

# Grains

## Old and New

Grains  
they're essential!



Les produits  
céréaliers,  
essentiels pour la santé !

Program funded by members of the Baking Association of Canada,  
The Canadian Wheat Board and the Canadian Pasta  
Manufacturers Association

By Laura Pasut, M.Sc., RD

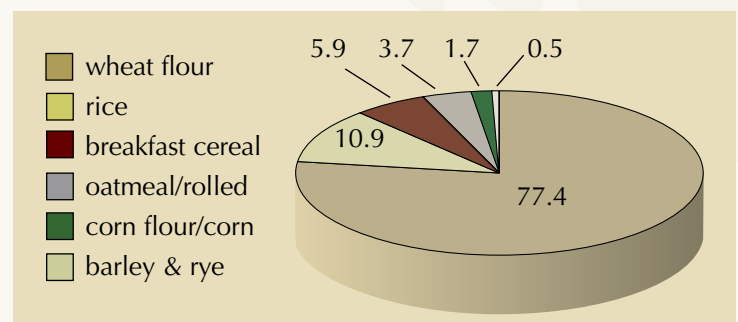
Current nutrition recommendations encourage the consumption of grain products with an emphasis on whole grains. In Canada, the grain we consume in the highest amount is wheat (Figure 1).<sup>1</sup>

Slowly, but steadily, less familiar grains such as bulgur, Kamut®, millet, sorghum and spelt are entering the mainstream market. What are these grains and why are they unique?

This backgrounder will review:

- Major worldwide grains – defined as the highest production and consumption worldwide
- Minor worldwide grains – important grains but not consumed in large quantities everywhere
- Not quite grains – often referred to as grains but are actually seeds

Figure 1 Grain Consumption in Canada (%)<sup>1</sup>



## Major Worldwide Grains

Of the 17 plant species that supply 90% of our food supply worldwide, eight of these are grains – wheat, rice, corn, barley, oats, rye, sorghum and millet. Within each of these species are many varieties.

Wheat, rice and corn make up 85% of the world grain production and wheat and rice are food staples for most of the world's population.<sup>2</sup> Corn is the third most commonly consumed grain worldwide, but not in Canada where it accounts for less than 2% of grain consumption.

### Wheat

Wheat grown in Canada includes:

- common (non-durum) wheat, which is classified as either hard or soft, and
- durum wheat.

Common wheat is used for breads, cakes, crackers, frozen dough, mixes and oriental-style noodles.<sup>4</sup> Hard wheat, with its higher gluten content than soft wheat, is

### Primitive or Ancient Grains

Four wheat-related grains, often referred to as “primitive grains” or “ancient grains”, have origins that date back to pre-historic times. These grains include: einkorn, emmer (farro), spelt and Kamut®.<sup>3</sup>

Einkorn was one of the first cultivated forms of wheat and is still produced in isolated areas of southern Europe and India. Its predominant use is in bulgur or in animal feed.<sup>3</sup>

Emmer evolved from einkorn and initially was consumed as porridge. Over the years, durum wheat has replaced emmer in most countries, although emmer is still grown in Ethiopia and mountainous regions of Europe and Asia. In Italy, emmer is known as farro and is considered a gourmet food.<sup>3,5</sup>

Similar to einkorn and emmer, spelt is a “covered wheat”, which means that

the kernels do not separate freely when harvested. Unlike eikorn and emmer, spelt remains a major cereal crop in isolated regions of southeastern Europe, as well as in some parts of the United States. Spelt products include whole grain and white flours, as well as a variety of processed products—pasta, hot and cold cereal, pre-packaged bread, muffin and pancake mixes.<sup>3</sup>

Kamut® or khorasan wheat is related to modern durum wheat. It was originally brought to the United States in the mid 1900's but was discontinued until the late 1970's at which time the Quinn family began growing it and registered it as Kamut®. The first Kamut® bread was marketed in 1989 and the first cereal in 1991.<sup>3,8</sup>

used primarily for bread and bread-like products, since it produces the desirable volume and structure. Soft wheat is used in cake flour, which produces a more delicately textured product.<sup>5</sup>

Durum wheat is used primarily in the production of pasta and couscous. Durum wheat is also used to make grano and bulgur. Grano is polished durum wheat kernels that have been soaked and cooked. It is still used as a traditional side dish in some parts of Italy.<sup>5</sup> Bulgur, also known as cracked wheat, is made from wheat kernels that are cooked, dried and cracked. Bulgur is most often made from durum wheat but it can be made from common wheat as well.<sup>6</sup> The most well-known dish using bulgur is tabouli (tabbouleh) – a grain and vegetable salad.

Of the major grains, wheat has the highest protein content at approximately 13.5% compared to rice which has the lowest at 8%. The better quality and higher protein level, specifically the gluten level, results in a better bread product.<sup>7</sup>

### Rice

China and India are the largest producers of rice.<sup>7</sup> Ninety percent of harvested rice is used for human consumption with over half of the world’s population depending upon rice for food.

Size determines the three general types of rice – long grain, short grain, and intermediate or medium grain rice. Within each type there are thousands of different varieties. As Table 1 illustrates, each type is characterized by unique cooking properties.<sup>9</sup> Most rice is offered in a white/beige form. Only brown rice, labelled whole grain, and specialty rice like wehani (wehini) rice or exotic rice like red, black or purple rice, are whole grain.

### Corn

The United States is the world’s leading producer of corn. Most corn is grown for livestock and a wide range of other products such as corn syrup, sweeteners, corn oil, ethanol and industrial products, such as fuel.<sup>10</sup> Sweet

**Table 1 Characteristics of rice and examples<sup>9</sup>**

Long grain rice	Short grain rice
Stays separate and fluffy after cooking. Examples are: <ul style="list-style-type: none"> <li>• Standard long grain rice</li> <li>• Basmati rice</li> <li>• Jasmine rice</li> <li>• Popcorn rice (American basmati available in brands like Texmati)</li> </ul>	Tends to be sticky. Examples are: <ul style="list-style-type: none"> <li>• Sushi rice</li> <li>• Japanese rice</li> </ul>
	Medium grain rice
	Absorbs a lot of water <i>without</i> getting sticky. Examples are: <ul style="list-style-type: none"> <li>• Risotto (Arborio) rice</li> <li>• Paella (Granza) rice</li> </ul>

corn is the one grain we eat as a vegetable. As sweet corn or popcorn, the grain remains whole, thereby retaining the whole grain benefits exerted by the phytochemicals. Total phytochemical content and antioxidant activity in uncooked grains found that corn has the highest total phenolic content and the highest antioxidant activity, followed by wheat, oats and then rice.<sup>11</sup>

Corn is also used to make corn oil and milled corn. Milling corn produces corn meal, corn flour, corn grits and corn starch. In the southern United States, dehulled corn, called hominy, is ground into corn grits, which are often used as a side dish or a breakfast food. More than half of the corn starch produced from milled corn is used to make corn syrup or glucose. The germ and bran are removed from milled corn during the milling process, consequently, milled corn products are not whole grain.<sup>10</sup>

## Minor Worldwide Grains

Minor grains include barley, sorghum, millet, oats and rye. Barley ranks fourth in grain production worldwide; sorghum and millet follow. However, these latter two grains are not as readily available in Canada as are barley, oats and rye.

The following discussion will focus on barley, oats and rye, which, while minor in worldwide production, offer enormous potential for adding variety to the Canadian diet. All of the grains can be found in multiple grain products like breads and cereals.

### Barley

Canada is one of the leading exporters of barley. In Canada, barley is the second most commonly grown grain, with 70% used for livestock, 15% processed as malting barley, and the remainder consumed as food barley.<sup>4</sup> It is common in Canada to add pearl or pot barley to soups and stews.

The process of “pearling”, a form of polishing, removes the inedible outer husk of the barley kernel, which in turn removes part of the bran layer and germ. As a result, pearl and pot barley are not whole grain. However, whole grain barley flour and barley flakes may be available in some stores.<sup>12</sup> The flour produced from barley is easier to digest than wheat flour, making it

**Table 2 Lesser Known Grains**

Grains:	Kamut <sup>®6</sup>
Where it's grown/ consumed	<ul style="list-style-type: none"> <li>• grown in Canada and the United States</li> </ul>
Interesting facts	<ul style="list-style-type: none"> <li>• 49% of North America's Kamut<sup>®</sup> is exported to Europe, 29% is sold in Canada and 22% is sold in the United States</li> </ul>
Nutritional importance	<ul style="list-style-type: none"> <li>• organic</li> <li>• considered less allergenic than wheat</li> </ul>
Products/ Availability	<ul style="list-style-type: none"> <li>• breakfast cereal is the most popular product in North America</li> </ul>

suitable for use in baby foods. Malt barley is primarily used for beer and food malt, which is a flavouring in many products such as candy and malt drinks.

Similar to oats, barley contains beta-glucan, a soluble fiber shown to help reduce cholesterol levels, although in barley, the amount of beta-glucan is lower than in oats. In spite of this, barley can be milled to produce high beta-glucan flour, which can be added to other flours to create products with a higher soluble fiber content.<sup>13</sup>

## Oats

Oats are grown in Canada, Finland, the United States and Scotland, and have been a staple food in Scotland for many years.<sup>6</sup> Canada exports about 50% of the oats grown and almost all exports go to the United States.<sup>4</sup> Within Canada, less than 4% of the grains consumed are rolled oats or oatmeal (Figure 1).

Only 5% of all cultivated oats are used for human consumption; most are fed to livestock.<sup>4</sup> Oats destined for human food must be of superior quality, while oats of lower quality enter the animal feed market.

The low oat consumption is somewhat surprising given the nutritional quality of oats. The hulled kernel, called the groat, retains the germ and bran making this grain one of the few grains almost always available as a whole

grain. Although oats have a high amount of fat in the germ compared to other grains, the fat is predominately unsaturated. Oats are a good source of soluble fiber (beta-glucan), which has been shown to help reduce the risk of heart disease.<sup>14</sup> Oatmeal and rolled oats are widely available in grocery stores and are found added to whole grain breads, baked goods and other products.

## Rye

Rye is the only other grain besides wheat that can produce leavened bread without the addition of another grain. Rye bread is denser, darker and heavier than wheat breads, due to rye's lower level of gluten and lower quality of protein.

First cultivated in northwest Europe, rye continues to be a staple in this region. Top rye producers are Russia, Belarus, Poland and Germany. In Canada, Saskatchewan is the main producer of rye.<sup>4,5</sup>

Rye flour is found in different colours and textures based on how it is milled. Dark rye flour used in pumpernickel bread is often, but not always, whole grain. Medium or light rye flour usually has the bran and germ removed and is therefore not whole grain. Whole grain rye has a high level of lignan, an insoluble fiber that also functions as a phytoestrogen. Check the label to see if the rye bread is whole grain.

Millet <sup>15</sup>	Sorghum <sup>10</sup>	Spelt <sup>3</sup>	Teff <sup>15</sup>	Triticale <sup>3,7</sup>	Wild rice <sup>7,16</sup>
<ul style="list-style-type: none"> <li>6th largest grain crop worldwide</li> <li>leading staple grain in India</li> </ul>	<ul style="list-style-type: none"> <li>5th most important grain crop in the world</li> <li>produced in the United States, India and Nigeria</li> </ul>	<ul style="list-style-type: none"> <li>grown in small amounts in Canada</li> <li>primarily grown in Germany, Switzerland, and the United States</li> </ul>	<ul style="list-style-type: none"> <li>produced primarily in Ethiopia where it is a major crop</li> <li>is the main ingredient in Ethiopian flatbread called injera</li> </ul>	<ul style="list-style-type: none"> <li>grown in small amounts in Canada</li> </ul>	<ul style="list-style-type: none"> <li>is native to Canada</li> <li>Canada and US grow commercial wild rice</li> <li>was a staple food in the diet of Ojibway, Menomini and Cree</li> </ul>
<ul style="list-style-type: none"> <li>primitive grain with a nutty, mildly sweet flavour</li> <li>used in North America primarily as a birdseed or in poultry feed</li> </ul>	<ul style="list-style-type: none"> <li>also called Milo</li> <li>versatile crop that can be boiled like rice, cracked like oats for porridge, malted like barley for beer, baked like wheat into flatbread and popped like popcorn</li> </ul>	<ul style="list-style-type: none"> <li>primitive grain that is the parent of modern day wheat</li> <li>known as dinkel in Germany</li> <li>along with emmer, known as farro in Italy</li> </ul>	<ul style="list-style-type: none"> <li>teff is the smallest grain in the world</li> <li>brought to the US in 1980's by Wayne Carlson who started The Teff Company</li> </ul>	<ul style="list-style-type: none"> <li>cross between wheat and rye</li> </ul>	<ul style="list-style-type: none"> <li>not part of the rice family</li> <li>wild rice belongs to the grass family</li> <li>dark kernels with a soft chewy texture and nutty flavour</li> </ul>
<ul style="list-style-type: none"> <li>gluten free</li> <li>high level of iron</li> </ul>	<ul style="list-style-type: none"> <li>gluten free</li> <li>protein has a low level of digestibility</li> </ul>	<ul style="list-style-type: none"> <li>considered less allergenic than wheat</li> </ul>	<ul style="list-style-type: none"> <li>gluten free</li> <li>is a good source of calcium, phosphorous, iron and thiamin</li> <li>good source of protein including the amino acid lysine</li> </ul>	<ul style="list-style-type: none"> <li>has a lower energy content compared to other grains</li> <li>good source of protein including the amino acid lysine</li> </ul>	<ul style="list-style-type: none"> <li>similar protein content to wheat</li> <li>very low in fat and most is either linolenic or linoleic acid</li> </ul>
<ul style="list-style-type: none"> <li>can be used in soups, cereals, breads, pilaf and other baked goods</li> <li>added to breads with multiple grains</li> </ul>	<ul style="list-style-type: none"> <li>Japanese sorghum snacks</li> </ul>	<ul style="list-style-type: none"> <li>available in a flour, whole grain or flake form in health food stores</li> <li>found in breads and breakfast cereals</li> </ul>	<ul style="list-style-type: none"> <li>injera is available in Ethiopian restaurants or stores</li> </ul>	<ul style="list-style-type: none"> <li>found in breakfast cereals, pancakes, breads with multiple grains, muffins, crackers</li> </ul>	<ul style="list-style-type: none"> <li>commercial wild rice is found in the rice section of many grocery stores and specialty stores</li> <li>used in rice mixtures and in soups</li> </ul>

NB: All these lesser known grains are available in health food stores or specialty stores.

## Not Quite Grains

There are several seeds that are often grouped with grains for a number of reasons. Some have a similar structure to grain kernels and are processed similarly. Others have found their way into grain products and have been used as substitutes for grains.

### Flaxseed

Flaxseed is an important oilseed crop in Canada where 40% of the world's flaxseed is produced. Canada ranks as the largest exporter of flaxseed and most exported flaxseed makes its way into linseed oil (used in paints, solvents and linoleum flooring) rather than into food.<sup>4</sup>

Flaxseed has garnered extensive research attention for its polyunsaturated fatty acid and lignan content. Flaxseed is a rich source of omega-3 fatty acids. Higher intakes of omega-3 fatty acids are associated with a decreased risk of chronic diseases such as heart disease. Lignans are both antioxidants as well as phytochemicals. Flaxseed is a good source of these compounds, which may play a role in the reduction of certain cancers.<sup>17</sup>

Flaxseed is often added to baked goods, such as breads, or sold whole to sprinkle on cereals, salads and desserts or ground for use in baking.

### Buckwheat

Buckwheat is a seed from a broad leafed annual plant. In structure and chemistry, it resembles grains and as a result is milled like grain. Although North America produces only about 1% of the world production of buckwheat, Canada and the United States are the world's largest exporters.<sup>18,19</sup>

Most buckwheat in Canada is used for human consumption as flour or groats. The flour is often blended with wheat flour for bread, or used to produce Japanese noodles called soba noodles, or added to breakfast cereals or pancakes. Groats, milled into grits and roasted, can become a dish called kasha.<sup>19</sup>

Although buckwheat flour is high in protein, the protease inhibitors and tannins reduce its digestibility. Buckwheat does contain antioxidants such as flavonoids and lignans.<sup>19</sup>

### Quinoa (pronounced key-wa or keen-wah)

Quinoa is a seed from a plant that is a relative of swiss chard and beets. It is grown primarily in South America and is a rich source of protein, including the amino acid lysine. Cooked quinoa delivers about 3g grams *each* of fat and fiber in a 125 mL serving. It must be rinsed prior to cooking to remove the bitter coating of resin called saponin. Quinoa is often used in place of rice or as a hot breakfast cereal.<sup>8,10</sup>

## Conclusion

Although there are only a few grains that provide most of the food supply worldwide, within each grain there are numerous varieties and products. In addition, the less familiar grains are shifting from novelty to mainstream, gathering devoted followers along the way. Grains – old and new – are readily available and can boost both the nutritional value and the variety of our diets. Grain diversity can awaken new interest in healthy eating.

## References

1. Statistics Canada, Agriculture Division. Supply and Disposition of Cereals-Canada, 2005.
2. Wesley A, Ranum P, eds. Fortification Handbook: Vitamin and mineral fortification of wheat flour and maize meal. The Micronutrient Initiative 2004 [http://www.micronutrient.org/resources/publications/Fort\\_handbook.pdf](http://www.micronutrient.org/resources/publications/Fort_handbook.pdf) (accessed March 2006).
3. Stallknecht GF, Gilbertson KM, Ranney JE. Alternative wheat cereals as food grains: Einkorn, emmer, spelt, kamut, and triticale. p156-170. In: J. Janick(ed), Progress in new crops. ASHS Press, Alexandria, VA. [www.hort.purdue.edu/newcrop/proceedings1996/V3-156.html#Table%201](http://www.hort.purdue.edu/newcrop/proceedings1996/V3-156.html#Table%201) (accessed March 2006).
4. Agriculture and Agri-Food Canada, Market Analysis Division. Grains and oilseeds—Canada: Handling, marketing, processing. 5th edition. Canadian International Grains Institute, 2004 [www.cigi.ca](http://www.cigi.ca) (accessed March 2006).
5. Whole Grains Council. Whole grains, from A to Z. [www.wholegrainscouncil.org](http://www.wholegrainscouncil.org) (accessed March 2006).
6. Grains Institute, University of Minnesota Whole grains overview [www.wholegrain.umn.edu/grains/index.cfm](http://www.wholegrain.umn.edu/grains/index.cfm) (accessed March 2006).
7. Weslund A. Plant Sciences 59 Cereal Crops online course. University of Saskatchewan <http://www.usask.ca/agriculture/plantsci/classes/plsc59/index.htm> (accessed March 2006).
8. Kamut Brand [www.kamut.com](http://www.kamut.com) (accessed March 2006).
9. USA Rice Federation [www.usarice.com](http://www.usarice.com) (accessed March 2006).
10. US Grains Council [www.grains.org/page.wv?section=Barley%2C+Corn+%26+Sorghum&name=Barley](http://www.grains.org/page.wv?section=Barley%2C+Corn+%26+Sorghum&name=Barley) (accessed March 2006).
11. Adom KK, Liu RH. Antioxidant activity of grains. J Agric Food Chem 2002; 50:6182-87.
12. Alberta Barley Commission [www.albertabarley.com](http://www.albertabarley.com) (accessed March 2006).
13. Keagy PM, et al. Health-promoting properties of a high beta-glucan barley fraction. Nutrition Today 2001; 36(3):121.
14. Kapica C. Oats—Nature's functional food. Nutrition Today 2001; 36(2):56.
15. Board on Science and Technology for International Development, National Research Council. Lost Crops of Africa: Volume 1: Grains. National Academies Press, 1996 <http://www.nap.edu/catalog/2305.html>.
16. Oelke EA, Teynor TM, Carter PR, et al. Wild Rice. In : University of Wisconsin : Centre for Alternative Plant & Animal Products and the Minnesota Extension Service, Alternative Field Crops Manual. [www.hort.purdue.edu/newcrop/afcm/wildrice.html](http://www.hort.purdue.edu/newcrop/afcm/wildrice.html) (accessed March 2006).
17. Oomah BD, Mazza G. Health benefits of phytochemicals from selected Canadian crops. Trends in Food Sci Tech 1999; 10:193-8.
18. Umin V. Buckwheat production in Canada: Market Report. North American Buckwheat Promotional Committee. [www.gov.mb.ca/agriculture/crops/specialcrops/pdf/bib03s01.pdf](http://www.gov.mb.ca/agriculture/crops/specialcrops/pdf/bib03s01.pdf) (accessed March 2006).
19. Izydorczyk M, Przybylski R, Campbell C. Buckwheat promotion. <http://www.specialcrops.mb.ca/crops/buckwheat.html> (accessed March 2006).

## Baking Association of Canada

7895 Tranmere Dr, Ste 202 Mississauga, ON L5S 1V9

Tel: 905-405-0288, Toll Free in Canada & USA 1-888-674-BAKE (2253) Fax: 905-405-0993 E-Mail: info@baking.ca

May be reproduced without permission provided no changes are made and credit is given. Printed April 2006.

Visit [www.GrainsEssential.ca](http://www.GrainsEssential.ca) or [www.cwb.ca](http://www.cwb.ca) to download PDFs of this resource.

