

Nutrition recommendations relating to grains and pulses - Current practice in Australia

Grains and pulses are key foods for healthy eating. Eating grain- and pulse-based foods is consistent with dietary guidelines and nutrition recommendations around the world.



Dietary guidelines



Dietary guidelines describe healthy food choices and habits which scientific evidence suggests will reduce the risk of developing diet-related diseases in healthy individuals. They provide advice to the general public about healthy eating. They are used as a basis for nutrition education and a benchmark for setting nutrition standards. Dietary guidelines may not be applicable to people with specific health conditions or in ill health.

The following dietary guidelines from around the world are relevant to the consumption of grains and pulses.

i. Cereals and pulses (legumes)

Since the development of the first dietary guidelines in 1968 (in Scandinavia), dietary guidelines from around the world have consistently recommended increasing consumption of grains and pulses.

Dietary guidelines reflect the eating patterns of different countries. Rice features more prominently in Asian dietary guidelines, whereas in Australia, more wheat-based foods, such as breads and pasta, are specifically mentioned. In Asia pulses are an important source of protein and are therefore represented in the "meat" food group. In Australia pulses are eaten as an accompaniment and feature in both the "meat" and "vegetable" food groups.

- Australia* (revised draft for Adults and Children/Adolescents - 2001) - "Eat plenty of cereals (including breads, rice, pasta, noodles), preferably wholegrain" and "Eat plenty of vegetables (including legumes) and fruits".
- Australia (Older Australians) - "Eat plenty of cereals, breads and pastas" and "Eat plenty of vegetables (including legumes) and fruit".
- Singapore - "Increase the intake of fruit, vegetables and whole grain cereal products, thereby increasing vitamin A, vitamin C and fibre intakes".
- China - "Eat a wide variety of foods, with cereals as the staple" and "Consume milk and beans and their products every day".
- Thailand - "Consume the five food groups daily" and "Consume foods containing dietary fiber regularly". Grains are included in the "Rice and other cereals" food group and pulses in the "Meat, poultry, fish, eggs, milk, pulse, nuts and seeds" food group.
- USA - "Choose a diet with plenty of grain products, vegetables and fruit".

Dietary guidelines relating to grains need to be modified to meet the needs of **different age groups**.

*The Australian dietary guidelines for adults, children and adolescents are currently being reviewed. The final version of the dietary guidelines will be available on the NHMRC website listed in the "Further Research" section.

ii. A wide variety of nutritious foods

Eating a wide variety of foods has been shown to reduce the risk of death. The importance of eating a wide variety of foods is reflected in most dietary guidelines around the world. To benefit from the differences in the nutrient content and nutritional attributes of different grains and pulses, eating a wide range of grain- and pulse-based foods is recommended. The processing technique can alter the nutritional attributes of a food product, making it slightly

different to the original food. For instance, although pasta, bread, breakfast cereals and noodles are all made from wheat, their nutritional attributes (such as the resistant starch content or glycaemic index) can differ depending on the food processing technique used to manufacture and prepare the food.

iii. Low in saturated fat

The importance of having a low-fat diet, especially one which is low in saturated fat, is a common theme in dietary guidelines around the world. A high-fat diet, particularly a high saturated fat intake, is linked to the development of chronic diseases such as heart disease and colon cancer. A high-fat diet may also be more conducive to weight gain.

Grains and pulses are mostly low in fat. The small amount present is low in saturated fat and high in polyunsaturated fat which is beneficial in terms of lowering blood cholesterol. The addition of fats and oils to grains and pulses during processing at home or by the food industry can increase their fat content.

Nutrition recommendations



The World Health Organisation recommends at least 55% of total calories or kilojoules eaten each day should come from carbohydrates provided by foods such as grains, pulses, vegetables and fruit.

In July 1999, the US Food and Drug Administration considered that there was sufficient evidence to support the following health claim on food products:

"Diets rich in wholegrain foods and other plant foods and low in saturated fat and cholesterol may reduce risk of coronary heart disease and certain cancers".

The US FDA defined wholegrains as "any food that is a grain or any food that contains at least 51% by weight of any combination of whole grains".

Nutrition recommendations and dietary guidelines are periodically updated to ensure they are consistent with new findings in nutrition research as well as changes in the food choices and health issues of the target population.

How much should we be eating?

The "[Australian Guide to Healthy Eating](#)" indicates the amount of food from each of the five food groups required each day for good health.

Grains are represented in the "Bread, cereals, rice, pasta and noodles" food group. Since pulses are eaten as both a source of protein and as a vegetable, they feature in the "Vegetables and legumes" food group as well as the "Meat, fish, poultry, eggs, nuts and legumes" food group.

The number of serves of food recommended in each food group varies according to age, gender and physical activity level. For instance, four serves of "Bread, cereals, rice, pasta and noodles" are recommended in sedentary adolescents aged 12-18 years, whereas 11 serves are recommended in adolescents who are physically very active.



Minimum number of daily serves of bread, cereals, rice, pasta and noodles recommended for a healthy diet

Population group	Age	Number of serves
Children	4–7 years	2
	8–11 years	3
Adolescents	12–18 years	3-4
Adults	19+ years	4

A sample serve of bread, cereal, rice, pasta, noodles

2 slices (60 g) bread, 1 medium bread roll;

1 cup (180 g) cooked rice, pasta, noodles;

1 cup (230 g) cooked porridge, 1 1/3 cups (40g) cereal flakes or ready-to-eat cereal;

1/2 cup (65 g) untoasted muesli;

1/3 cup (40 g) flour.

A sample serve of legumes/pulses (as part of vegetable group)

1/2 cup (75 g) cooked dried beans, peas or lentils.

A sample serve of legumes/pulses (as part of meat group)

1/2 cup (80 g) cooked (dried) beans, lentils, chickpeas, split peas and canned beans.

[For More Detailed Information](#)

[Further Research](#)

Role of grains and pulses in the diet



FAO food balance sheets describe each country's per capita food supply in terms of the amount of primary foods available for human consumption each year since 1961.

Table 1. Per capita food supply in 1999

Country	Cereal supply (kg/year)	Pulse supply (kg/yr)	Meat supply (kg/year)	Energy from cereals (cal/d)	Protein from cereals (grams/d)
Australia	90.9	9.1	108.9	727	24.7
Egypt	250	8.2	22.6	2188	59.4
China	193.9	1.1	49.1	1675	36.6
Malaysia	148.3	2.8	54.0	1256	25.7
Thailand	112.8	3.5	24.6	1091	20.1
India	155.6	12.8	4.6	1428	33.7
Developing countries	165.6	6.8	26.9	1458	33.9
Developed countries	130.0	3.0	77.1	1009	28.9

FAO Food Balance Sheets www.fao.org

FAO Food Balance Sheets in 1999 (Table 1) indicate:

i. World consumption of grains and pulses

- According to recent FAO Food Balance Sheets, the world's biggest consumers of cereals are Egypt, Turkey, China and the Middle East. They eat from 180 kg of cereals/person/year to 250 kg/person/year. In Australia, consumption is around 91 kg/person/year.
- The world's highest consumers of pulses are Brazil, Mexico, Central America, Turkey, India and Nigeria - eating from 12 kg/person/year to 19 kg/person/year. In comparison, Australians ate around 9 kg/person/year.

ii. Eating patterns associated with grain and pulse consumption

- Cereals (grains) are staple foods, contributing substantially to total energy and protein intake (Table 1).
- The more cereals are eaten, the greater their nutritional contribution.
- Cereal consumption decreases with economic development -the amount of cereals eaten per person generally declines as the income per person in a country increases.
- As more animal products are eaten, cereal consumption decreases, contributing less to caloric and protein intake.

iii. The type of grains eaten around the world

- Wheat is the most popular cereal eaten in the world.
- Most wheat (100-200 kg/person/year) is eaten in North Africa and Europe.
- Rice is the main cereal eaten in Asia, particularly Indonesia, Vietnam and Thailand where most meals are based on rice (up to 165 kg/person/year).
- Maize is the preferred cereal in parts of southern Africa (up to 135 kg/person/year) and Central America, particularly Mexico,(129 kg/person/year).
- Few countries have millet available for human consumption, except in Africa (12.7 kg/person/yr).
- Lithuania is the largest consumer of rye (49 kg/person/year) compared to average consumption in the world (1.2 kg/person/year). Rye is also popular in Scandinavia (~15 kg/person/year), Eastern Europe (up to 35 kg/person/year) and Russia.

iv. Trends in grain and pulse consumption

Comparing FAO Food Balance Sheets from the 1960s with 1999 shows how the food supply has changed over time.

In China the availability of pulses has declined from 5.5 kg/person in 1969 to 1.1 kg/person in 1999, whereas meat consumption has increased from 9.3 kg/person to 49.1 kg/person. Consequently, the Chinese dietary guidelines encourage Chinese people to eat more pulses and cereals.

Interestingly, as less plant-based foods are eaten, the incidence of chronic diseases such as coronary heart disease, cancer and obesity seems to increase. However, other diet and non diet-related factors may explain this association.

What are FAO food balance sheets?

They are indirect estimates derived from the difference between food production, utilization, waste and loss. Differences in the reporting of food production between countries can result in discrepancies in the data presented in Food Balance Sheets. For example, Australian data for wheat are reported as flour, some countries report cereal data as grain and others apply a correction factor to allow for the extraction rate (about 70%) of flour from grain. Hence this data is useful for simply comparing general grain and pulse consumption patterns and trends around the world.

Grains and pulses in the Australian diet



Trends in grain consumption

Apparent consumption data

Australian **apparent consumption data** suggests that consumption of grain products decreased from the 1950s until 1992, when it started increasing to current levels (Table 1). This trend is reflected in the apparent consumption of bread from 1939 to 1997 which is illustrated in Figure 1. **Socio-economic** factors explain some of the fluctuations in bread consumption recorded over this period.

Table 1. Per capita consumption of grain products in Australia in 1998-99

Food	Amount
Grain products from:	146 kg =
Wheaten Flour	69.7 kg
Breakfast foods (includes oatmeal and rolled oats)	7.9 kg
Table rice (excludes rice flour; canned rice; rice used in breakfast cereals)	7.1 kg
Bread	53.4 kg

Ref ABS. Apparent consumption of foodstuffs. Catalogue 4306.0. 1998-99

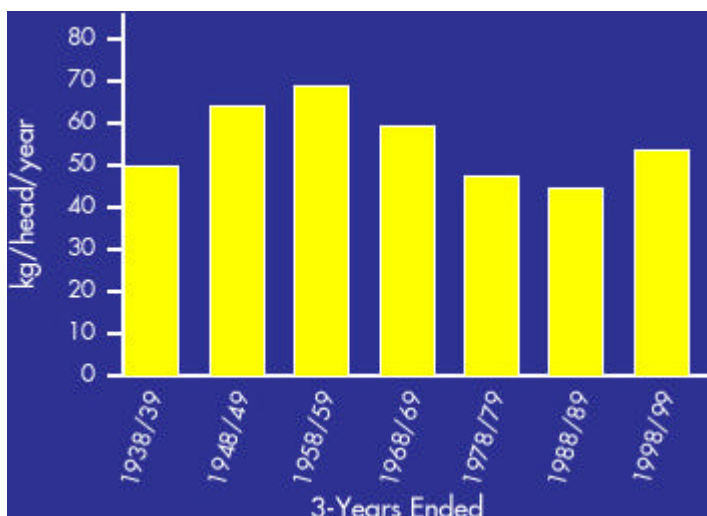


Figure 1. Apparent consumption of bread in Australia 1939-1997

1995 National Nutrition Survey



The **1995 National Nutrition Survey**, conducted from February 1995 to March 1996, is the most recent Australian **dietary survey**. It provides a useful insight into the role of grains and pulses in the Australian diet.

How popular are grains and pulses in the Australian diet?

The relative popularity of foods is represented by the percentage of people (19 years and over) eating these foods on the day of the 1995 National Nutrition survey.

Percentage of people (19+ years) eating grain and pulse-based foods on the day of the survey:

- Various types of bread (93%), particularly regular breads and rolls (80%)
- Different types of breakfast cereals (50%)
- Rice and rice products (14%)
- Pasta and noodles (12%)
- Pulse products and dishes such as pappadam, baked beans, tofu and vegetarian sausages (7%)

The data clearly suggests that grain-based foods, particularly bread, are staple foods in the Australian diet because 95% of Australians aged 19+ years reported eating cereal foods every day. Breakfast cereals are also eaten by most Australians every day.

Because they are eaten so frequently, both in Australia as well as in most countries around the world, grains play a major role in the diet. Pulses and pulse-based foods are eaten less frequently and hence play a much smaller part in the Australian diet.

How much grains and pulses do Australians eat?

The average daily intake of cereals represents the average intake of all the people surveyed in Australia in 1995, i.e. both those eating cereals and not eating cereals on the day of the survey. Table 2 suggests women aged 19 years and over are not eating enough cereal foods.

The amount and type of grain- and pulse-based foods eaten varies according to **factors** such as age, gender, geographical location, country of birth, socio-economic status, day of the week the season.

Table 2. Average daily intake of cereals in different population groups compared to recommended amounts*

Age group (years)	Intake of cereals in males (grams)	Intake of cereals in females (grams)	Recommended amount of cereals* (grams)
4–7	168.1 g	140.4 g	120 g
8–11	208.1 g	175.7 g	180 g
19 +	250.2 g	181.2 g	210 g

* NHMRC, Core Food Groups, 1995



Table 3. Average and median intake of grain- and pulse-based foods by Australians (aged 19+ years) on the day of the 1995 National Nutrition Survey

Food	Average intake of consumers and non- consumers (grams)	Median intake of consumers (grams)
Bread		
Regular bread and rolls	91 g	96 g
Fancy breads, flat breads, English muffins and crumpets	10 g	65 g
Breakfast cereal		
Plain breakfast cereal	10 g	30 g
Mixed breakfast cereal	13 g	59 g
Hot porridge type breakfast cereal	18 g	260 g
Pasta and pasta products	30 g	213 g
Rice and rice products	40 g	195 g
Pulses	10 g	94 g

Contribution of grains and pulses to nutrient intake in the Australian diet

Grains and pulses are nutrient-dense foods, containing a wide range of nutrients. Since grain-based foods, such as bread and breakfast cereals, are eaten frequently, they make a substantial contribution to total nutrient intake in the Australian diet.

Cereal and cereal products, particularly bread and breakfast cereals, are an important low-fat source of energy, dietary fibre, carbohydrate and protein in the Australian diet.

Cereal and cereal products made the following contribution to total nutrient intake across all population groups (i.e. different ages and gender groups) on the day of the survey:

- 20% of total energy intake (10% from bread);
- 33% of total carbohydrate intake;
- ~16% of total protein intake (10% from bread);
- About one-third of dietary fibre, mainly from bread (19%) and breakfast cereals (10%);
- Only around 6% of total fat intake, mainly from polyunsaturated fat (~13% of total intake and only 3% of total saturated fat).

Bread and breakfast cereals provide a wide range of vitamins, particularly thiamin and folate, in the Australian diet:

- ~40% of total thiamin intake (bread-making flour is fortified with thiamin and thiamin is added to most breakfast cereals in Australia);
- 12 to 14% of total natural folate* intake from bread and 4 to 5% from breakfast cereals;
- ~18% of total riboflavin intake, mainly from breakfast cereals (which is added to most breakfast cereals in Australia);
- ~8% of total niacin intake from regular bread and 7% to 10% from breakfast cereals (higher in younger age groups);
- From 1-6% of total vitamin A intake, mainly from breakfast cereals (higher in children and adolescents and lower in adults).

Cereal and cereal products, especially regular bread and breakfast cereals, are an important source of minerals, particularly iron and magnesium, in the Australian diet:

- From 29% to 40% of total iron intake, depending on the intake of breakfast cereals. Breakfast cereals provided a quarter of total iron intake in males 2 to 18 years, a fifth of total iron intake in females aged 2 to 18 years and around 15% in persons aged 19 years and over;
- ~25% of total magnesium intake from regular bread (about 11%) and breakfast cereals (about 8%);
- 14% of total zinc intake, mainly from regular bread (7%);
- 10 to 13% of total calcium intake, mostly from regular bread (7-9%).

Legume and pulse products and dishes are eaten less frequently and hence make a smaller contribution to total nutrient intake in the Australian diet. They made the following contribution to total nutrient intake across all population groups on the day of the survey:

- ~2% to total dietary fibre intake
- ~1% of total natural folate* intake
- From 0.8 to 1.5% of total iron intake (1.5% in males aged 12 to 18 years and 0.8% in females aged 2 to 11 years).

*Survey estimates are based on the natural folate content of foods and beverages and do not include additional folate from food and beverages fortified with folate.

Nutrient fortification

Staple foods, such as bread-making flour and breakfast cereals, are commonly used as vehicles for improving the nutrient intake of populations.

Fortification of flour was first introduced in the UK to replace nutrients removed during the milling of wheat. Subsequently, fortification of staple foods became a useful means of preventing nutrient deficiencies of at-risk subgroups of the population without requiring them to change their dietary habits. Two important nutrient fortification programs have been implemented in Australia - Fortification of bread-making flour with thiamin and the Folate Pilot Health Claim Program.

Food regulations permit the addition of specific vitamins and minerals in permissible amounts to certain foods. Added vitamins and minerals are listed in the ingredients list and the amounts present in the food product are indicated in the nutrition information panel.

Most breakfast cereals and some breads in Australia are voluntarily fortified with vitamins and minerals. Consequently, they are important sources of B vitamins and iron in the Australian diet.

Fortification of bread-making flour with thiamin

In January 1991, an amendment to the Australian Food Standards Code made it a legal requirement that bread-making flour contains no less than 6.4 mg/kg of thiamin.

The thiamin content of white and wholemeal flours, before fortification, is 2.0-2.5mg thiamin/kg and 4.5-5.0 mg thiamin/kg respectively. Consequently, additional thiamin must be added to the flour before it is used for making bread.

Why was thiamin fortification required?

Mandatory thiamin fortification of bread-making flour was introduced to reduce the incidence of Wernicke-Korsakoff syndrome (WKS) in Australia. WKS is a degenerative brain disease associated with a high alcohol intake and a diet deficient in thiamin. Australia has a relatively high incidence of WKS compared to other countries.

Thiamin plays a critical role in carbohydrate metabolism. A daily intake of 1.1 mg is recommended for good health in healthy adults since thiamin is not synthesised or stored in the body. The requirement for thiamin is increased for those consuming a diet high in sugar or alcohol.

A short period of low thiamin supply may deplete thiamin reserves which can lead to subclinical thiamin deficiency. Thiamin fortification would help to increase the thiamin reserves of those who eat poorly and hence help to prevent WKS.

In 1987, the NHMRC recommended addition of thiamin to beer and flagon wine to reduce the incidence of WKS. However, since fortification of alcoholic beverages was not practiced in other countries, it was opposed by nutritionists, brewers and anti-alcohol groups. The NHRMC therefore decided that thiamin should be added to bread flour since thiamin fortification of white flour is a common practice in other industrial countries (such as the UK and USA) to restore losses from wheat during milling.

The decision to fortify bread-making flour with thiamin was controversial since at the time, there was little evidence to suggest that such a major public health measure would reduce the prevalence of WKS in Australia. However, dietary surveys suggest that specific groups, including the elderly, at risk of low thiamin intake would also benefit from thiamin fortification of the diet.

Why is bread fortified with thiamin?

Bread is a staple food, consumed by most individuals in the Australian population. The 1983 National Dietary Survey of Adults indicated that unfortified bread and cereals were the major sources of thiamin intake in the Australian diet.

Breads and cereals are considered "thiamin donors" because they supply more than sufficient thiamin to metabolise the kilojoules they provide.

Technical aspects of thiamin fortification

- Thiamin is added to flour as synthetic thiamin mononitrate. The level of addition is approximately 0.5 mg/100 g for white flour and 0.2 mg/100 g for wholemeal flour. To achieve this low level reliably, the thiamin is first mixed with a small amount of flour to form a pre-mix.
- Thiamin is relatively stable at pH 5, the pH of most bread products, but increasingly unstable at high pH.
- Thiamin is sensitive to heat. Loss of thiamin during the baking of bread varies from 5% to 40%, depending on the product (since the majority of thiamin destruction occurs in the crust) and production process used. For instance, a BRI Australia study showed that

thiamin losses are greater in Arabic flat breads which are cooked at higher temperatures and have a larger surface area.

- Flour treatment agents commonly applied at the mill have no significant effects on the thiamin content of flour.
- The quantity of thiamin added does not affect the baking properties of the flour.
- Thiamin does not affect the taste, texture or smell of bread.

Effectiveness of thiamin fortification

i. Thiamin content of bread

A national study of the nutrient composition of bread conducted by BRI in 1993/4 showed that the thiamin content of white, mixed grain and wholemeal breads had increased to 0.45 mg/100 g (compared to 0.16 mg/100 g for white and 0.22 mg/100 g for wholemeal breads prior to thiamin fortification)¹.

Another study conducted in Victoria in 1993 found that the thiamin content of 15 white bread samples averaged 5.0 mg/kg and 15 samples of wholemeal bread averaged 4.8 mg/kg². These results suggest compliance with mandatory fortification of thiamin to bread-making flour at the level of 0.64 mg/100 g flour.

In some of these samples, there was a low thiamin content which could be attributed to inadequate mixing of thiamin and flour. It is difficult to obtain a homogenous mix of a small quantity of thiamin and a large quantity of flour.

ii. Thiamin status of Australians

CSIRO nationwide surveys conducted in 1988 and 1993 show that there has been a significant increase in thiamin intake in all sub-groups of the population³. This is likely to be due to thiamin fortification of bread-making flour. Despite a decrease in intake of sliced bread, risk of inadequate intake existed in only 3% of women and 7% of men. It was estimated that without thiamin fortification, 8% women and 21% men would have had intakes below the RDI for thiamin.

The 1995 National Nutrition Survey reported an average intake of 1.4 mg and 1.9 mg in women and men aged more than 19 years respectively. Breads and rolls contributed approximately 20% of total thiamin intake in the Australian diet. More than 90% of Australians in most age and sex sub-groups exceeded the RDI for thiamin.

iii. WKS incidence

Autopsy studies conducted before and after the introduction of mandatory thiamin fortification of bread-making flour show a significant reduction in the prevalence of WKS in Australia. Prior to thiamin fortification of bread-making flour, the incidence of WKS was 2.8% in Perth and 2.1% in Sydney⁴. From 1996 to 1997, the prevalence of this syndrome in NSW had reduced to 1.1%⁵. Of the 25 cases identified, 2 were acute cases, 6 were acute-on-chronic cases and 17 chronic cases (reflecting past episodes). The fact that fewer cases of acute WKS were identified suggests that thiamin fortification of bread-making flour may have had an impact on the occurrence of acute cases in Australia. Furthermore, the results of this study may underestimate the beneficial effect of the thiamin fortification as many of the cases of chronic WKS observed in these autopsies may have been present before thiamin fortification.

A retrospective survey of hospital records from 17 major general hospitals in Sydney for cases of WKS suggest a reduction in the incidence of acute WKS as well as in reported deaths from WKS since bread was fortified with thiamin^{6,7}. The average incidence of acute cases of WKS from 1992-1996 was 40% lower than in the 5 years before fortification (1986-1990) but appears to be reaching a plateau of approximately 41 acute cases per year⁷. However, these results suggest that to achieve elimination of this disease complex, addition of thiamin to beer is required.

References

1. Mugford DC, Griffiths PJ, Walker AR. Nutrient levels in white, mixed grain and wholemeal bread. An Australia-wide survey of breads from different bakeries and different States. *Food Australia* 1996; 48(6):264-269
2. Menz N et al. Thiamin content of bread sold in Melbourne. *Food Australia* 1995; 47(8):381-384
3. CSIRO Division of Human Nutrition. Food and nutrition in Australia. Does five years make a difference? 1996; Adelaide: CSIRO.
4. Harper C. The incidence of Wernicke's encephalopathy in Australia - a neuropathological study of 131 cases. *J Neurol Neurosurg Psychiatry* 1983; 46:593-598
5. Harper CG et al. Prevalence of Wernicke-Korsakoff syndrome in Australia: has thiamine fortification made a difference? *MJA* 1998; 168:542-545
6. Ma J, Truswell AS. Wernicke-Korsakoff syndrome in Sydney hospitals: before and after thiamine enrichment of flour. *MJA* 1995; 163:531-534
7. Rolland S, Truswell AS. Wernicke-Korsakoff syndrome in Sydney hospitals after six years thiamin enrichment of bread. *Public Health Nutrition* 1998; 1(2):117-122
8. Drew LR, Truswell AS. Wernicke's encephalopathy and thiamine fortification of food: time for a new direction? (editorial) *MJA* 1998; 168:534-535

Folate Pilot Health Claim Program

In 1994 the NHMRC recommended a revision of the food standards to allow for voluntary folate fortification of key staple foods to reduce the incidence of neural tube defects (NTDs), such as spina bifida, in Australia.

In 1995 an amendment to the food standards regulating the addition of vitamins and minerals to food products on sale in Australia (Standard A9) and New Zealand allowed flour, bread, savoury biscuits, breakfast cereals, pasta, yeast extracts and fruit and vegetable juices to be fortified with up to 50% RDI of folate per serving on a voluntary basis.

As an incentive to food manufacturers to reformulate food products and/or develop new products with additional folate, ANZFA amended the food standards to pilot the use of a health claim (relating to the benefits of folate in helping reduce the number of babies born with NTDs) on approved products. To make a folate/NTD health claim, foods must contain at least 40 (g of folate in each serving).

Why is folate fortification necessary?

Epidemiological studies suggest that maternal folate deficiency increases the risk of NTDs, especially in women with a family history of NTDs. NTDs are the most common congenital abnormality which can affect 400-500 births each year in Australia. Folate fortification has the potential to prevent 50-66% of these NTDs.

Folate is a water soluble vitamin B found in a wide range of fresh fruit and vegetables, legumes, cereal grains and derived products. The recommended dietary intake for people aged 12 years and over is 200 (g folate/day and 400 (g folate/day for pregnant women.

Surveys at the time indicated that few women achieved the folate RDI for pregnancy. According to the 1995 National Nutrition Survey, folate intake in women of childbearing age, prior to voluntary folate fortification, was approximately 230 (g/day from foods and beverages, indicating that there was a need to increase folate intake via food fortification.

Dietary modelling indicated that folate fortification to 50% RDI per serving of staple foods would result in a mean folate intake of 500(g/day in the target population without placing the population, as a whole, at risk. Folate fortification of the food supply has the advantage of reaching most women of childbearing age, particularly unplanned pregnancies.

Technical aspects of folate fortification of bread

- The average folate content of wholemeal bread, prior to fortification, is 40 (g/100 g and for white bread, 20 (g/100 g. To achieve 100 (g of folate in a 50 g serving of bread, approximately 4 mg of folate per kilogram must be added to bread-making flour.
- Folate is water-soluble, heat labile and alkali sensitive. Folate in bread comes from the yeast and the flour. Added folate appears to be stable throughout the bread baking process with small losses at high temperature. It has also been shown to be stable during storage in enriched flour as well as in the finished baked product for up to 5 days.
- Folate has no noticeable effect on the flavour, colour or appearance of the enriched cereal grain.

Evaluation to date

The effectiveness of the NHMRC and ANZFA policies depend on the extent to which food manufacturers fortify foods with folate. The NHMRC recommended that voluntary fortification be

reviewed three years after the date of gazettal to determine its effectiveness and whether there is a need to introduce mandatory fortification of flour. ANZFA is evaluating implementation of the folate pilot program. For information on the progress of this program, visit the ANZFA website.

In 1998, over 40 products, mainly breakfast cereals, were fortified with folate. Breads fortified with folate contain from 50-200 (g folate/100 g and breakfast cereals, 111-333 (g folate/100 g².

In September 2000, 35 bread products and 20 breakfast cereals provided at least 40 (g folate per serving of food.

References

1. Lawrence M. Why fortify foods with folate? *Food Australia* 1998;50(10):503-505
2. Lawrence M, Rutishauser IHE, Lewis JL. An analysis of the introduction of folate-fortified food products into stores in Australia. *Aust J Nutr Diet* 1999;56(1):15-21