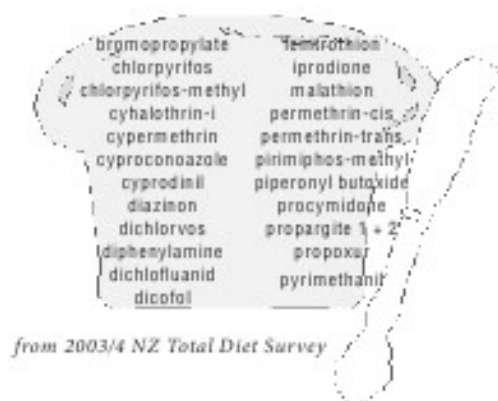


## Our daily bread

Bread is an important part of our culture and of many cultures with a long history of use. Wheat, the main ingredient in bread, has many valuable nutrients. But just how good for us is the bread we eat nowadays? What pesticides are in non-organic bread and what types of bread are there? Why should we reduce the amount of white bread we eat? This article also looks at some different types of bread and flours you can buy.

### Pesticides in bread



Bread and all products containing wheat have high levels of pesticides in New Zealand, especially compared to other countries. In fact bread and wheat products are at the top of the dirty dozen list, with residues detected in 94.4% of 90 samples in 1997/8 (White 2003), and near the top in 2003/4, with 23 pesticides found in 168 samples. The dirty dozen are foods eaten in New Zealand which are ranked on the percentage of samples with pesticides found

and the number of pesticides detected. Wheat products sampled in the 2003/4 Total Diet Survey included bran cereal, biscuits, noodles, snack bars, spaghetti, wheat biscuit cereal, cake, muffin, pizza, sausages, muesli, hamburger, meat pie and the batter around fish (Vannort 2005). The Total Diet Survey is carried out by the Food Safety Authority every 5-7 years to look at pesticides and contaminants in our diet.

The chances are, then, you are also taking in organophosphate residues (a type of chemical insecticide) most of the time you eat something with non-organic flour in it. Many of these residues result from the post harvest application of a fumigant on the stored grain. Other countries are increasingly using non-pesticide means of storage for their grain, for example, cold storage or carbon dioxide.

### Possible harm from these pesticides

Children are particularly susceptible to the organophosphate pesticides usually found in flour and may suffer from acute poisoning due to the additive nature of organophosphates also found in other fruit and vegetables. Other possible long term damage from organophosphates include nervous system damage and inhibiting cholinesterase in the blood. Six of the pesticides found most frequently in bread and flour products are listed below in order of frequency with other specific effects. The first five are organophosphates.

- 1) **Pirimiphos methyl** Not much is known because data is incomplete (Orme 2000)
- 2) **Chlorpyrifos methyl** Information very incomplete. Chlorpyrifos is the chemical parent (Orme 2000).
- 3) **Fenitrothion** Possible endocrine disruptor, but data is incomplete (Cox 2000)

**4) Chlorpyrifos** can, through newly discovered mechanisms, alter the development and function of a number of regions of the brain and central nervous system, according to recent research. The prenatal brain is especially vulnerable to it, even at very low doses, with potentially permanent effects on cognitive development and behaviour (Colborn 2006). It has also been linked to birth defects, nervous system, genetic and immune system damage, and in addition is accumulative. It has been found in air, ground water, rivers, lakes, rain and fog. It has been found to act synergistically with other chemicals (Cox 1994).

**5) Malathion** is a suspected endocrine disruptor and a possible carcinogen (Orme 2000). Linked with gene damage, and sperm and thyroid disruption (Cox 2003)

**6) Procymidone** This fungicide is a probable carcinogen and suspected endocrine disruptor (Orme 2000). It has an effect on the androgen receptor, feminising male rat offspring (Gray 1999).

## **Different types of bread**

### **White bread**

White bread is produced from flour made from the endosperm (white fleshy part) of the wheat grain. In New Zealand white flour contains 78% of the grain, referred to as the extraction rate. The wheatgerm and bran are removed during the milling process, which results in a higher gluten content, giving a lighter and spongier texture. The removal of fibre makes it more easily digested, but valuable nutrients are lost, including many vitamins, minerals and dietary fibre. (The wheatgerm commonly ends up in animal and poultry feed.) In other countries such as the UK and USA, white flour is enriched or fortified with some minerals and B vitamins in an attempt to replace some of this loss of nutrients. I have seen one brand of bread fortified in NZ, with added iron, folate and Vitamin E. [ See the chart to compare fibre and nutrients in white flour and wholemeal flour. Room to include chart below?]

### **Wholemeal bread**

Wholemeal bread is supposedly made from the whole grain, containing bran and wheatgerm as well as the endosperm. It may contain up to 10% of white flour (Pickford 1999). However, wheatgerm is normally removed from milled flour and not put back into 'wholemeal' flour because of its tendency to go rancid, especially in warm weather (Pickford 1999, Fraser 1985). This means in practice that wholemeal bread does not contain wheatgerm unless it is stated on the label. On the other hand, because organic wholemeal bread is normally made from stoneground or zentofan flour, a different process, it includes the wheatgerm.

### **Essene bread**

This is genuinely 100% wholemeal bread where the grain is soaked, sprouted, ground up and then cooked at a low temperature for a long time, mimicking conditions in the desert, where it has been done this way for many centuries. It has a rich, dense and naturally sweet flavour, with more nutrients than other breads

### **Brown bread**

Brown bread is made from a mixture of white and wholemeal flours, containing at least 60% wholemeal by law. Wheatmeal and oatbran breads may fit into this category.

### **Wholegrain bread**

Wholegrain or multigrain bread consists of white flour mixed with kibbled grains, with varying percentages sometimes stated: 10-25%. Kibbled grains are a mixture of

broken wheat grains, barley, oats, rye and sometimes other grains or seeds. Wholegrain bread is higher in fibre and nutrients than white bread because of the kibbled grains. Because the kibbled grains take a while to digest (that is, wholegrain bread has a moderate to low Glycaemic Index, especially compared to white bread), this provides more sustained energy. The extent to which nutrients from the kibbled grain is actually digested by the body can be debated, however. Certainly wholegrain bread provides more roughage than white bread and may be a useful compromise for those who don't want to have wholemeal bread. It would be useful for consumers to know what percentage of kibbled grain bakers put into their bread – it is often not labelled.

### Spelt bread

Spelt (*triticum spelta*), is a 'great uncle' of wheat (*triticum aestivum*), grown in Europe thousands of years ago. After the 19th century it was forgotten, partly because of its lower yield in comparison to wheat, and also because of the need to mechanically dehull the grain before grinding. The sturdy hull protects the spelt grain from insects before it is made into flour, and it also helps retain the nutrients in the kernel.

Rich in fibre and B vitamins, spelt contains more protein than wheat, including all eight amino acids. It also contains ingredients which have been reported to stimulate the immune system (Grainger). Some people who are sensitive to wheat gluten may be able to tolerate spelt. In sum, spelt is a useful bread to lessen the over consumption of wheat and provide complex carbohydrates for sustained energy release.

### Gluten free bread

Gluten is a mixture of proteins found mainly in wheat but also in rye, barley, oats and millet. People who are allergic or sensitive to gluten need to avoid foods that contain these and use alternatives. Some, who may not necessarily be sensitive to gluten, report they feel better not having so much wheat: less lethargic and more able to focus. (Is that a reason why we are becoming a coffee-dependent society?) Fortunately there is a range of gluten free breads available now, especially in organic and health food stores.

### Nutrients in New Zealand flour

Per 100g	White flour 78% extraction	Wholemeal flour for breadmaking
Dietary fibre	3.6g	11.8g
Magnesium	32mg	104mg
Potassium	195mg	449mg
Calcium	21mg	34mg
Manganese	680µg	3670µg
Iron	1.4mg	3.5mg
Zinc	0.8mg	3mg
Thiamin (B1)	0.39mg	0.8mg
Riboflavin (B2)	0.1mg	0.16mg
Niacin (B3)	2.6mg	4.4mg
Vitamin B6	0.21mg	0.44mg
Pantothenate	0.3mg	0.9mg

Biotin	1µg	7µg
Folate	22µg	51µg
Vitamin E + alpha tocopherol	0.4mg	3.5mg

*From Monro & Humphrey-Taylor 1994*

### **White vs wholemeal**

If we study the chart above comparing retail white flour with wholemeal flour for breadmaking, drawn from a composite of samples from the North and South Islands, we can see that wholemeal flour has consistently higher levels of minerals and vitamins as well as significantly higher levels of dietary fibre.

Whole grains, as opposed to refined, offer the advantage of supplying, along with starch, the proper proportion of the B vitamins the body needs in order to burn glucose as fuel. In addition, the fat and protein in the package, and its indigestible fibre covering, slow down the digestive process and give the sugars from carbohydrate digestion a little longer time in which to enter the blood. This means that because whole grains satisfy your appetite and your nutritional needs at the same time, it is possible to eat them in moderation and still lose weight (Robertson 1978). Eating a slice of wholemeal bread gives you more nutrients and fills you up as much as 2-3 slices of white bread.

Lack of fibre in the typical Western diet through eating refined carbohydrates such as white bread has contributed to the development of many diseases that are common in our society, according to several researchers (Burkitt 1983, Harris 1993, Horne 1984, MOH 1997, Monro 1994). Dr Denis Burkitt, for example, observed that Africans eating a diet almost entirely vegetarian and high in fibre did not develop constipation, bowel cancer, appendicitis and diverticulitis to name a few. There is also evidence that a low fibre diet contributes to high blood cholesterol and heart disease and that there is a link between reduced breast cancer and increased fibre intake. Of course other factors can be expected to play a role in these diseases, but it is not my intention to cover these here.

Refining grain such as wheat and reducing or removing trace minerals may result in an imbalance of minerals and subsequent deficiencies, especially if not many fruit and vegetables or meat are eaten. Zinc, for example, has a protective effect against the toxic heavy metal cadmium. The lower zinc levels in white flour may lead to more accumulation of cadmium in the body and subsequent ill-health (Robertson 1978).

A disadvantage of consuming whole grains is that they contain phytic acid which has the capacity to lock up minerals in the intestine, resulting in non-absorption. Before you race back to your white bread, however, be aware that there are some compensating factors. An enzyme called phytase in the intestine gives the body the ability to handle a certain amount of phytic acid in the diet. Phytase is also present in certain whole grains, eg wheat and rye, and during bread making the conditions required for leavening – moisture and a warm temperature – activate this enzyme and enable it to break down much of the phytic acid in the grain. Bread dough which has been left to rise a longer time will have developed more phytase (Robertson 1978). Soaking the grain also develops more phytase (Monro 1994), as well as sprouting.

Nowadays most bakers, especially the larger ones, allow the bread to ferment only a short time, with the result that less phytase would be developed.

### **What should I give my children?**

The outer covering of wheat or bran is acknowledged to be a very good for getting the bowels moving, but it may be too indigestible for young children. As the Ministry of Health comment:

High-fibre diets are not recommended for young children as the bulkiness of high-fibre foods make it difficult for children to eat sufficient to meet their energy requirements... Too early and too large amounts of fibre may exceed the capacity to ferment indigestible fibre in the colon....Children should be encouraged to eat a wide variety of fruit and vegetables and whole grain cereal products. This recommendation should not result in over consumption of fibre in the child's diet. (MOH 1997)

Ministry of Health advice is to gradually increase the fibre in your child's diet, not giving food with added bran to very young children. Some nutritionists recommend not giving a child wheat at all until they are 9-12 months old, because intolerance to wheat is common, and delaying it until a later time if there is any family history of allergies (Hamilton 2005).

On the other hand it is easier to get children to accept whole grains if they are introduced earlier rather than later. For that reason and for nutritional reasons I would recommend not introducing white wheat bread to young children, but instead in the first two years especially introducing a variety of whole grains into a child's diet, for example, corn, quinoa, spelt, rice, buckwheat, thus getting them used to different tastes and reducing the current overemphasis on wheat that we have in our society. It can be argued, in fact, that mostly fruit and vegetables should be given to young children, putting less emphasis on grains. If you bake wheat bread for your children, the more finely ground zentofan flour may be better tolerated.

### **How much bread is good for you?**

We eat more bread in New Zealand compared to some other countries, with consumption being higher than in Australia, the UK and US. The average is about 1.4 loaves per person per week (Monro 1994). Since the 1980s consumption of white bread has reduced: in 1981 75% ate white bread but in 1991 less than 50% did so (Pickford 1999).

The Food and Nutrition guidelines from the Ministry of Health recommend that we have a least 6 servings of breads and cereals a day. However this recommendation seems to reinforce current patterns of dietary behaviour rather than improving them. While wheat has many commendable nutrients, we do tend to overdo our consumption of it in our society: some people have it all day and every day. It is a good idea to reduce your consumption of white bread and increase your consumption of whole grains, eating a variety of them, not just wheat, but at the same time aim to consume more fruit and vegetables rather than grains.

## Baking: different types of flour

### Stoneground flour

Stoneground flour has wheatgerm as well as bran included in it and as such it is important to buy it as fresh as you can. Connoisseurs maintain that grinding your own is the best way to get maximum nutrients and taste. It is milled between two rotating stones, pulverising the grain by friction. The heat generated may affect the nutritional quality of the grain. It is often more coarsely ground, which results in a nuttier flavour but a denser texture.

### Zentrofan flour

Like stoneground flour, zentrofan flour is genuinely whole grain. It is air-milled by spiralling the grain inside a stone cavity. Centrifugal force pushes kernels against the stone and the movement of air keeps the flour cool. It is very finely ground, resulting in a lighter texture than stoneground flour. Zentrofan flour is about 6% drier than stoneground flour, so use a little more liquid in your baking. It can be bought from organic and health food stores.

**Bran & wheatgerm** from wheat flour both contain valuable minerals and B vitamins and wheatgerm has Vitamin E in addition. If you consume white bread and flour products, these could be useful additions to your diet, depending on how long after milling you consume it. Make sure the wheatgerm is fresh and kept refrigerated and that the bran in particular is organic – all non-organic bran has high levels of pesticides.

### Gluten free flours

These include: buckwheat (not a true grain), soy, cornmeal (the wholegrain is yellow, as opposed to white cornflour), rice, quinoa and chickpea.

## Recommendations

- Buy organic bread and flour to avoid the high pesticide levels.
- Reduce or eliminate the amount of white flour you eat and increase your whole grains.
- Cut down on the amount of wheat, eating a range of grains.
- Use a variety of wholegrain flours from different grains in your baking.
- Try sprouting grain and mixing it with salads.

### To bakers and the NZ Flour Millers Association:

- Urgently investigate other means of storing wheat so fumigation with pesticides is unnecessary.
- Include the fibre content in the nutrition information panel.
- Label percentage of white flour and 'wholemeal' flour used.
- Label the percentage of kibbled grain in bread.
- Use wheatgerm in bread and label it.

## References

- Burkitt D 1983: *Don't forget the fibre in your diet*, Martin Dunitz.
- Cox C 1994: *Chlorpyrifos Toxicology*: <http://www.pesticide.org/triclopyr.pdf>
- Cox C 2000: *Fenitrothion*: <http://www.pesticide.org/fenitrothion.pdf>
- Cox 2002: *Piperonyl butoxide*: [http://www.pesticide.org/piperonyl\\_butoxide.pdf](http://www.pesticide.org/piperonyl_butoxide.pdf)
- Cressey P. et al 2000: *1997/98 New Zealand Total Diet Survey. Part 1: Pesticide Residues*. Ministry of Health.
- Fraser I 1985: pers.comm. (Flour mill manager)
- Grainger P: [www.venerdi.co.nz](http://www.venerdi.co.nz) Accessed 28/1/06
- Harris PJ, Ferguson LR 1993: Dietary fibre: its composition and role in protection against colorectal cancer, *Mutation Research*, 290:97-110.
- Horne R 1984: *The Health Revolution*, Happy Landings Australia.
- Ministry of Health 1997: *Food And Nutrition Guidelines for Healthy Children Aged 2–12 Years*, [www.moh.govt.nz](http://www.moh.govt.nz)
- Monro J & Humphrey-Taylor V 1994: *Composition of New Zealand Foods: 5. Bread and Flour* New Zealand Institute for Crop & Food Research, New Zealand Flour Millers Association, New Zealand Association of Bakers.
- Orme S & Kegley S (2000): *PAN Pesticide Database*, Pesticide Action Network, <http://www.pesticideinfo.org>
- Pickford M 1999: *Wheat growing, flour milling and bread making*, [http://www.newzealandeconomics.com/SITE\\_Default/SITE\\_Publications/x-files/358.pdf](http://www.newzealandeconomics.com/SITE_Default/SITE_Publications/x-files/358.pdf)
- Robertson L, Flinders C & Godfrey B 1978: *Laurel's Kitchen: a Handbook for Vegetarian Cookery and Nutrition*, Bantam Books.
- White A 2003: The Dirty Dozen, *OrganicNZ* 62:3, p12  
<http://www.soil-health.org.nz/pastissues/mayjune03/dirtydoz.htm>

\*\*\*

*By Alison White updated October 2007. A version of this article first appeared in Organic NZ March/April and May/June 2006.*