Cereals are the edible seeds or grains of the grass family, Gramineae. A number of cereals are grown in different countries, including rye, oats, barley, maize, triticale, millet and sorghum. On a worldwide basis, wheat and rice are the most important crops, accounting for over 50% of the world's cereal production. All of the cereals share some structural similarities and consist of an embryo (or germ), which contains the genetic material for a new plant, and an endosperm, which is packed with starch grains.

After harvest, correct storage of the grain is important to prevent mould spoilage, pest infestation and grain germination. If dry grains are held for only a few months, minimum nutritional changes will take place, but if the grains are held with a higher amount of moisture, the grain quality can deteriorate because of starch degradation by grain and microbial amylases (enzymes). Milling is the main process associated with cereals, although a range of other techniques is also used to produce a variety of products. Slightly different milling processes are used for the various grains, but the process can generally be described as grinding, sifting, separation and regrinding. The final nutrient content of a cereal after milling will depend on the extent to which the outer bran and aleurone layers are removed, as this is where the fibre, vitamins and minerals tend to be concentrated. There is potential for contamination of cereals and cereal products by pests, mycotoxins, rusts and smuts. Recently, acrylamide (described as a probable carcinogen) has been found in starchy baked foods. No link between acrylamide levels in food and cancer risk has been established and based on the evidence to date, the UK Food Standards Agency has advised the public not to change their diet or cooking methods (Kelly, 2003). However, the EU’s Scientific Committee on Food has endorsed recommendations made by FAO/WHO which include researching the possibility of reducing levels of acrylamide in food by changes in formulation and processing.

Cereals have a long history of use by humans. Cereals are staple foods, and are important sources of nutrients in both developed and developing countries. Cereals and cereal products are an important source of energy, carbohydrate, protein and fibre, as well as containing a range of micronutrients such as vitamin E, some of the B vitamins, magnesium and zinc. In the UK, because of the mandatory fortification of some cereal products (e.g. white flour and therefore white bread) and the voluntary fortification of others (e.g. breakfast cereals), cereals also contribute significant amounts of calcium and iron. Cereals and cereal products may also contain a range of bioactive substances and there is growing interest in the potential health benefits these substances may provide. Further research is required in this area, including identification of other substances within cereals and their bioavailability.

There is evidence to suggest that regular consumption of cereals, specifically wholegrains, may have a role in the prevention of chronic diseases such as coronary heart disease, diabetes and colorectal cancer. The exact mechanisms by which cereals convey beneficial effects on health are not clear. It is likely that a number of factors may be involved, e.g. their micronutrient content, their fibre content and/or their glycaemic index. As there may be a number of positive health effects associated with eating wholegrain cereals, encouraging their consumption seems a prudent public health approach. To increase consumption of wholegrain foods, it may be useful to have a quantitative recommendation. Additionally, a wider range of wholegrain foods that are quick and easy to prepare would help people increase their consumption of these foods. As cereal products currently contribute a considerable proportion of the sodium intake of the UK population, manufacturers need to continue to reduce the sodium content of foods such as breakfast cereals and breads where possible.

Nutrition labelling is currently not mandatory in the UK, although many manufacturers provide information voluntarily. The fibre content of most UK foods is still measured using the Englyst method rather than the American Association of Analytical Chemists (AOAC) method used by other EU countries and the USA. However, UK recommendations for fibre intake currently relate to fibre measured by the Englyst method and not the AOAC method, and hence need revisions. EU changes to labelling regulations will see the labelling of common foods and ingredients causing allergic reactions, including cereals containing gluten and products derived from these foods. The introduction of EU legislation covering health claims may help consumers identify foods with proven health benefits.
Nutritional aspects of cereals

Several misconceptions exist among the public with regard to cereals and cereal products. Firstly, many more people believe they have a food intolerance or allergy to these foods than evidence would suggest and, secondly, cereals are seen by some as ‘fattening’. The public should not be encouraged to cut out whole food groups unnecessarily and, as cereals and cereal products provide a range of macro- and micronutrients and fibre, eliminating these foods without appropriate support and advice from a registered dietitian or other health professional could lead to problems in the long term.

In the future it is possible that white flour in the UK may be fortified with folic acid (the synthetic form of the B vitamin folate) to decrease the incidence of neural tube defects during pregnancy. Such a move could also be of benefit for heart health, as poor folate status is associated with high homocysteine levels, an emerging risk factor for cardiovascular disease. However, high intakes of folic acid can mask vitamin B12 deficiency, a condition that occurs more frequently with age and has serious neurological symptoms affecting the peripheral nervous system.

Manipulating the expression of native genes can increase the disease resistance of cereal crops. Novel-genes may also be used for this purpose, as well as for developing cereals with resistance to herbicides, and cereals with improved nutritional properties (e.g. increased levels of iron in cereals and of beta-carotene in rice). The long-term consequences and consumer acceptability of such advances must be considered and consumer choice maintained. There is a continual growth in the knowledge of the interactions between human genes and nutrients, and in the future it may be possible to target specific nutrition messages to people with specific nutritional profiles.

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