



This Food Science Fact Sheet is one of a series compiled by Institute of Food Science and Technology, providing clear, concise and scientifically reliable information on key food science topics for consumers.

Cereals and Ancient Grains

Introduction

Cereals provide complex carbohydrates, including dietary fibre and proteins. They are typically low in fat and nutrient dense. Examples include wheat, rice, oats and corn (maize). Breakfast cereals and white flour can be fortified with many essential vitamins and minerals.

There is no official definition of ancient grains, but the accepted term relates to varieties remaining unchanged for several hundred years, compared to more widespread cereals, such as maize, rice, oats, and modern varieties of wheat (*Triticum*), which are the product of years of selective breeding. Examples of ancient grains include, barley, bulgur (cracked wheat), einkorn, emmer, fonio, freekeh, Khorasan wheat (Kamut), rye, sorghum, spelt wheat, teff, wild rice. Also pseudograins (not true cereal grains, but treated as such since similar nutritionally, and used culinarily like them), such as amaranth, buckwheat, chia, millet and quinoa.

Cereals and grains are used in the production of bakery products, gluten-free products, animal feed, meat fillings, dairy analogues, breakfast cereals, extruded snacks, baby foods and pasta, for example.

Why should we consume cereals?

Cereal fibre, especially wholegrain, is beneficial and important to the diet as can reduce the risk of developing diseases, such as coronary heart disease, colon cancer and type 2 diabetes. Complex carbohydrates are a good source of energy within the diet as cereals allow for the slow release of energy after being consumed.

Usages around the world

Quinoa is a native grain of the Andean region (e.g. Peru, Bolivia) roasted and made into flour which can be used for bread, breakfast cereals, soup, pasta and fermented beer. It is highly nutritious and genetically diverse with an ability to grow in different agri-environmental conditions.

Amaranth is commonly mixed with chocolate or rice in Mexico, and also a staple in Ethiopia and India. It can be used for baby food and added to soups. It is high in fibre and can reduce the risk of colon cancer and type 2 diabetes.

Sorghum is a subsistence crop in Asia (e.g. China, India) and Africa (e.g. Nigeria, Sudan, Zambia) used for thickening porridge, in fermented and unfermented bread production, beer and malted flours. Varieties range from white to reddish brown in colour.

Chia seeds are harvested from the *Salvia hispanica* plant, a staple in Latin America (e.g. Mexico, Guatemala), it is used as a thickener for sauces and soups, a sugar replacer for homemade jam, and a substitute for egg. It is advantageous to health as is a source of potassium, which contributes to the maintenance of normal blood pressure, is high in fibre and a rich source of calcium for bone health.

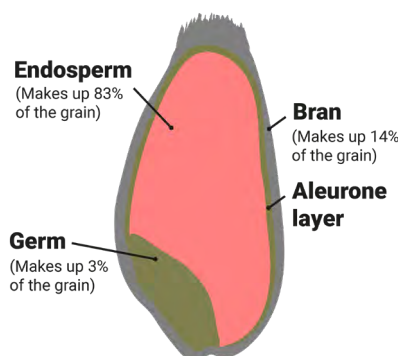
Millet sustains a third of the world's population and is a staple in Asia (e.g. India, China) and Africa (e.g. Mali, Nigeria, Niger). It is easily digestible and gluten-free; can be added to cakes, breakfast cereals, salads and unleavened breads. Toasting, with the addition of liquid, enhances a nutty flavour. It is a good source of manganese and dietary fibre.

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The structure of a wheat grain

A whole wheat grain, or kernel, comprises three edible parts: bran, germ, and endosperm, protected from damage, from sunlight, water, and pests, by the husk. During the milling process, they are separated, then recombined depending on the flour type. White flour consists of only the starchy endosperm. Brown flour contains endosperm with some added bran and wheat germ. Wholemeal flour is ground whole wheat.

ANATOMY OF A WHEAT GRAIN



Dietary recommendations

The Scientific Advisory Committee on Nutrition (SACN) assessed the evidence for links between fibre and health outcomes. It was found that regular consumption of fibre reduces the risk of cardiovascular disease, type 2 diabetes, and colorectal cancer. SACN recommend 30g dietary fibre per day for UK adults, whereas actual average intake is around half of that, depending on age and gender. There are also specific recommendations for children which are not achieved either. It is also recommended to swap out starchy foods, in particular refined products, such as white bread and white rice, for wholemeal or wholegrain alternatives. The Eatwell Guide is a helpful visual representation of the UK Government's recommendations for a healthy balanced diet. It is based on five food groups and how much one should consume from each. It recommends starchy foods account for just over a third of the diet.

How does cereal impact Glycaemic Index (GI)?

This is a rating system for foods containing carbohydrates which shows how quickly food impacts blood glucose levels. Foods with high GI include white and wholemeal bread. Low or medium

rated foods e.g. oats (for porridge), basmati rice, bulgur wheat, barley, and couscous, are broken down more slowly, and over time will cause a gradual rise in blood glucose. High GI foods are not necessarily unhealthy, and low or medium foods are not necessarily healthy, hence attention to GI alone is not a good way to decide whether foods or meals are better.

Other benefits of cereals and grains

Cereals such as wheat, rice and maize aid food availability and address malnutrition globally, due to being rich sources of energy. Biofortification is a breeding technique to reduce the risk of mineral and vitamin deficiencies particularly in developing countries. This is typically achieved by conventional selective breeding or genetic engineering.

What are the allergen and intolerance risks?

Cereals containing the water insoluble protein gluten, namely wheat (including specific varieties such as spelt and Khorasan), rye, barley, oats (and their hybridised strains) and products thereof, are listed as allergens in EU regulations, emphasised in the ingredients list (usually in bold) on prepacked foods. Some products are exempt from allergen labelling because the process undertaken to extract them means that they are gluten-free, for example wheat-based glucose syrups and dextrose. Varieties of oats have been bred to be gluten-free. Foods labelled as gluten-free in the EU/UK must contain no more than 20mg/kg gluten.

Coeliac disease is an autoimmune disorder, rather than an allergy, and has a different mechanism. When gluten is consumed, the immune system attacks the body's gut tissue which means that the body cannot absorb the required nutrients, due to damage of the small intestine.



References

- [Gluten labelling advice - FDF](#)
- [Overview of starchy foods - British Nutrition Foundation](#)
- [What is the Glycaemic Index? - NHS](#)
- [Eatwell Guide - NHS](#)