Whole grains

09 July 2015

Grains are the seeds of cereal crops such as wheat, rye, rice, oats or barley. They have been a staple food for humans for thousands of years.

Nowadays, it is widely recognised that foods made with whole grains can make an important contribution to our health and wellbeing. Whole grains provide benefits relating to the many individual nutrients and bioactive compounds (also called phytochemicals) they contain. Extensive research has examined the link between regular consumption of whole grain foods and the risk of heart disease, certain types of cancer, type 2 diabetes, and body-weight management.

This review looks at the definition of “whole grain” and what qualifies as a whole grain food. Current intakes of whole grains, and dietary guidelines in different countries are presented, along with data on current understanding of the health benefits of whole grain.

1. What does whole grain mean?

The term “grain” applies to the species of the grass family and includes the cereal grains wheat, rice, barley, maize (corn), rye and oats and the term “pseudocereals” applies to amaranth, buckwheat, quinoa and wild rice. All these grains are structurally similar and are made up of three distinct sections: the outer fibre-rich bran, the micronutrient-rich germ and the starchy main ‘body’ of the kernel known as the endosperm. Oilseeds, and pulses and other legumes are not classed as grains.
Historically there has been some variation in the definition of “whole grain”. However since 2010 the EU-funded project HEALTHGRAIN identified the need to develop a European definition. There is now a growing international consensus that whole grains “consist of the intact, ground, cracked or flaked kernel”, which, “after removal of the inedible parts such as the hull or husk”, must contain “the same relative proportions of starchy endosperm, germ and bran found in the intact kernel. Small losses of components, that is less than 2% of the grain or 10% of the bran, that occur through processing are allowed”.

Whole grain can be a food on its own such as oatmeal, brown (red, black, or wild) rice or popcorn. Alternatively, it can be processed and used as an ingredient in a product.

When whole grain ingredients are used to make breads, pasta, crackers, breakfast cereals, and other grain-based foods, inconsistency exists between countries as to what qualifies as a whole grain food product. Discussions are ongoing to unify the definition of whole grain foods and provide consistent guidance for researchers, labelling purposes and dietary guidelines. The HEALTHGRAIN Forum, the follow-up organisation of the HEALTHGRAIN project, is currently working on a more comprehensive definition which is expected to be published in 2016.

2. The nutritional composition of whole grains

The bran is the multi-layered outer skin, which along with the husk, helps to protect the other two parts of the kernel from sunlight, pests, and water. The bran contains fibre, minerals such as iron, zinc, copper and
magnesium, vitamin E, B vitamins, and a multitude of other bioactive compounds. Bioactive compounds (such as flavonoids, carotenoids) have a beneficial biological action in the body, and emerging research suggests they may, together with fibre be responsible for many of the health effects of whole grains.

The germ is the embryo, which will sprout into a new plant under favourable conditions. It contains essential unsaturated fats, B vitamins, vitamin E, selenium, antioxidants, plant sterols, and other bioactive compounds.

The endosperm is the germ's initial food supply, providing essential energy. The endosperm is the largest portion of the kernel, and contains largely starchy carbohydrates, some proteins, and small amounts of fibre, vitamins and minerals.

Although all grains have the same basic structure, the precise balance of nutrients and bioactive compounds they contain varies by species, the cultivar used, and the growing conditions. Some examples comparing the nutritional composition of different grain species and their whole grain (green column) and refined (white column) varieties are in the table below. The dietary fibre content is made up of different types of fibre which varies between grain species. Wheat and rye are higher in insoluble and less fermentable fibre like cellulose; oats and barley are rich in fermentable, soluble fibre like beta-glucans. The health benefits are explained in the section “Health effects of whole grains”.

Table 1. Nutritional composition of different whole grain and refined grains, per 100 g

<table>
<thead>
<tr>
<th></th>
<th>Whole wheat flour</th>
<th>White, wheat flour, 75% extr action</th>
<th>Rye flour</th>
<th>Rye flour, 60% extr action</th>
<th>Brown rice (raw)</th>
<th>White rice (raw)</th>
<th>Barley (whole grain raw)</th>
<th>Pearl barley</th>
<th>Oatmeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates, g (% of energy)</td>
<td>62 (75.6)</td>
<td>71 (80.6)</td>
<td>59.2 (71.4)</td>
<td>73 (85)</td>
<td>73.5 (82.4)</td>
<td>78 (87)</td>
<td>60.8 (72.8)</td>
<td>67 (79)</td>
<td>60.7 (63.9)</td>
</tr>
<tr>
<td>Protein, g (% of energy)</td>
<td>10 (12.2)</td>
<td>12.6 (14.3)</td>
<td>10 (13)</td>
<td>8 (9.3)</td>
<td>8.3 (9.3)</td>
<td>7 (8)</td>
<td>10.6 (12.7)</td>
<td>9 (10.6)</td>
<td>12.8 (13.2)</td>
</tr>
<tr>
<td>Fat, g (% of energy)</td>
<td>2 (5.5)</td>
<td>1.1 (2.8)</td>
<td>2 (5.8)</td>
<td>1 (2.6)</td>
<td>2.6 (6.6)</td>
<td>1 (2.6)</td>
<td>2.1 (5.7)</td>
<td>2 (5.3)</td>
<td>7.3 (18.1)</td>
</tr>
<tr>
<td>Dietary fibre, g</td>
<td>11</td>
<td>4</td>
<td>15</td>
<td>5</td>
<td>3</td>
<td>1.3</td>
<td>14.8</td>
<td>8.6</td>
<td>7.3</td>
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<tr>
<td>Vitamins</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Vitamin B&lt;sup&gt;1&lt;/sup&gt; (Thiamine), mg</td>
<td>0.4</td>
<td>0.07</td>
<td>0.4</td>
<td>0.15</td>
<td>0.34</td>
<td>0.04</td>
<td>0.31</td>
<td>0.03</td>
<td>0.60</td>
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<tr>
<td>Vitamin B&lt;sup&gt;2&lt;/sup&gt; (Riboflavin), mg</td>
<td>0.15</td>
<td>0.04</td>
<td>0.2</td>
<td>0.07</td>
<td>0.03</td>
<td>0.03</td>
<td>0.10</td>
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<tr>
<td>Vitamin B&lt;sup&gt;3&lt;/sup&gt; (Niacin), mg</td>
<td>5.7</td>
<td>1</td>
<td>1.7</td>
<td>1</td>
<td>6.1</td>
<td>1</td>
<td>5.2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Vitamin B&lt;sup&gt;6&lt;/sup&gt; (Pyridoxine), mg</td>
<td>0.35</td>
<td>0.12</td>
<td>0.22</td>
<td>0.23</td>
<td>0.25</td>
<td>0.12</td>
<td>0.56</td>
<td>0.25</td>
<td>0.12</td>
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<tr>
<td>Vitamin B&lt;sup&gt;9&lt;/sup&gt; (Folate), µg</td>
<td>37</td>
<td>22</td>
<td>78</td>
<td>28</td>
<td>49</td>
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<td>Minerals</td>
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<td></td>
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<tr>
<td>Iron, mg</td>
<td>4</td>
<td>0.8</td>
<td>4</td>
<td>1.5</td>
<td>1.3</td>
<td>0.4</td>
<td>6.0</td>
<td>2</td>
<td>4.0</td>
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<tr>
<td>Zinc, mg</td>
<td>2.9</td>
<td>0.64</td>
<td>3</td>
<td>1.3</td>
<td>0.8</td>
<td>1.8</td>
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<td>2</td>
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<tr>
<td>Magnesium, mg</td>
<td>124</td>
<td>20</td>
<td>92</td>
<td>51</td>
<td>157</td>
<td>13</td>
<td>91</td>
<td>44</td>
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<td>Sodium, mg</td>
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<td>5</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

*Varies between products and countries. Check nutritional information on pre-packed product labels.

Impact of processing

Processing can also affect the nutritional value of cereals. For example when grains are milled into flour, the intact botanical structures are opened, which lowers the amount of resistant starch (a type of starch that is not fully broken down and absorbed). Thus milling makes the nutrients more available for digestion. During wet processing such as soaking, fermentation of dough or in the preparation of porridge, another component called phytate may be degraded (broken down). Phytate binds minerals like copper and iron (decreasing their bio-availability), so its degradation may increase the availability of such micronutrients for
absorption and use in the body.

After the kernel has been subjected to food processing techniques that alter its physical form (such as cracking, crushing, flaking, thermal treatment, milling), it must retain the same relative proportions of bran, germ and endosperm as the original grain in order to be classified as “whole grain”.

The widely used practices of recombination (when the bran, the germ and the endosperm of the same cereal batch have been separated, processed and recombined in the final flour) and reconstitution (same practice, but the fractions come from different batches of the same cereal grain) are acceptable, as long as GMP (Good Manufacturing Practice) is observed during production.

3. Health effects of whole grains

The majority of observational studies of free living populations have found an inverse association between whole grain consumption and certain diseases, where those consuming more whole grains have a lower risk of the disease. A recent prospective analysis suggests intake of whole grains and cereal fibre may reduce the risk of all-cause mortality and death. There is some inconsistency between studies, particularly the criteria for which foods qualify as whole grain. For example, historically bran and cereals enriched with bran or fibre were included into the working definition of whole grain. Hence the effects of whole grains could not be isolated from the effects of dietary fibre in such early studies. It appears that cereal fibre and/or bran may account for much of the reduced risk of chronic disease and death associated with eating whole grains. Some of the mechanisms underlying the health effects may relate to individual species. For example oat fibre, specifically beta-glucans, have been found to lower cholesterol.

Observational studies identify an association, and intervention trials such as Randomised Controlled Trials (RCTs), test whether there is a real cause and effect between following a diet containing whole grain and a reduced risk of disease. There is considerable inconsistency between Randomised Controlled Trials (RCTs), possibly due to differences in study design such as duration of the study, population chosen (ill or healthy), type of whole grain chosen, and compliance with the test diet.

Research on the impact of whole grains on heart disease, cancer, gastrointestinal health, diabetes, and weight management is discussed below.

Cardiovascular disease

Early observational studies consistently found that individuals taking 3 or more servings of whole grain per day have a 20 to 30% lower risk of cardiovascular events (heart disease or stroke) compared to individuals with lower intakes of these foods. In many of these studies the impact of whole grain could not be differentiated from that of bran, as explained above. More recent analyses have been able to isolate the impact of whole grain. A meta analysis of 10 prospective studies, where populations were followed over time, reported a 21% reduction in CVD risk in people consuming an average of 48-80 g/day of whole grain
(equivalent to 3-5 servings), compared to those consuming the lowest level of whole grains. A recent study of two large prospective studies that followed 118,000 men and women for over 20 years found a significant inverse association between whole grain intake and death from CVD. In particular Wu et al. estimated that for every 28 g/day of whole grain consumed there was a 9% lower risk of death from CVD.

RCTs examining the impact of diets rich in whole grains on markers for CVD provide mixed results. For example, the WHOLEHEART study, which examined the effect of an increased whole grain intake for 16 weeks in over 300 overweight participants, did not find any significant changes in cholesterol levels, blood pressure or body weight. The lack of effect may be due to the difficulties in prescribing dietary changes in intervention studies, which may not reflect the diets of people who normally consume whole grains. For example, in this intervention the dietary changes to increase whole grain intake concurrently reduced fruit consumption which may have offset any health benefits of the whole grains. RCTs which combine a reduced energy intake with increased whole grain intake have shown significantly greater reductions in blood pressure, and abdominal fat, compared to low-energy diets alone. A meta-analysis which pooled results from 21 RCTs found that a higher whole grain intake lowers fasting blood glucose, insulin, total and low density cholesterol, blood pressure, and weight gain.

Potential mechanisms for this health effect have been proposed, but are not fully understood. Components of some whole grains (including soluble fibre like beta-glucan, alpha-tocotrienol, and the arginine-lysine ratio), are believed to play a role in lowering blood cholesterol. Whole grains may also decrease risk of heart disease through their antioxidant content. Oxidative stress and inflammation are predominant pathological factors for several major diseases and it has been suggested that the variety of bioactive compounds found in whole grains may directly or indirectly inhibit oxidative stress and inflammation. Other bioactive compounds are believed to play a role in vascular reactivity, clotting, and insulin sensitivity.

Colorectal Cancer

Evidence suggests that a high intake of dietary fibre, in particular cereal fibre and whole grains, appear to be associated with a reduced risk of colorectal cancers, although there is some inconsistency between studies. This is supported by a recent meta-analysis of 25 prospective observational studies. The study found that for every 10 g of cereal fibre consumed or every 90 g (three 30 g portions) of whole grain consumed per day, there is a 10% or 20% reduction in the risk of colorectal cancer, respectively. Similarly, a major prospective observational study of over 40,000 men found that whole grain consumption was associated with a lower mortality, specifically from colorectal cancer.

Several mechanisms by which whole grains protect against bowel cancer have been proposed. The fibre in whole grain foods may decrease the risk of colorectal cancer by increasing stool bulk and speeding up the excretion of waste, thus reducing the contact time between carcinogens (cancer producing substances) and the gut lining. Certain types of fibre and resistant starches can also be fermented in the colon which produces protective substances used by the gut wall. Whole grains also contain antioxidants that help protect against oxidative damage and inflammation, which may play a role in cancer development. Further possible mechanisms by which whole grains support bowel function and may reduce cancer risk are in the section on gastrointestinal health below.
The European Cancer Organisation acknowledges the importance of whole grain in the prevention of cancer and encourages a diet with plenty of whole grains.

Diabetes

Early observational studies consistently reported a 20 to 40% lower risk of type 2 diabetes (T2D) in people consuming the most whole grain, bran and cereal fibre compared to those consuming the lowest.\(^8,11,12,33-35\) Again the effect of whole grain was not distinguished from that of bran or cereal fibre.\(^8\) A review carried out by The German Nutrition Society stated that prospective observational studies consistently indicate that a high intake of whole grain products or dietary fibre from cereal products causes a lower risk of diabetes.\(^12\) A recent meta-analysis of 6 prospective observational studies found a 26% lower risk of T2D in those consuming 48-80 g whole grain/day (equivalent to 3-5 servings) compared to those with the lowest intakes.\(^9\) A recent study examining the impact of whole grains on the development of T2D in over 72,000 women found an inverse dose response effect: the higher the intake of whole grains, the lower the risk of T2D.

RCTs indicate that intake of whole grains improves blood glucose control, may lower fasting insulin levels, and decreases insulin resistance.\(^4,9,11,33,37\) This suggests that eating whole grains may increase insulin sensitivity (how responsive cells are to insulin, which controls blood sugar levels).

The level of processing of whole grain foods can influence the rate of digestion, which in turn affects the metabolic response to its consumption. The following stepwise increases in insulin responses based on the physical nature of the whole grain have been observed - whole grains < cracked grains < coarse flour < fine flour.\(^39\) Thus different forms of whole grain have a different impact on glucose metabolism.

Overall current observational data suggests that whole grains are protective against the development of type 2 diabetes but long-term RCTs are needed to clarify the complex relationship between whole grains, dietary fibre, carbohydrate metabolism and the metabolic response.

Weight management & body composition

Emerging evidence suggests that intake of whole grains may contribute to maintaining a healthy weight. Long-term prospective observational studies show that people who include whole grains as part of a healthful diet are less likely to gain weight over time.\(^8,9,11,41\) These studies have found that a higher intake of whole grains, equivalent to 3 servings (48 g)/day is associated with a lower body mass index (weight in relation to height), smaller waist circumference, and lower body fat levels.

The evidence from RCTs of the effects of diets containing whole grain foods compared to non-whole grain foods on body weight is less consistent. For example, a review of data from 26 studies found consumption of whole grain foods compared to refined foods had no overall effect on body weight status but may have a beneficial effect on the level of body fat.\(^42\) Larger and more long-term intervention studies are needed to more thoroughly investigate whether whole grain intake is just a marker for a healthier lifestyle or a factor which favours a lower body weight.
Multiple mechanisms by which eating whole grains may support weight management have been suggested. For example, whole grain foods have a lower energy density (kilocalories/unit weight), they also contain more non-digestible carbohydrates compared to refined cereal foods. Studies comparing feelings of fullness, or actual food intake, after eating whole grains compared with refined grain controls indicate a trend towards increased satiety for whole grains. This may be mediated via a slowing of digestion, and the consequential impact on blood glucose and insulin responses or the modulation of gut bacteria and the subsequent impact on satiety signals via hunger hormones.

Gastrointestinal health

Gastrointestinal health is determined by the maintenance of efficient digestion and optimal immune responses, minimal inflammation and the absence of disease. The gastrointestinal tract is constantly exposed to pathogens and toxins from food and drink as well as to metabolites formed in the body from food constituents and excreted into the gut via bile. Whole grains contain insoluble cereal fibre that provides bulk in the intestine and speeds up the removal of toxins. Other components of whole grains, such as soluble fibres and resistant starches, act as prebiotics. Prebiotics are non-digestible carbohydrates that can selectively increase the amount of beneficial gut bacteria that combat pathogens. Fermentation of certain types of fibre also produces short chain fatty acids which have anti-inflammatory effects and increase barrier function in the gut lining cells. Micronutrients in whole grains such as folate and vitamin B₆, along with polyphenols and other antioxidant compounds, work together to reduce inflammation and lower the pathogen load. It is suggested that whole grain consumption reduces the risk of colorectal cancer through synergistic effects between the many anti-carcinogenic compounds they contain and the fermentation of whole grain components by gut bacteria.

Health claims

Health claims are designed to inform consumers and encourage consumption of healthier foods. To ensure harmonisation of health claims across Europe, EU Regulation 1924/2006, Nutrition and Health Claims made on Foods, came into force on 1st July 2007. The European Commission and Member States together, are responsible for approving health claims, and they are advised by the European Food Safety Authority (EFSA).

The EU has approved health claims relating to specific components of whole grains such as beta-glucans from oats. Foods providing at least 3 g oat beta-glucans per day can claim to maintain or even reduce blood cholesterol. However, the beta-glucans do not necessarily have to come from whole grain oats, it could, for example, be from added oat fibre. A food containing 6 g rye fibre/100 g of food can claim to improve bowel function. Foods providing at least 6 g of wheat bran/100 g food can claim it contributes to an increase in faecal bulk. If it provides 10 g wheat bran/day a food can also claim it contributes to a reduction in transit time (the time taken for faecal waste to travel through the gut).

In 2010, EFSA provided a scientific opinion on health claims related to ‘whole grain’. The health claims were related to gut health/bowel function, weight control, blood glucose/insulin levels, weight management, blood cholesterol, satiety, glycaemic index, digestive function and cardiovascular health. As
whole grain foods are defined differently across countries, including within the EU, it was considered “…that the food constituent, whole grain, […] is not sufficiently characterised in relation to the claimed health effects…” On the basis of the data provided the Panel concluded “…that a cause and effect relationship cannot be established between the consumption of whole grain and the claimed effects considered in this opinion.” The US Food and Drug Administration has approved health claims whereby certain foods containing more than 51% whole grains can claim to reduce the risk of heart disease and certain cancers.

4. Recommendations for cereal grain consumption

Cereal grains are a good source of carbohydrates and fibre, and the World Health Organisation as well as national dietary guidelines encourage the consumption of starchy and fibre-rich foods. As scientific knowledge of the health benefits of whole grains has emerged, whole grains are now specifically encouraged. Recommendations relating to whole grains vary from being general, for example “eat starchy foods like bread, rice or pasta at every meal, preferably whole grain” or “consume at least half of all grains as whole grain,” to more prescriptive with precise portions or grams per day. The table below shows some current whole grain guidelines that vary between countries according to cultural dietary habits.

Examples of dietary recommendations including whole grain foods

<table>
<thead>
<tr>
<th>Organisation, Country</th>
<th>Dietary recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Health England</td>
<td>Eat plenty of bread, rice, potatoes, pasta and other starchy foods – choose whole grain varieties when you can.</td>
</tr>
<tr>
<td>Austria</td>
<td>Four servings of grains, breads, pasta, rice or potatoes a day (five servings for active athletes and children). Prefer whole grain products.</td>
</tr>
<tr>
<td>Food and Health Authorities in Denmark, Sweden and Norway</td>
<td>At least 75 g of whole grains/day, or 90 g/day for men and 70 g/day for women.</td>
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<tr>
<td>The Netherlands Nutrition Centre</td>
<td>Two to seven servings of whole grain bread (depending on age and sex).</td>
</tr>
<tr>
<td>Greece</td>
<td>Eight servings per day of whole grain food products.</td>
</tr>
<tr>
<td>Department of Agriculture (USDA), United States</td>
<td>Three to eight ounce equivalents of grains per day depending on age and sex, very active people may be able to consume more. Consume at least half of all grains as whole grains. Increase whole-grain intake by replacing refined grains with whole grains.</td>
</tr>
</tbody>
</table>
### Health Canada

Three to eight servings of grain products per day depending on age and sex. Make at least half of these grain products whole grain.  

### Australian Government

Four to eight servings of grain products per day depending on age and sex, mostly whole grain and/or high cereal fibre varieties. Pregnant women are recommended to eat at least eight and a half servings, and breastfeeding woman nine servings per day.

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1 serving of grains =

1 slice of bread

75-120g (¼ cup) of cooked rice, or pasta, about the size of an adult’s fistful

30 g (⅓ cup) dry oats, or other cereal

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### 5. Consumption of whole grains

Whole grain is not routinely measured in national dietary surveys in many parts of the world. Most data comes from the US and Northern European countries. Currently the vast majority of people do not achieve the national recommendations. For example in the UK, over 70% ate less than ~2 servings (32 g whole grain), with 18% of adults and 15% children/teenagers not consuming any whole grain at all.  

This is similar to consumption in the US, where according to a recent report of the Department of Agriculture (USDA), only 7% of Americans achieved 3 whole grain portions a day. A recent study in France shows that 55% of children and 68% of adults in France do not consume any whole grain; and among the French that do eat whole grains, half of them eat less than 10 g per day.  

Nineteen percent of German children and adolescents do not consume any whole grain and intakes overall were around half the amount recommended. In Irish children and adolescents, the picture is a little better with over 90% consuming some whole grains, mainly in the form of ready-to-eat cereals, although the average intake was still low at around half the recommended 3 portions at day.

By contrast, Scandinavians tend to have higher intakes of whole grains mainly due to their reliance on whole grain rye bread as a staple food. It is difficult to compare studies due to differences in measurement but data suggest that intakes in Norway are four times greater than in the UK. Despite this, average whole grain intakes in Sweden, Denmark and Norway are still below the current recommended level of 75 g/day (NB. study samples may not be representative of the population). The percentage of Scandinavians achieving the current recommendation varies from between 16% for Danish men and 35% in Norwegian women. Men seem to consume more whole grain than women, but this may simply be because of a greater total food intake. In the UK, higher levels of education and income are linked with a greater intake of whole grain, whereas in Finland the highest intakes of rye bread were observed in the lower social
The Danish Wholegrain Campaign in 2009 aimed to increase whole grain content in foods and increase consumers’ knowledge about whole grain products. Whole grain consumption in Denmark has reportedly increased (from 32 g in the 2000-2004 dietary survey to 55 g per day in the 2011-2012 survey), and the proportion of Danes meeting the recommended daily intake has also increased from 6% to 27%.

6. Innovations in the food supply

Barriers to the consumption of whole grain foods include the perception of the appearance, taste and flavour of these products, as well as their cost. Food manufacturers can help by creating high quality less expensive new products with the best taste possible, and by reformulating existing products to contain increased levels of whole grains while avoiding increases in sugar or fat.

HEALTHGRAIN was a European project (EU FP6 funded, 2005-2010) initiated to increase the intake of protective compounds in whole grains. The project explored new methods to incorporate grain-based ingredients with high nutritional value into consumer products that would appeal to European consumers, including products suitable for individuals with gluten-related disorders. A number of novel technologies have been developed for dry milling, wet processing and for fermentation, to increase levels of health relevant components, whilst delivering good sensory properties such as taste and texture. A follow-up project, HealthBread (EU FP7 funded, 2012-2014), further optimised these technologies, and developed cost-effective means of producing bread products that taste similar to white bread and have a nutritional content at least similar to wholegrain.

Another strategy is to produce food products containing a mix of whole grain and refined cereals. These foods may be produced for various reasons including improved shelf-life and stability but they also have a more familiar taste and can help people train their palates towards the nuttier whole grain flavour. For example it has been shown that replacing refined grain foods with partially whole grain foods (25-50%) is a good strategy for increasing whole grain intake in children and adolescents.

Other traditional whole grains, such as oats and barley, are gaining popularity with consumers. Whole grain barley, wheat and rice are also now available in quick-cooking varieties (for wheat and rice, pre-cooked varieties that can be prepared in a few minutes in the microwave).

7. How to eat more whole grains

Intake of whole grains can be increased simply by swapping some portions of refined starchy staples for whole grain varieties. Swapping food choices rather than eating additional food helps maintain energy intake and hence energy balance (and body weight). Increasing the consumption of whole grains should be done progressively to let the body adapt to a higher fibre intake.

Table 3. Suggestions of whole grain choices
### Type of food | Whole grain option
---|---
Breakfast cereals | Porridge made with rolled oats or oatmeal  
Whole-wheat cereals  
Puffed whole grains  
Whole grain muesli and cereal bars

Bread and crackers | Rye bread (pumpernickel), wholemeal, and sometimes granary or mixed grain breads (check the label).  
Whole-wheat crackers, rye crackers and crispbreads  
Whole grain rice cakes  
Oatcakes

Flour | Wholemeal flour, buckwheat flour, whole rye and whole barley flour, oatmeal and oat flour, and sometimes wheat germ (check the label)

Meal accompaniments | Brown rice, whole-wheat pasta, whole barley, bulgur wheat (cracked wheat), quinoa, barley (not pearl)

### How to recognise whole grain foods?

It might seem simple to find a whole grain product, but just because it is brown or it states that it is high in fibre does not necessarily mean it contains whole grains. Although there is a common labelling requirement for food products in the European Union, the term “whole grain” is not yet harmonised in Europe as a food ingredient. However the following may help consumers identify foods containing whole grains.

**Product name:**

To verify that a product is whole grain, consumers should be encouraged to look beyond a product’s name. Descriptive words in the product’s name, such as stone-ground, multi-grain, 100% wheat, or bran, do not necessarily indicate that a product is whole grain. As a general guide, look out for the word ‘whole’ as in “wholemeal”, “whole grain” or “100% whole wheat” on the packaging.

**Ingredient statement:**

The ingredient statement will list whole grains by the specific grain, such as whole-wheat flour, whole oats, or whole grain corn. In many whole grain foods, a whole grain is among the first ingredients listed. Where foods have been made with several different whole grains these may be noted further down on the list of ingredients but may also qualify as a whole grain food. Foods calling attention to their whole grain content need to clarify the amount contained.
Colour/Texture:

The brown colour of a food is not an indication of content of whole grains (e.g. some breads may be brown because molasses or caramel colouring have been added). Many whole grain products, such as cereals, are light in colour. Also, whole grain foods are not always dry or gritty; some may be dense with a pleasant “nutty” flavour or light and flaky like a cereal grain.

Fibre content:

Just because a product is high in fibre does not automatically mean that it is whole grain. For example, food enriched with wheat or oat bran may be high in fibre but it does not necessarily contain the whole grains. On the other hand, the fibre content of a whole grain food varies depending on the type of grain, amount of bran, density of the product, and moisture content.

Graphic:

In Europe there is currently no officially endorsed logo for whole grain content. Manufacturers may use their own graphical illustrations as part of package design to highlight ingredients such as whole grain. Whereas in the US and Canada, members of the Whole Grain Council, can use the “Whole Grain Stamp” logos on whole grain products, which indicate whole grain amount per serving.

In Nordic markets (Norway, Sweden and Denmark), foods which meet certain nutritional criteria, for whole grain but also sugar, fat and salt content, are easily recognisable with a green keyhole tick on the label. However, consumers may not be aware that the conditions of the logo include whole grain.

8. Bottom line

Most of the healthful components in whole grains are found in the germ and bran that are removed when producing refined cereals such as white flour. Simply switching from refined to whole grain foods would increase the level of fibre, micronutrients and many other bioactive compounds in the diet. Health campaigns are encouraging consumers to eat more whole grains. With increased availability of appealing whole grain products and improved labelling and sign posting of whole grain foods, consumers may find it easier to increase their intake.

Regarding the health effects of whole grain, observational data suggests a protective effect of daily whole grain consumption against cardiovascular disease, diabetes and cancer, and that it aids in weight management. However intervention trials are sometimes inconsistent and mechanisms of action are still being elucidated.

Whole grain foods contain many important nutrients and European and worldwide Health Authorities already encourage consumption of whole grain foods as part of a healthful diet. Further well designed intervention studies may clarify the relationships between whole grains and health, which may result in additional opportunities for developing healthy food products.
More information (in simple terms): [Q&A Whole grain](#)

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