



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

# Thiamin levels in Australian breads: Results from the 2010 and 2012 national bread surveys

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## SUMMARY

This report presents thiamin content data from two bread analytical surveys undertaken in 2010 and 2012 under the Implementation Sub-committee for Food Regulation (ISFR) National Coordinated Survey Plan. The surveys were part of ongoing activities to monitor the impact of mandatory folic acid and iodine fortification of bread and were used by Food Standards Australia New Zealand (FSANZ) to also determine the amount of thiamin in breads on the Australian market.

The surveys sampled three types of breads commonly consumed by Australian from the capital cities of all states and territories. The samples were chemically analysed for the amounts of thiamin, folic acid and iodine they contained. The chemical analysis was undertaken by the National Measurement Institute (NMI) of Australia's food analytical laboratories in Melbourne following a successful tender bid. The results for folic acid and iodine are reported elsewhere. The analytical method used for the determination of thiamin (vitamin B1) in bread is accredited by the National Association of Testing Authorities, Australia (NATA).

The results indicated that within the limits of the analytical tests, breads manufactured by either large-scale industry bakeries or small-scale local bakeries contained added thiamin, which reflected the use of thiamin fortified wheat flour as required by the Australia New Zealand Food Standards Code (the Code).

## INTRODUCTION

Thiamin fortification of wheat flour for bread-making was mandated in Australia in January 1991 to minimise the incidence of Wernicke-Korsakoff syndrome [Wood and Breen (1980); Harper (1983) and Harper et al. (1989)]. Bread is widely consumed within the Australian population and was selected as the preferred food vehicle for mandatory thiamin fortification. Standard 2.1.1 – *Cereals and Cereal Products* (mandatory folic acid, iodine and thiamin fortification standard) of the Code, requires wheat flour for making bread to contain no less than 6.4 mg/kg of thiamin.

Thiamin fortification of bread had not been formally monitored on a national basis since the standard was implemented in 1991. However, some analytical surveys had been undertaken by FSANZ and health departments in some jurisdictions in the years after the implementation of the standard. For example, the 2006 and 2008 Key Food Programs by FSANZ, and the 2007 Western Australia Department of Health pilot survey of thiamin in bread making flour and bread products, all indicated thiamin levels in these products to be higher than before fortification.

As part of ongoing activities to monitor the impact of implementing the mandatory folic acid and iodine fortification standard, the 2010 and 2012 surveys for folic acid and iodine content of bread were undertaken as part of the ISFR National Coordinated Food Survey plan. There was agreement for FSANZ to add thiamin analyses into the sampling plan.

## THE BREAD SURVEYS AND SAMPLE ANALYSIS

### Survey Objectives

The objectives of the two surveys in relation to the thiamin content of bread were to:

- determine the amount of thiamin in white, wholemeal and multigrain and seeds breads at two different time periods (2010, 2012)
- note any variability in the amount of thiamin present in the bread types
- use the data to update thiamin values for these breads in the Australian food composition databases NUTTAB and AUSNUT.

### Survey Methodology

#### *Sampling*

A total of 61 samples (phase 1) and 96 samples (phase 2) of white, wholemeal and multigrain wheat-flour based sandwich breads, commonly consumed by Australian households were purchased for the 2010 and 2012 surveys, with an additional 4 samples of home-baked bread with no added fortificants being analysed in Phase 2, making 100 samples in total. Samples were purchased from major supermarkets and small bread shops in the capital cities of all states and territories. The retail outlets used were those from which consumers would normally purchase their bread. The phase 1 samples were purchased between June and July 2010 and phase 2 samples in March and April 2012 (refer to folic acid fortification monitoring report for details).

Specific sampling plans were developed and provided to each jurisdiction to ensure the purchase of samples were consistent across the states/territories. The sampling plan also ensured adequate samples were purchased from commercial industry bakeries, supermarket chain bakeries and small-scale local bread shops. The description of the retail outlets in the different bakery types used was as follows:

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

#### *Sample delivery and analysis*

The distance between the majority of the sample purchase sites and the contracted analytical laboratory made it critical that samples were delivered quickly to the laboratory. This was accomplished through effective coordination and liaison between nominated jurisdictional liaison officers (from state/territory health departments) who purchased the samples, and the National Measurement Institute (NMI) laboratory manager. Samples were air-freighted to ensure quick delivery to the laboratory and to maintain freshness. The NMI food analytical laboratories in Melbourne undertook the analytical work.

The samples from the two surveys were analysed using the National Association of Testing Authorities, Australia (NATA) accredited HPLC method for determination of thiamin (vitamin B1) in bread (AOAC 1995). The method is generally quite sound with no particular known limitations. The limit of reporting is 0.05 mg/100g. Samples from the two phases were analysed using the same analytical technique to ensure that results from the different time periods could be compared.

Although the samples were air-dried and homogenised for the analyses, the laboratory provided results that reflected the amounts of thiamin present in the samples as purchased (i.e wet weight at the initial moisture content). Cereal grains naturally contain some amount of thiamin therefore, the levels measured in the samples reflected the amounts of both the natural and added thiamin following the effects of the bread making process and baking.

## RESULTS

The analytical results indicated the amount of thiamin present in samples of the three bread types commonly consumed by Australians. Table 1 gives the summary results of the amount of thiamin in the bread samples. White sandwich bread had the highest mean amount of thiamin for both phase 1 and phase 2 samples (0.59 and 0.64 mg/100g respectively) compared to the other bread types and the widest range of thiamin values. The results indicate multigrain bread had the lowest amount of measured thiamin (0.39 and 0.42 mg/kg for phase 1 and phase 2 respectively).

**Table 1: Thiamin content of bread\* - All Australian states/territories**

Bread type	Sample size	Mean moisture content (g/100g)	Thiamin content (mg/100g)		
			Mean	Median	Range
<b>Phase 1</b>					
White, sandwich	28	38	0.59	0.55	0.11-1.80
Wholemeal, sandwich	16	40	0.47	0.47	0.23-0.70
Multigrain, sandwich	17	37	0.39	0.38	0.15-0.54
<b>Phase 2</b>					
White, sandwich	32	38	0.64	0.58	0.09-1.80
Wholemeal, sandwich	32	39	0.50	0.53	0.23-0.76
Multigrain, sandwich	32	38	0.42	0.43	0.13-0.64

\*The thiamin values reflect analysed amounts present in the samples as purchased

## DISCUSSION

Standard 2.1.1 of the Code specifies that the amount of thiamin present in wheat flour for making bread should not be less than at 6.4 mg/kg (or 0.64 mg/100g) of thiamin.

Bread is made from a number of ingredients with wheat flour as the major ingredient. In that respect, a bread sample made from a recipe containing 80% thiamin-fortified wheat flour (maximum expected proportion of wheat flour in bread at the specified thiamin level), would be expected to have about 0.51 mg thiamin/100g bread (0.8 x 0.64 mg). Breads with lower proportions of wheat flour due to the addition of other ingredients to the recipe, such as other cereal and maize flours, whole grains and seeds would be expected to have lower levels of thiamin as only wheat flour is required to be fortified with thiamin. This assumes there would be no effect on the thiamin from the other ingredients in the recipe during the bread-making processes and during baking.

In fact, the thiamin content of bread may also be affected by several other factors. Thiamin is a heat labile nutrient and factors such as baking temperature and duration of the baking process are known to contribute to its degradation (Batifoulier et al., 2005; Matinez-Villaluenga et al., 2009) and thereby lowering the amount in the final product. Other studies have also indicated that baking temperature can reduce the amount of thiamin naturally

present or added to flour (Tanphaichitr, 2001; Tabekhia and D'Appolonia, 1979) or through loss of thiamin in the dough making process. The acidity or alkalinity of the dough is another factor known to affect thiamin degradation in bread, with thiamin losses increasing as the pH increases to 6.0 (Nadeau, 1982). In general, the average loss of thiamin caused by the classical bread-making process (yeast fermentation of the dough) is estimated to be between 5% and 30% (Menz et al., 1995).

The bread survey results indicated the mean amount of thiamin in white sandwich breads at the two sampling time points to be about the same, but higher than in the other bread types. Results were consistent with thiamin fortified flour being used in white bread. However, the range of analytical values indicated a wide variation in thiamin levels between the individual bread samples, in particular for white bread. The variations may arise from differences in the amount of thiamin originally added to the flour, recipes for different white breads, how the ingredients interacted to affect the pH of the dough, the temperature at which they were baked and the duration of baking. Examination of the ingredients listed on the packaging of the bread samples indicated some ingredients that were not common to all the breads. Some of the white breads had additional ingredients such as rye flour, malted wheat flour and maize flour. These ingredients may have been added to produce white breads with increased dietary fibre and could have changed the amounts of thiamin in the various doughs and thereby in the resulting baked breads.

The amounts of thiamin in wholemeal and multigrain breads at the two sampling points were similar, and less varied between the individual samples as indicated in Table 1. Results were consistent with thiamin fortified flour being used in these bread types. The lower thiamin levels in multigrain breads compared to white breads can be related in part to the relatively lower amount of fortified wheat flour used in relation to other cereal grain flours such as rye, triticale, buckwheat barley, millet, oats and maize that may form the 'mixed grain' component of the recipe. Flour from these grains is not required to be fortified with thiamin. The ingredients list on the wrappers of some multigrain bread samples indicate that the mixed grain component of the recipe could vary from 8% to 17%. Such a variation would certainly impact the amount of thiamin measured in the breads.

## **INFERENCES FROM THE ANALYTICAL RESULTS**

Within the limitations of the study design and the analytical method used, the following assumptions can be made from the results:

- bread manufacturers (small and large scale bakers) are using thiamin fortified wheat flour for the production of the bread types commonly consumed by Australians
- white breads had slightly higher mean thiamin values per 100g when compared to the other bread types analysed and a wider range of values
- the amounts of thiamin in the bread types commonly consumed by Australians were not very different at the two sampling time points.

## **CONCLUSION**

Within the limits of the analytical tests, breads manufactured by either large-scale industry bakeries or small-scale local bakeries contained added thiamin, which reflected the use of wheat flour fortified with thiamin as required by Standard 2.1.1 of the Code.

The differences in the amounts of thiamin in the three commonly consumed bread types, highlights the importance of a monitoring program to track the impact of changes in the

recipes used for commercial breads on the Australian market on their nutrient content, particularly the mandatory fortificants.

The study provides valuable information on how much thiamin (added or naturally present) may be lost in the manufacture of different types of breads. A useful follow-on study in the future would be to analyse the thiamin present in the recipe dry ingredients for samples of the different bread types and in the final baked breads.

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