# Non-celiac wheat sensitivity: should we care about bread wheat ATIs?

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There is great attention in the social media in the perceived health benefits of "ancient grains" and increasing marketing of products to exploit these benefits [1, 2, 3]. However, most of this appears to be based on belief and emotion, rather than on sound scientific data. For example, spelt (Dinkel) is frequently suggested to be much healthier based on the assumption that it contains more dietary fiber, lower FODMaPs and a better overall nutritional profile. In fact, spelt is a form of the same species as bread wheat, being hexaploid with the AABBDD. It is therefore not surprising that detailed studies show that spelt and bread wheat, as sold in the market, have essentially the same compositions (Table 1).

| Component | Unit | Bread wheat | Spel wheat |
|---|---|---|---|
| Water | gram | 10.74 | 11.2 |
| Energy | Kcal | 340 | 338 |
| Protein | gram | 13.21 | 14.57 |
| Lipid | gram | 2.50 | 2.43 |
| Carbohydrate | gram | 71.97 | 70.19 |
| - of which starch | gram | 57.77 | 53.92 |
| - of which fibers | gram | 10.70 | 10.70 |
| - of which sugars | gram | 0.41 | 6.82 |
| Ash | gram | 1.58 | 1.78 |

*Table 1: Composition of different grains. Values are in g/100 grams grain, Source: USDA, Food composition tables 2013.* [4]

Other recent marketing claims state that certain wheat types that do not have the D genome, such as modern durum wheat, "ancient" emmer wheat (which are both forms of the same tetraploid species with the AABB genome), and "ancient" einkorn (which is diploid with the AA genome) are better digestible and do not contain 'harmful D-genome gluten'.

Such wheat species have been marketed under the name '2ab Wheat' with the claim that this wheat type "*only contains ancient gluten, as opposed to modern gluten, which triggers troublesome symptoms in sensitive people suffering from gluten intolerance*". However, such marketing claims may falsely lead to the perception that 2ab wheat is safe for individuals that suffer from gluten intolerance (celiac disease), while in reality, all wheat species, including "ancient" types, contain gluten and all are bio-reactive with regard to immune and inflammation responses seen in celiac disease.

In fact, a research group that addressed this in detail stated "*our findings provide further evidence for the need of a strict gluten-free diet in celiac patients, including avoidance of ancient strains of wheat*" [5,6]

Research has also indicated that wheat amylase trypsin inhibitors (ATIs) may be a causing factor of IgE-mediated wheat allergy, and may also induce adverse reactions as seen in non-celiac gluten sensitivity (NCGS, recently referred to as 'non-celiac wheat sensitivity', NCWS). Indeed, ATIs are known to be wheat allergens [7], but allergy to wheat is a rare phenomenon present in about 0.25-0.30 % of the adult population. In fact, NCWS is characterized by intestinal and extra-intestinal complaints in the absence of wheat allergy and celiac disease by mechanisms that indicate the involvement of the native immune system. NCWS has an estimated prevalence of 3-5% of the population.

However, many questions remain about this type of sensitivity. Because there are at present no clear diagnostic criteria nor diagnostic tests many cases of NCWS are based on self-diagnosis and on the belief/expectation that the perceived complaints are due to the consumption of wheat. Other observations indicating the complexity of NCWS are the overlap of symptoms and blood biomarkers with those observed in patients with celiac disease, irritable bowel syndrome, fibromyalgia, and wheat allergy, and the fact that symptoms improve on a diet free of wheat, barley and rye, all which contain both gluten and ATIs [8,9,10].

At present, however, a true causative role of ATIs in NCWS has not been established. This is partly because about 20 ATI isoforms occur in wheat grains and their relative intestinal bio-reactivities (as measured in *in vitro* tests) have not been established. Furthermore, the presence and proportions of these isoforms vary between wheat species (and possibly also between genotypes within species).

Zevallos et al [11] reported that grains of ancient diploid and tetraploid wheat species contained less ATIs, with lower *in vitro* bioreactivity compared to bread wheat. Accordingly, they suggested that grains of these ancient wheat species may be more tolerated by sensitive individuals. However, more recent research using improved analytical methods showed that the quantitative distribution of 6 selected ATI isoforms differs between wheat types and that emmer and durum wheats have higher levels of total ATIs than bread wheat [12] (Figure 1 below) (disproving the earlier observations of Zevallos et al [11]). Geisslitz et al. [12] further reported that only einkorn wheat contained very low levels of total ATIs. However, only 6 isoforms of ATI were measured and others are known to be present in einkorn wheat.

**Take-home message:** A true causative role of ATIs in NCWS is currently unclear and can only be speculated about. Despite this, marketing claims related to ATI reduction or control may run ahead of science, potentially remaining unsubstantiated. The near future should clarify whether and how

ATIs present in grains and in vital wheat gluten isolated from grains and flour, and cereal products such as beer and starch, are involved in NCWS.

**This is the focus of our next steps in "Well on Wheat?-2."**

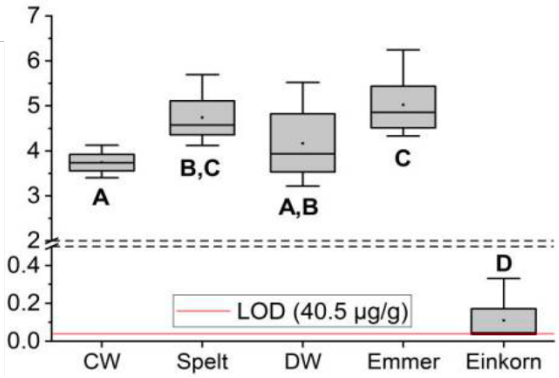


Figure 1. *Amounts of 5 predominant ATIs (0.19+0.53, 0.28, CM2, CM3 and CM16) in 8 cultivars of each wheat type. Data are shown as box plots with median (line in the box), average (point in the box), outliers (points outside the box), minima and maxima (whiskers) and limit of detection (LOD, red line). Source Geisslitz et al 2018 [12]. CW =common wheat=bread wheat, DW= durum wheat*


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