

Much Ado About Gluten?

How do ancient grains compare with modern grains, and can gluten and wheat lead to obesity and disease? Can we separate the wheat from the chaff in terms of “what is true?”

by Prof Dr Fred Brouns

Social media and popular books, such as *Wheat Belly* by William Davis and *The Grain Brain* by David Perlmutter, suggest that eating cereals, cereal products and bread, mainly wheat, makes many people ill. They claim that it leads to obesity and diabetes and to adverse effects on the brain and that eating cereals containing gluten lead to ADHD, epilepsy, autism and even Alzheimer’s disease.

The belief that the best thing to do is to stop eating bread is reinforced by claims made by celebrities from the world of show business and sport. For many people, these individuals act as role models, and their claims that they feel better if they don’t eat cereal products have a significant influence on the public. But what is true about grains and gluten?

In this context, following discussions in the Food and Health working group of the international Health Grain Forum, the universities of Maastricht and Wageningen, in collaboration with the Dutch Bakery Center (Nederlands Bakkerij Centrum) and Leeds University and Rothamsted Research Institute in the UK, embarked on a major research project entitled Well on Wheat? (WoW). In addition to donations from the cereals-processing chain, this project is financed by the Dutch government’s Top Sector Agri-food initiative. The WoW research primarily focuses on which substances in wheat could cause health problems in some people. Who, when,

how and why are key questions in this context. If we know exactly which substances are involved, it may be possible to eliminate them in the future by using new technologies and targeted seed processing.

Inside Grains and Gluten

Grains belong to the grass family. Among others, this includes wheat, rye, barley, oats and spelt, as well as rice, maize and other grains that are less common in Europe, such as millet (which is mainly eaten in India, Africa and China), sorghum (Africa, US) and teff (Africa). These are all grains that grow well in areas with low rainfall. Some of these grains contain gluten; others don’t. Quinoa (South America) and chia seeds (South America, Mexico) are not grains at all but are often promoted as gluten-free alter-

natives. Of all the grains, wheat is the most commonly grown gluten-containing grain.

History of Wheat

Types of wheat have probably existed for millions of years. The oldest forms are diploid (such as modern einkorn) and tetraploid (such as modern emmer and durum wheats), but modern hexaploid bread wheat only originated about 11,000 years ago. These forms originated from genetically related grass species with the A, B and D genomes (see figure 1), with the tetraploid and hexaploid forms having arisen by natural hybridizations. These ancestors, and therefore also the genomes of the grains that are cultivated today, are extremely old. They all contain gluten protein. The gluten composition and baking qualities are therefore deter-

mined by the genetic characteristics of the A, B and D genomes and combinations thereof.

Selection Process

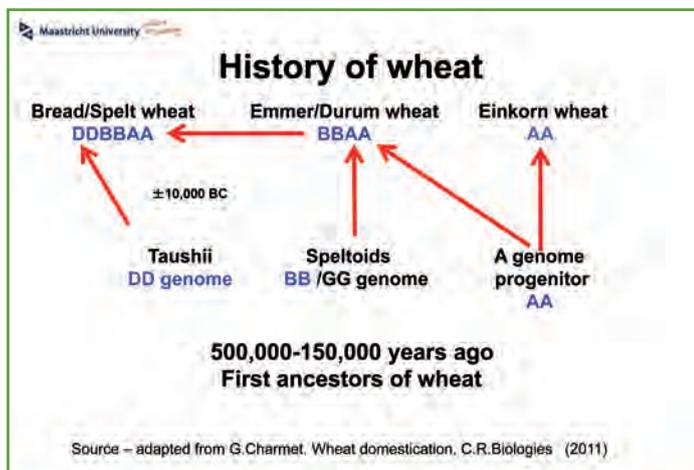
In a continuous selection process, farmers finally selected a handful of wheat varieties that were the most attractive regarding yield and workload from the available species. Ultimately, some 11,000 years ago, the popular bread wheat that we consume today produced the best result. It was simply a natural variant with an excellent yield (i.e., it was not a genetically modified grain). Bread wheat produces a yield that is 2-4 times greater than, and also has far better baking qualities, other supposed wheat species such as einkorn, emmer and spelt.

The rash claim made by many that we have only been eating grains for 10,000 years would appear to be incorrect. Archaeological finds, such as microscopic remains in the holes of millstones found in Ohalo near the Sea of Galilee in Israel, and in the dental enamel of Neanderthals living in Belgium, confirm that, as well as plants, tubers and fruit, people were already eating wheat, rye and barley some 50,000 years ago.

The oldest known bread, a kind of pitta bread, was already being baked by hunter-gatherers who lived at the end of the paleolithic age. This type of bread was easy to dry and store for times when food was scarce. So, the claim



Figure 1: A History of Wheat



by many followers of the Paleo diet that our early ancestors ate no grains at all is untrue. Who knows, people may well have been eating ancient wheat varieties far earlier than that, but we just haven't found the evidence to prove it yet.

What is Gluten?

Gluten is a type of protein that belongs to the prolamins group. It is contained in wheat, rye, bar-

ley and spelt. It comprises two components, gliadin and glutenin, which, following the addition of water and salt, form an elastic structure as a result of kneading. It's a bit like the elastic skin of a balloon.

When you blow air into it, the surface expands but the air can't get out, so the balloon "rises." If you burst this skin, the balloon goes down. This is similar to kneaded dough in which

yeast and bacteria, in a process called fermentation, form gases that can't escape through the elastic gluten. As a result, the dough rises. If you then prick the dough with a knife or a fork, it sinks and the gases escape. Gluten is therefore responsible for the good baking qualities of bread, giving it an elastic, aerated structure. Gluten-free grains, therefore, produce a far smaller and more compact loaf.

Gluten Content

One question that people often ask is whether bread wheat contains more gluten than other (older) wheat varieties. The leading European Health Grain Research Consortium has conducted an in-depth study into the composition of wheat. Here, 150 varieties of wheat from seed banks were sown, cultivated and harvested under exactly the same conditions. The results of the analysis indicated that more recent varieties contain less gluten and more starch than older varieties (see figure 2). This dis-

pels the myth that the grains that we eat today contain more gluten than older grains.

It is clear, however, that the type and composition of the protein fragments (peptides) vary depending on the genome of the grain. Whether this impacts on the occurrence and severity of health issues is the subject of much international research.

Plant Protection

It is also clear that the content of other protein components, such as the natural plant protection protein amylase-trypsin inhibitor (ATI), varies according to the type of grain. ATIs inhibit the digestion of starch and protein in harmful predators such as insects, rendering them harmless.

ATIs appear to be resistant to exposure to heat (boiling, baking), gastric acid and digestive enzymes in the gut. Consequently, once the grain product has been consumed, ATIs remain mostly intact and can cause immune reactions in the gut of people who are sensitive to them.

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Figure 2: Wheat Protein Changes Over Time

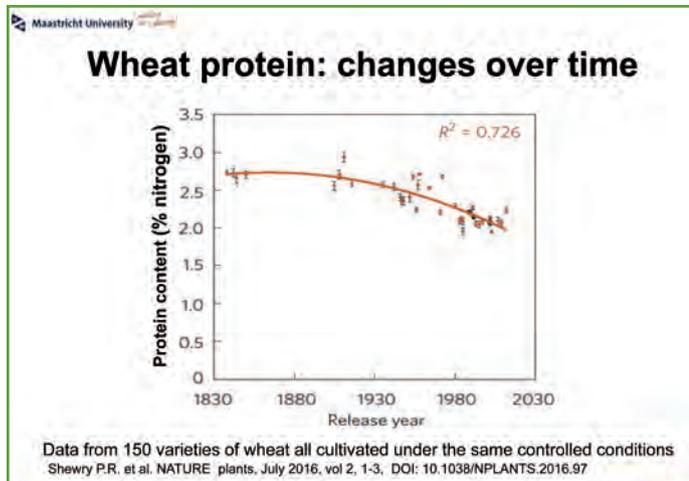
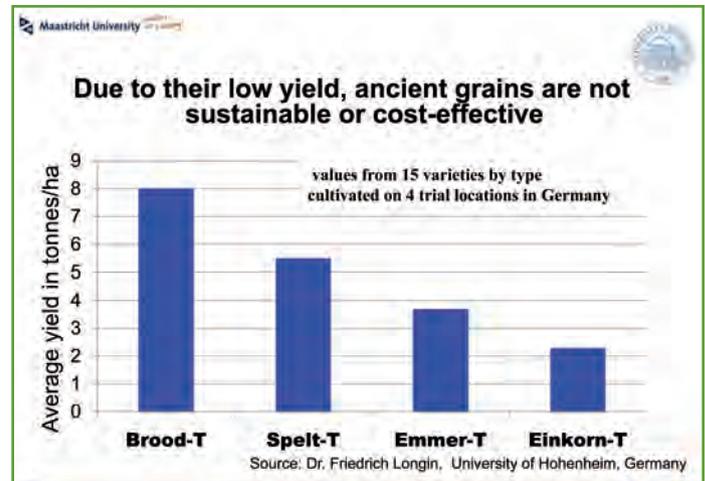


Figure 3: Average Yield of Selected Grains



would be a retrograde step. In this respect, researchers from the University of Hohenheim in Germany studied the yield of “ancient grains” is currently available. It is grown on experimental plots with the same soil and climatological conditions. Nitrogen fertilizer load was adapted for each wheat type to help avoid the risk of lodging (i.e. the bending over of the stems near the ground level in grain crops,

which makes them very difficult to harvest and can dramatically reduce yield). The research group irrefutably demonstrated that the yield of ancient wheat types was considerably lower than that of bread wheat. Spelt, Emmer and Einkorn yielded 40-70 percent less (see figure 3).

Hypersensitivity Reactions

Can wheat lead to intolerance or hypersensitivity reactions? The

answer to this question is definitely yes. For example, celiac disease, a chronic immune response to the presence of undigested gluten fragments (peptides), causes damage to the small intestine. The intestinal villi lose their structure, which ultimately results in a “flat” intestinal surface. This leads to a significant decrease in the ability to digest and absorb, which in turn leads to bowel problems,

diarrhea and nutrient deficiency. Celiac disease only occurs in people with a specific hereditary predisposition, however.

Depending on the country in which data are collected, this occurs in approximately 20-40 percent of the population. Of this group, 2-3 percent will go on to develop the disease. In the total population, this equates to about 1 percent, although the actual percentage may be

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higher because far from everyone is diagnosed. However, diagnosis is straightforward using specific antibodies that can be detected in the blood.

Contrary to what is often suggested in the media, celiac disease is not an allergy. It is an immune response related disease condition that develops over many months. In an allergy, the symptoms usually improve within a few hours of exposure, e.g., asthmatic conditions (generally in combination with physical effort) or skin irritations. About 0.2-0.5 percent of the population are allergic to wheat proteins. This is demonstrated by the formation of IgE antibodies, which can be detected in the blood.

Non-Celiac Gluten Sensitivity

Recently, another type of adverse reaction known as non-celiac gluten sensitivity, or sometimes as “wheat-sensitive irritable bowel syndrome,” has been described. This can give rise to specific bowel problems but also to general malaise, headaches and muscle and joint pain.

It is not yet clear which substance or substances in wheat play a key causative role in this.

Nor, as yet, is there an effective diagnostic test. Some work suggests that gluten may be causative but other work invalidates this. Some researchers suggest ATIs to play a role and others feel it is primarily, rapidly fermentable indigestible carbohydrates (FODMaPs). Moreover, there appears to be an overlap of symptoms as experienced in celiac disease, irritable bowel syndrome and food allergy. The puzzle is very complex.

Consequently, if a person perceives that the consumption of wheat or gluten may cause specific health problems, it is crucial that they consult a doctor in the first instance to exclude the presence of celiac disease. If the diagnosis is negative, they can then take steps to completely avoid wheat and other gluten-containing grains for a period of between three and six months to establish whether their health problems disappear.

It is necessary to do this over a long period because of significant nocebo effects (the opposite of placebo effects) can occur, and these generally take several months to subside. If their health problems do indeed disappear, they can then double check by

eating grains once again for a short period. If their health problems come back, it is an indication that they would be better off avoiding wheat and gluten on a lifelong basis. If, however, their health problems don't come back, they don't need to do this.

Inside FODMaPs

As well as proteins, indigestible, rapidly fermentable carbohydrates (FODMaPs) such as fructans, which are present in grains in small amounts, can lead to the formation of gas. This is particularly true for people who suffer from irritable bowel syndrome. For these individuals, avoiding FODMaPs can have a beneficial effect on the severity of their condition and the associated sense of well-being.

However, this does not apply to everyone. The formation of gas through fermentation is not a sign of illness, allergies or inflammation. Carbohydrate fermentation in the large intestine is a process that generally offers health benefits.

Intake Recommendations

So, to get back to the crux of this story. According to international recommendations, people

should be eating more whole-grain products, the majority of which contain wheat and gluten. Wholegrain means the entire grain, e.g., grains of wheat, rye, barley, brown rice and maize kernels.

Wholegrain flour means that all the substances present in the intact grain of cereal are also present in the flour. When, way back when grains were “ground” by hand and millstone, the ultimate result was wholegrain flour.

Everything that was in the grain was also in the flour. With modern milling technology, however, this has totally changed.

Nowadays, you can separate the various components of the grain during the milling process. This has advantages in that the unsaturated fats in the germ are subject to oxidation (turn rancid), so wholegrain flour has a relatively short shelf life. Refined flour, i.e., flour without the germ and bran (white flour), therefore has a far longer shelf-life.

By adding fresh germ and bran to the refined white flour at a later stage, a wholegrain composition can still be reconstituted. Another benefit of these separate milling flows is that a far greater range of products can be produced.

One disadvantage is that many tasty products made from white flour, such as white bread and cookies, no longer contain many of the nutrients that are present in high concentrations in the germ and bran. Consequently, white flour is comprised mainly of starch and protein. So, from a health perspective, it is better to choose products made from refined white flour less often and to opt instead for wholegrain products. ▼

› Inside Grains: In Summary

- Grains are the world's number one food source.
- Ancient wheat varieties are not demonstrably healthier than bread wheat, nor are they more sustainable.
- Bread wheat has not been genetically modified, it is the result of a natural cross-fertilization in the wild.
- Some people develop health problems as a result of eating wheat and other gluten-containing grains. The role of ATIs, which are always present together with gluten protein, requires further research.
- It is estimated that a couple of percent of the population suffer from wheat-sensitive irritable bowel syndrome. It is not yet known which substance or substances cause this primarily and as yet there is no effective test and diagnosis.
- As a result of fermentation, indigestible, rapidly fermentable carbohydrate fibers (FODMaPs) may give rise to the formation of gas, which is particularly difficult for people who suffer from irritable bowel syndrome.
- People who have been diagnosed as wheat and/or gluten intolerant must avoid wheat and gluten completely. They must choose gluten-free, fiber-rich alternatives such as brown rice, wild rice, oats, buckwheat, quinoa, teff, amaranth, millet, sorghum and maize.
- The impact on health of consuming wholegrains appears to be relatively stronger than the effects of consuming fruit and vegetables. Thus, eating fruit, vegetables and wholegrain products on a daily basis will do the majority of the population good.
- The majority of the population can eat wheat and gluten without any problems. Bread will, therefore, remain on the menu, in the future too.
- Persons with intolerance to grains need special attention.

This article is an extract of a report published by the “Well on Wheat?” consortium. For the full article: www.wellonwheat.org => publications Prof. Dr. Fred Brouns works at the University of Maastricht in the Netherlands and is a partner on the “Well on Wheat?” consortium. For more information: Fred.Brouns@Maastrichtuniversity.nl