The anti grain in diet lobby does start from some truths about the consumption of grain/bread but completely ignores others.

They ignore that the cultivation of wheat and other cereals and their consumption is historically the corner stone of farming, of the change from nomadic hunter gathering to settled human habitation – cultivation and consumption of cereals is the most successful and important part of the human diet in “historic” times.

What the anti-grain lobby latches onto is the nature of a cereal grain. The vast majority of the volume of a grain is a locked store of food/energy for the plant germ to feed on when and if it finds the right conditions to germinate. As such it is designed to withstand decay and to be unattractive as a food source to other life forms in the form of being indigestible to them, to the degree of being actively anti-nutritious in some respects.

One principle respect in which grains are indigestible, anti-nutritious is their phytic acid (aka phytin) component concentrated in the bran and aleourone (directly under the bran) layers. Phytic acid is an insoluble (in water) form of phosphorus keeping the phosphate needed for plant growth unavailable till needed at germination. Phytic acid when digested by life forms unable to turn this phosphorous into a soluble version also binds (“chellates”) to various nutritionally important minerals as zinc, iron, magnesium and calcium making these also unavailable to the “thief”. See <http://en.wikipedia.org/wiki/Phytic_acid>

Likewise the “storage proteins”, gliadin and glutenin that make up gluten are insoluble in water though gliadin is soluble in dilute acid and glutenin in diluted alcohol.

The key(s) to breaking down these elements to digestible formats for the plant at germination or for any would be “thief” are enzymes. So the grain does for instance contain inhibitors/blockers for the activity of the form of alpha amylase (starch digester) specific to certain insects.

Precisely this unattractiveness to other life forms as a source of food is why the early farmers hit on its cultivation, the ability to store grain for long periods, especially through winter season with relatively little threat of its “theft”. Other animals have evolved to digest grain, the ruminants, who have in particular their own supply of the enzyme phytase in their secondary stomachs to digest phytic acid – hence also domestication of sheep, goats and cows as part of farming since its inception.

Lacking a significant internal supply of phytase and other enzymes necessary for grain digestion they key to human consumption of grain is of course its processing prior to consumption. The first step is of course the breaking of the outer protective layer of the grain, milling. Subsequent steps are essentially the mimicking of the processes of unlocking the food content of the grain that happens at germination, a sequence of activation of numerous groups of enzymes (phytases, amylases - to chop starch into simpler sugars, proteases, lipoxygenases, pentosanases, xylanase and more).

Clearly it’s the historical mastery of the processing of grain into a digestible form for humans that the anti-grain diet proponents ignore. But is it possible that they have a point in that the historical process is no longer being correctly performed and/or modern grain, in particular wheat, is no longer as responsive to the process?

First in the case of the plant, has currently grown wheat undergone significant changes that might affect its digestibility for us?

There is a significant cut off between heritage and modern wheat varieties. In the early 1960s US wheat breeder, Norman Boraug at the CIMMYT research centre in Mexico laid the cornerstone of the so-called Green Revolution, the crossing of hitherto one metre plus wheat varieties with the Japanese dwarf wheat Norren 10 to produce plants less than half metre tall. The effect of this was that synthetic fertilizer could be applied to the crop, increasing yield of grain, without the crop inevitably falling over (lodging) at maturity as would be the case with previous taller varieties. The price of the higher yield (HYV) short varieties is the plant no longer out competes weeds in the same manner as taller lines, so in conventional farming herbicides are applied to the crop area. The consequence of this in conjunction with the genetic homogeneity of a modern single line cultivar (and limited choice of varieties in cultivation across fields/farms/regions/countries) is that the crop is more vulnerable to epidemic scale attack by pest or disease and as a result conventional farmers spray pesticides and fungicides as a preventative routine. Clearly all this chemical use has some bearing on human consumption value but this is not central to the discussion here.

Aside from yield the main thrusts of modern wheat (for milling) breeding have been disease resistance and “bakability”. “Bakability” refers to keeping a high gluten level despite higher yields (the relationship is normally inverse) and good gliadin/glutentin balance within the gluten. The gliadins, especially α-gliadins are thought to be the main culprits for those suffering from celiac (or coelica) disease.

In 2010 Dutch researchers led by Hetty C. van den Broeck <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2963738/> think they have found that the expression of the gliadins too which the highest proportion of celiac sufferers react to has increased in a selection of modern wheats in comparison to a selection of heritage wheats tested by them. The mechanism by which this change may have taken place given that wheat breeders have not been consciously selecting for specific gliadins is unclear but most probably possibly relates to selection for general “bakability”. However its not really transparent how the basket of modern wheats and basket of heritage wheats used in this research was chosen. One possibility is that at the genetic diversity bottlekneck that is the initial “Green Revolution” wheat breeding event a common ancestor(s) was introduced carrying expressed alleles for producing these particular versions of gliadians that CD sufferers tend to react worst to. Historical records of wheat germplasm flow such as the information given here <http://apps.cimmyt.org/Research/economics/map/facts_trends/wft9596/htm/wft9596part1_1.htm#WheatOrigins> could be used to identify more coherently possible “culprits” in modern wheat ancestry.

Another clear difference between modern and heritage wheats would appear to be total protein levels. After the 2012 harvest the Brockwell Bake Association sent three heritage wheat samples to <http://www.niab.com/pages/id/4/Laboratory_Services> which tests thousands of samples of UK grown wheat per season. Results as follows.

|  |  |  |
| --- | --- | --- |
| **NIABs ref no** | **Sample Id** | **Protein content (g/100g dmb)** |
| 1 | Hen Gymro Composite | 13.75 |
| 2 | Lambeth Latino | 14.44 |
| 3 | Red Lammas Composite | 13.69 |

These were in fact the top three protein level results seen by the NIAB lab for the 2102 harvest. Considering the overall reputation of heritage wheats as being less strong in gluten than modern, this might seem very surprising, however the results were not surprising to other UK heritage wheat growers, John Letts and Andrew Wilkinson, or French colleagues in the field. It does not mean to say however that some heritage wheats are as strong or stronger in gluten as modern lines, but rather that there may be higher levels of other proteins, possibly the (water) soluble albumin and globulin and/or significant changes in the types of gliadin and glutenin that give a “stronger” flour result for modern milling ([NABIM group 1](http://www.nabim.org.uk/content/1/102/harvest-data.html)) wheat. In either case the difference here could be quite critical in the digestibility and therefore nutritional value of heritage as opposed to modern, post-Green Revolution wheat lines. More research is needed.

Having considered the plant itself the next question in the progress to consumption is the harvesting process. Farmers have to decide not only which varieties of wheat to grow, when to apply their arsenal of chemicals etc and then when to harvest. [NABIM group 1](http://www.nabim.org.uk/content/1/102/harvest-data.html) milling wheats will not always qualify for milling quality premium. In the UK there are three criterion for passing, protein level, specific weight (weight per metric bushel which will indicate whether sufficient grain size or not) and Hagberg Falling Number.

http://occmed.oxfordjournals.org/content/47/1/21.full.pdf