgram
NTD neural tube defect
UL upper level of intake (for more information, see the Nutrient Reference Values for Australia and New Zealand website)

a. Analysis omitting New South Wales from the study population was undertaken as a sensitivity analysis to assess the potential bias of missing data from the state. Inclusion of New South Wales provided a much larger population and improved the study power.

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In Australia, mandatory iodine fortification has increased the level of iodine in the food supply, and thereby increased iodine intakes and status among women of child-bearing age and young children (the key target populations) (Table 2). The population is consuming sufficient iodine to address the recent re-emergence of mild iodine deficiency.

Table 2: Key mandatory iodine fortification outcomes in Australia

Key monitoring question and measurement	Pre-mandatory fortification	Post-mandatory fortification	Further details	Outcome
Has the level of iodine in our food supply increased? *Mean iodine level of bread*	<2 µg/100 g	53–70 µg/100 g	The predicted mandatory fortification level was 46 µg/100 g.	✔
Are the food industries adequately complying with the mandatory fortification standards?	Not applicable	Salt manufacturers and bakers have systems in place to ensure compliance.		✔
Have iodine intakes in the population increased, particularly in women of child -bearing age and young children? *Mean iodine intakes*	Women aged 16–44: 98 µg/day Children aged 2–3: 127 µg/day	Women aged 16–44: 149 µg/day (51 µg/day increase; 52%) Children aged 2–3: 164 µg/day (37 µg/day increase; 29%)	The predicted post-fortification predicted increase was 46 µg/day among women aged 16–44 and 38 µg/day among children aged 2–3. Iodine intakes sufficient for the general population. Iodine supplementation for pregnant and breastfeeding women continues to be necessary (as expected when developing the mandatory fortification requirement).	✔

Proportion of the population with iodine intakes below the estimated average requirement (EAR)	Women aged 16–44 (non-pregnant EAR): 60% Women aged 16–44 (pregnancy EAR): 95% Women aged 16–44 (lactating EAR): 100% Children aged 2–3: 9%	Women aged 16–44 (non-pregnant EAR): 9% Women aged 16–44 (pregnancy EAR): 65% Women aged 16–44 (lactating EAR): 85% Children aged 2–3: <1%		
Has the iodine status of the population improved, particularly in women of child-bearing age and young children? *Median urinary iodine concentration (MUIC)*	Children aged 8–10: 96 µg/L	Children aged 5–8: 175 µg/L All women aged 16–44: 121 µg/L Pregnant women aged 16–44: 116 µg/L Breastfeeding women aged 16–44: 103 µg/L	Pre- and post-mandatory fortification data for children suggest an increase in MUIC. MUIC for all women aged 16–44 and children aged 5–8 indicative of iodine adequacy. Note, the MUIC for pregnant and breastfeeding women aged 16–44 is indicative of insufficient iodine intake post-fortification.	✔
Has the iodine status of the population improved? *Iodine status*	Refer to information on nutrient status.			
Does mandatory iodine fortification result in adverse health effects for the population? *Proportion of the population with iodine intakes above the upper level of intake (UL)*	Women aged 16–44: 0% Persons aged 17 and over: 0% Children aged 4–8: 0% Children aged 2–3: 7%	Women aged 16–44: 0% Persons aged 17 and over: 0% Children aged 4–8: <1% Children aged 2–3: 20%	Minimal change in adults exceeding the UL. A higher proportion of children aged 2–3 exceeded the UL but is not considered a health risk. The UL for children is based on an end point for high intakes in adults. The proportion of young children exceeding the UL also decreases with age with <1% exceeding the UL after age 4.	●●

✔ **Desired** outcome achieved

≈ **Partial** achievement

●● **Not applicable:** data did not support an overall assessment or a rating was not appropriate.

µg microgram
EAR estimated average requirement (for more information, see the Nutrient Reference Values for Australia and New Zealand website)
MUIC median urinary iodine concentration
UL upper level of intake (for more information, see the Nutrient Reference Values for Australia and New Zealand website)

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In New Zealand, mandatory fortification has resulted in increases in the level of iodine in the food supply (Table 3). While there has been a modest improvement in iodine intakes, the AIHW's review shows that some population groups continue to be at risk of mild iodine deficiency. However, the data available at the time of the AIHW's review was from small sub-national surveys. Provisional results from a larger national survey, the 2014/2015 New Zealand Health Survey, have since been published and show that median urinary iodine concentrations for women aged 16–44 (104 µg/L) and adults aged 15 and over (103 µg/L) are within the range for adequate iodine status [1].

Table 3: Key mandatory iodine fortification outcomes in New Zealand

Key monitoring question and measurement	Pre-mandatory fortification	Post-mandatory fortification	Further details	Outcome
Has the level of iodine in our food supply increased? *Mean/median iodine level of bread*	<2 µg/100 g (mean)	28–49 µg/100 g (median)	The predicted mandatory fortification level was 46 µg/100 g.	✔
Are the food industries adequately complying with the mandatory fortification standards?	Not applicable	Salt manufacturers and bakers have systems in place to ensure compliance.		✔
Have iodine intakes in the population increased, particularly in women of child-bearing age and young children? *Mean iodine intakes*	Women aged 16–44: 99 µg/day Children aged 5–14: 45 µg/day	Women aged 18–44: 108 µg/day Children aged 5–14: 93 µg/day (48 µg/day increase)	Iodine intakes for women were higher than at baseline; however, results must be interpreted with caution because different methodologies were used (see Section 4.3). When developing the fortification requirement, the post-fortification predicted increase was 73 µg/day among women of child-bearing age. Iodine intakes continue to be insufficient. Iodine supplementation for pregnant and breastfeeding women continues to be necessary (as expected when developing the fortification requirement).	Women of child-bearing age ≈ Children aged 5–14 ✔
Proportion of the population with iodine intakes below the estimated average requirement	Women aged 16–44: 68% Children aged 5–14: 95%	Women aged 18–44: 39% Children aged 5–14: 21%		≈

Has the iodine status of the population improved, particularly in women of child-bearing age and young children? *Median urinary iodine concentration (MUIC)*	Women aged 18–44: 48 µg/L Children aged 8–10: 68 µg/L	Women aged 18–44: 68 µg/L Children aged 8–10: 113 µg/L	MUIC for women aged 18–44 is indicative of mild iodine deficiency. MUIC for children aged 8–10 is indicative of iodine adequacy.	Women of child-bearing age ~ Children aged 8–10 ✓
Has the iodine status of the population improved? *Iodine status*	Refer to information on nutrient status.			
Does mandatory iodine fortification result in adverse health effects for the population? *Proportion of the population with iodine intakes above the upper level of intake (UL)*	Adults: 0% Children aged 5–14: <1%	Adults: Not applicable Children aged 5–14: <1%	No assessment of intakes against the UL was performed for adults post-fortification. As intakes are lower than expected, adults aged 18–64 are not expected to be above the UL.	●●

✓
Desired outcome achieved
~
Partial achievement
●●
Not applicable: data did not support an overall assessment or a rating was not appropriate.

µg microgram
EAR estimated average requirement (for more information, see the Nutrient Reference Values for Australia and New Zealand website)
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Folic acid is important for the healthy development of babies, particularly in early pregnancy. The neural tube closes and fuses very early in pregnancy, often before a woman is aware she is pregnant. If it fails to close, neural tube defects such as spina bifida can occur. Folic acid taken at the recommended level of 400 micrograms a day for at least one month before and three months after conception can reduce the risk of neural tube defects [2]. Since the 1990s, various initiatives have encouraged women of child-bearing age to increase their folic acid intakes. Despite these campaigns, folic acid intakes are below recommended intakes.

Iodine deficiency has re-emerged as a public health problem in Australia and New Zealand. Various studies have shown mild to moderate iodine deficiency among different population groups [3, 4]. As iodine is essential for normal brain development, it is particularly important that unborn babies and young children have adequate intakes.

To address these important public health problems, mandatory fortification of bread with folic acid (in Australia only) and iodine (in both Australia and New Zealand) was introduced from September 2009. Folic acid is added to wheat flour for bread-making purposes to further reduce the incidence of neural tube defects. Iodine is added to bread (as iodised salt) to address the re-emergence of iodine deficiency in Australia and New Zealand. Bread labelled as organic is exempt from mandatory fortification with folic acid and iodine.

These changes to the food supply are designed to help shift population intakes of folic acid and iodine toward recommended levels. Bread is a staple food eaten by the majority of the population and is therefore a suitable choice for fortification. Mandatory folic acid fortification is aimed at women of child-bearing age. Mandatory iodine fortification is aimed at the general population, especially infants, young children, pregnant and breastfeeding women.

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The AIHW identified key baseline data for monitoring the population health effects of mandatory folic acid and iodine fortification in Australia and New Zealand. This was published in a baseline and supplement report in 2011.

In 2015–2016 the Australian Government Department of Health managed an independent review of mandatory folic acid and iodine fortification. The 3 phases of the review assessed:

- industry and enforcement agency compliance
- population health impacts of mandatory fortification
- the effectiveness of the mandatory fortification.

In this more recent review, the AIHW was responsible for the second phase.

AIHW report

The AIHW report Monitoring the health impacts of mandatory folic acid and iodine fortification presents data on the health impacts of mandatory fortification. The report uses a monitoring framework with five main components:

- food composition and food industry compliance
- nutrient intake
- nutrient status
- health benefits
- adverse health effects.

The tables above (tables 1, 2 and 3) summarise the report's key findings.

References

1. Ministry for Primary Industries 2016. Mandatory iodine fortification in New Zealand: Supplement to the Australian Institute of Health and Welfare 2016 report—Monitoring the health impacts of mandatory folic acid and iodine fortification. Wellington: Ministry for Primary Industries. Viewed 28 June 2016.
2. National Health and Medical Research Council (NHMRC) 2014. Folate. Canberra: NHMRC. Viewed 24 March 2016.
3. Li M, Eastman C, Waite K, Ma G, Zacharin M, Topliss D et al. 2006. Are Australian children iodine deficient? Results of the Australian National Iodine Study. Medical Journal of Australia 184(4):165–9.
4. Ministry of Health 2003. NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey. Wellington: Ministry of Health.

Data

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Related material

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Latest related reports

- Monitoring the health impacts of mandatory folic acid and iodine fortification 2016 | **Publication** | 28 Jun 2016
- Neural tube defects in Australia: prevalence before mandatory folic acid fortification | **Publication** | 19 Dec 2011
- Mandatory folic acid and iodine fortification in Australia and New Zealand: supplement to the baseline report for monitoring | **Publication** | 06 Oct 2011
- Mandatory folic acid and iodine fortification in Australia and New Zealand: baseline report for monitoring | **Publication** | 11 May 2011

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