

7 Does Wheat really make you sick and thick?

Books such as “Wheat Belly” or “Grain Brain” are at the top of our bestseller lists. They come up with varying hypotheses and draw curious conclusions such as changing our entire western diet; a diet that has been established throughout the millennia since the beginning of agriculture. The authors of these books suggest in particular that consuming wheat makes us gain weight, speeds up the aging process, is responsible for dementia, diabetes and numerous other diseases. Banning wheat completely from our diet should be our only hope to get healthy. Millions of consumers follow this advice, especially in the USA and Australia, and “gluten free” is a megatrend (Fig. 7-1). Lately there are more and more people in Europe as well declaring to live gluten free. But, is all this just another media hype, promoted on instagram and facebook by popular actors and singers and inflated on health blogs? And is it really gluten that is making us sick? For sure, it is a billion-dollar market.

What is gluten?

Most consumers do not even know what gluten actually is. Gluten, derived from the Latin word *gluten*, meaning glue, is a mixture of proteins that consists mostly of gliadin and glutenin (Fig. 7-2). In bread production, gliadin makes sure that the little bubbles created by the yeast during fermentation process are caught in a type of matrix so that the bread turns out light and fluffy. Glutenin on the other hand influences the dough’s strength and elasticity. When making a dough with wheat flour, both protein types link and form gluten. Gluten helps baked goods keep their form and the amount of gluten determines the baking capacity. Bread and bread roll dough generally have a high gluten content, whereas other baked goods and noodles contain less gluten. This is easily seen when comparing how a baked product rises and



Fig. 7-1: Gluten free products in an American supermarket and in a small bakery in Australia; their bread doesn't even contain eggs or milk.

how light or firm its structure turns out to be. Furthermore gluten can also be found in beer and soy sauce and even in various cosmetic products, where most people don't read the label. Gluten is also present in rye, barley, oats, and even ancient wheat forms like einkorn, emmer, spelt.

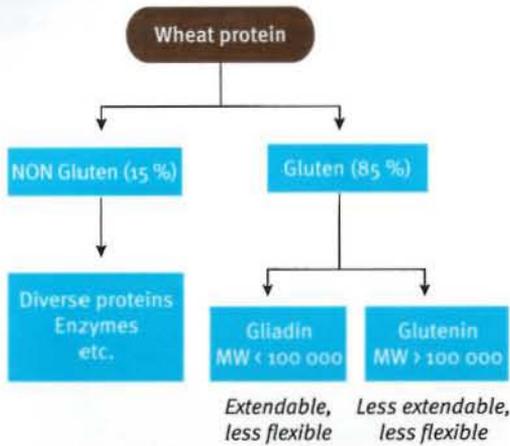


Fig. 7-2: Composition of wheat protein, about 85% are glutens; important for baking quality are gliadins with low and glutenins with high molecular weight (MW).

Three recognized disease patterns caused by wheat – and its relatives

The influence of wheat, or gluten to be precise, on **celiac disease** is uncontested. Celiac disease is an inherited autoimmune disease that leads to a chronic illness of the small intestine. It is caused by a lifelong hypersensitivity to gluten. Approximately 0.5-1% of the population have celiac disease and are affected in very different ways (see Fig. 7-3). Typical symptoms are gastrointestinal disorders, deficiency symptoms and fatigue. However, most people with celiac disease do not have any symptoms, which is called asymptomatic celiac disease. Diagnosing celiac disease happens on several levels. There are blood tests that use so-called IgA-antibodies and anti-TG2-antibodies. Moreover, a colonoscopy thoroughly examines the surface of the villi. Patients with celiac disease have a much smaller amount of and less developed villi and thus a much smaller surface of the colon as well, which leads to deficiency symptoms and the like. After celiac disease has clearly been diagnosed, the only form of treatment is lifelong abstinence from gluten. A gluten-free diet means that the patient can have no more than 20 mg of gluten daily, which corresponds to a bread cube with the size of a cubic centimeter! By law, foods may be marked

“gluten free” when the product contains no more than 20 mg of gluten per kilogram.

There is gluten in every wheat species, i. e. in bread wheat, durum wheat, spelt, emmer, einkorn, Kamut® (Khorasan wheat) as well as in rye and barley. Scientists are studying if oat really can trigger celiac disease – currently it is looking like it cannot, but patients should wait for final scientific analyses. Now, one could try to remove gluten from wheat, either technically or by plant breeding. But it is not that easy. Gluten consists of 2700 different peptide components altogether, approximately 90 of which trigger an unspecific reaction in patients with celiac disease and only a handful of which are responsible for the truly harmful effects this genetically determined disease can cause.

It is gluten in particular that makes wheat excellent for baking, unlike other cereals such as maize, rice, millet or pseudocereals. Without gluten, the traditionally known fluffy, soft and moist, aromatic pastries would quickly turn into dry bricks that nobody would want to eat. And this is exactly the challenge with gluten-free products and the unpleasant part of treating celiac disease. Patients have to abstain from gluten and consequently relinquish their traditional lifestyle, including those appealing baked goods and pasta products. This is why banishing gluten from their diet in general is unimaginable for healthy consumers. And despite the fact that the gluten protein structures in the older wheat species einkorn and emmer are slightly different from those in bread wheat, they still trigger celiac disease. Hence there is nothing to be done about the fact that patients who have been diagnosed with celiac disease will need to relinquish gluten from their diet for the rest of their lives. For further information we recommend the homepage of the Celiac Disease Foundation (<https://celiac.org/>) or similar associations in other countries. Gluten might also be present in some candies, fried foods, broth in soups and bouillon cubes, salad dressings, some lunch meats and hot dogs, malt, soy sauce, seasoned chips and other seasoned snack foods.

The second clearly outlined and diagnosable disease pattern is **wheat allergy** (Fig. 7-3). This can have different effects, but symptoms typical of allergies, including anaphylactic shocks, are generally present. Some patients meanwhile will only have an allergic reaction when doing sports. The wheat allergy is triggered by individual wheat proteins. Less than 1 % of the world population suffers from this type of allergy. It is usually diagnosed through common allergy tests and the only treatment is a life with no allergens, meaning no wheat. As with celiac disease, we need to assume that all wheat species including spelt, emmer, Kamur® (Khorasan-wheat) and einkorn can trigger allergic reactions. Both wheat allergy and celiac disease patients are safe to consume for example millet and pseudocereals (see the following chapters), as well as maize and rice.

Furthermore, there is another much less distinct, but also scientifically accepted disease triggered by wheat called **nonceliac gluten sensitivity**, or NCGS. The symptoms are many, from gastrointestinal disorder to discomfort, fatigue and

others. Spelt processors in particular are frequently confronted with this discussion as there are numerous customers who report discomfort when consuming bread wheat products and who claim that such discomfort is alleviated when eating spelt. Children are often said to be affected as well. Unfortunately, and despite the many opinions stated in various books, on the internet and in other media, it has yet to be scientifically determined what exactly is responsible for the described symptoms. Hence, there is no diagnostic technology either. Typically, doctors will first try to rule out other food allergies, celiac disease and IBS (Irritable Bowel Syndrome) before testing whether or not a wheat-free diet will diminish the patients' symptoms from a medical point of view. Due to this lack of diagnostic technology there are no specific numbers describing how many people are affected by this disease. Experts estimate anywhere from 0.5 to 8 % of the population. There is no definite treatment either as eating less wheat seems to suffice already. It is

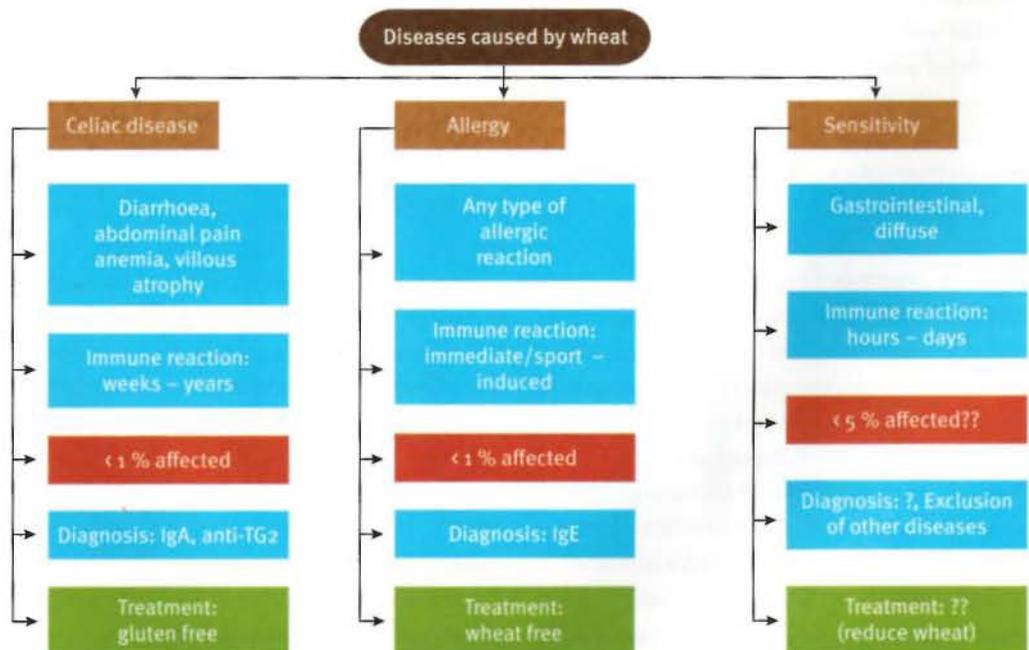


Fig. 7-3: Schematic classification of scientifically acknowledged diseases that can be triggered by wheat (IgA, IgE, anti-TG2 are specific antibodies determined by blood tests).

also unknown whether or not it is safe to consume wheat species other than bread wheat.

Scientists are currently testing two hypotheses that could explain the reason behind sensitivity to wheat. The first one claims that α -Amylase-Trypsin-Inhibitors (ATI) are the trigger for this sensitivity. ATI are proteins with a natural occurrence in wheat and other raw materials. In combination with gluten they are said to induce the immune system's unwanted reaction. Allegedly there is a genetic predisposition for these proteins as well, which means that only a small percentage of the population reacts negatively to ATI. However, there are barely any scientific studies as of yet that show ATI as being the trigger for wheat sensitivity at all. Scientific studies are currently looking into this hypothesis. Initial propositions claiming that newer bread wheat contains more ATI than older wheat species such as einkorn, are wrong. In fact, different cultivars of bread wheat contain different amounts of ATI which are not just influenced by genetics but rather heavily by the environment as well. This environmental influence is not at all surprising, since ATI are proteins within the wheat grain and the protein content of wheat grains highly depends on the location, the cultivation method and the use of fertilizers (cf. chapters 3 & 4).

An alternative hypothesis emanates from a group of nondigestive carbohydrates as well as polyvalent alcohol, the so-called FODMAPs (fermentable oligo-, di-, monosaccharides and polyols), being responsible for wheat sensitivity. This group of substances occurs in a lot of foods, including wheat. Particularly onions, beans and white cabbage have high contents. In wheat, these low-molecular sugars result from incomplete degradation of starch to glucose. These incompletely decomposed sugar components are usually rated positive as they trigger the so-called pre-biotic effect, which is promoted by yoghurt and other foods. But evidently a small percentage of the population experiences trouble digesting these FODMAP substances. Our metabolism already absorbs a part of them in the small

intestine, while the other part moves further into the colon where they are fermented by the bacteria present there. Frequent consumption of cereal products can lead to bloating, flatulence and other gastrointestinal disorders. There is no scientific proof yet that FODMAP is the trigger for wheat sensitivity, but IBS patients seem to experience aggravated symptoms through FODMAP. 15% of the population is estimated to have IBS, whereas most of them have symptoms, but no clear diagnosis. So, their afflictions could well be mixed up with those of patients with wheat sensitivity.

The first studies to specifically test the raw form of grains show at least no vast differences in terms of FODMAP contents in einkorn, spelt or wheat. However, dough and bread production has a huge influence on their content level in the final product. A traditionally long dough process with yeast and particularly the use of sourdough, lead to an almost complete degradation of FODMAP in bread. Contents of ATI seem to reduce in longer dough processes as well. The changes in modern baking techniques in comparison to earlier times could well be one reason for the increased number of patients with wheat sensitivity. In addition to that, more and more additives are being used nowadays, including pure gluten. Especially in whole grain breads, due to the fact that they don't rise as easily as others, bakers add purified gluten. The Australian baking industry has increased its use of gluten by 300% in the last twenty years!

There is obviously a desperate need for scientific research with regard to wheat sensitivity, focusing on the reasons for this disease. But in summary it is important to note that far less than 10% of the population suffers from diseases caused by wheat, and for over 90% of the population a diet containing sufficient amounts of (whole grain) wheat is beneficial for their health (see below).

Rumors and (conscious) misinterpretations about wheat

The authors of bestsellers like "The Wheat Belly" and others hardly refer to the abovementioned

disease patterns at all. Their books make numerous generalizations that can roughly be summarized in the following statement: The increased wheat consumption and the breeding of new wheat cultivars are responsible for all obesity, diabetes and other diseases. On top of that, they claim that wheat is highly addictive and even worse than heroin. We can only give our point of view on a few main points, more detailed information based on scientific research is to be found for example at www.aaccnet.org/publications/plexus/cfw/pastissues/2012/OpenDocuments/CFW-57-4-0177.pdf.

Wheat as the reason for obesity and diabetes

The success in improving these disease patterns by abstinence from wheat, which is what those bestselling authors refer to, is based on a diet with reduced carbohydrates. This reduced amount of carbohydrates is a key component of almost all diets, along with an increase in the amount of workouts, and has nothing to do with wheat. Actually there is clear scientific evidence that nutrition schedules including whole grain foods

lead to considerable reduction in obesity, cardiovascular diseases, diabetes and cancer (see below). Furthermore, the number of patients with obesity in countries with the highest wheat consumption such as Kazakhstan (310 kg/person and year), Algeria and Iran (240 kg each) is far smaller than that in the USA (80 kg) or the EU (105 kg), where people eat a lot less wheat (Fig. 7-4). In countries such as Italy and Greece people eat 75 % more wheat than in the USA and still their obesity rate is only half as high. And, Italians live about three years longer on average than Americans. Both, scientific studies as well as statistical values referring to wheat consumption and obesity diametrically contradict the bestselling authors. Within the last one hundred years, bread consumption in Germany has also reduced by half, from 400 to 500 g per person down to just 220 g. Consequently there should be a lot fewer issues with wheat than before.

Wheat contains addictive substances

There is in fact a protein in gluten that, when degraded, turns into a peptide named gliadorphin that

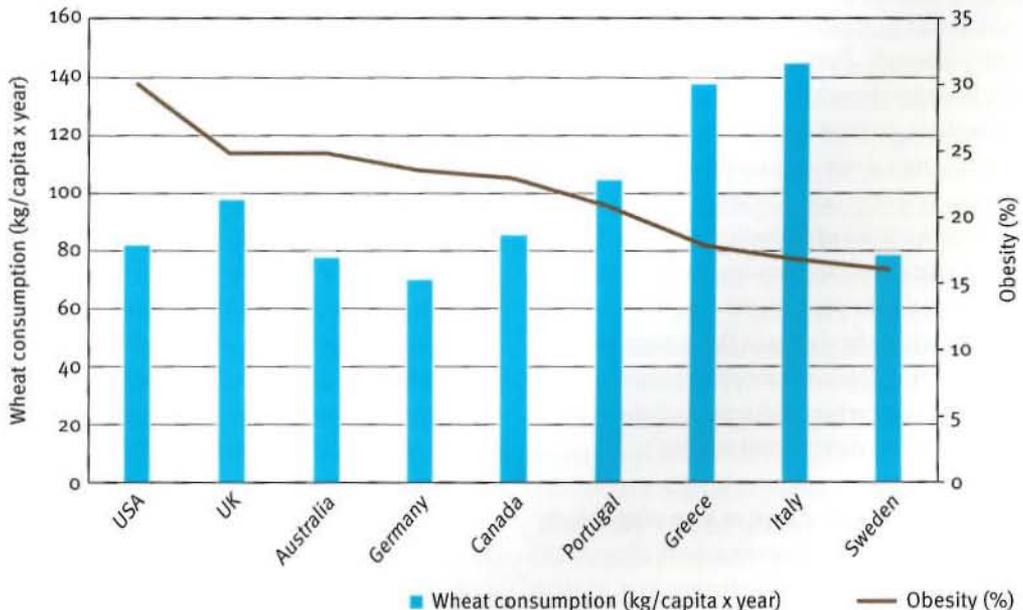


Fig. 7-4: Yearly wheat consumption and obesity rates in countries with a predominantly European population; data: FAO or FAOSTAT 2013.

triggered effects similar to opiates in an experiment with rats. But one has to bear in mind that this peptide has seven amino acids and is therefore too long to be absorbed by the human colon. Before it can even pass the human colon and reach the necessary opiate receptors, it would need to be degraded into smaller components, which would again lead to a complete loss of reactivity. So in this case, based on a single animal experiment, an inaccurate statement was blown out of proportion without even considering the human metabolism.

The breeding of modern wheat cultivars creates new toxic proteins

There is no doubt that the impact of plant breeding over the last century has been profound. The first farmers already started by selecting better wheat cultivars when they sorted through their grains and kept the best ones to be sown again (“the good into the pot, the bad into the crop”). Modern wheat cultivars are much more resistant to plant diseases and are higher yielding, which satisfies the need for food supply for the world population using less and less land and fewer pesticides. Here, breeding accomplishes a socio-political achievement that cannot be rated highly enough. Breeders cannot simply create new proteins though, but they are merely trying to combine positive traits from different wheat cultivars into a new one on the basis of natural crossing and selection. Contrary to the claims of the abovementioned bestselling authors, there is not a single genetically modified wheat cultivar in commercial cultivation worldwide. Furthermore, in contrary to the claims of those same authors, modern wheat cultivars have a lower gluten content than the older wheat cultivars and the ancient wheats such as einkorn and emmer.

Humans could not adapt to digesting wheat

The authors referred to above establish a hypothesis in which wheat is a relatively new and modern phenomenon in the human diet and hence our metabolism has not been able to adapt correspon-

dingly. This is evidently wrong, seen as wheat has been a main source for carbohydrates since the Neolithic revolution about 10 000 years ago. Moreover we have been eating wild wheat forms before that, since these were growing predominantly in the savannas of the Fertile Crescent, the cradle of agriculture (see chapter 1&2). The first wild grains, particularly emmer, barley and oat, were already being ground 23 000 years ago in Ohalo, a region of present-day Israel. Archeologists have even found microparticles from wild forms of wheat, rye and barley in the teeth of Neanderthals, who lived about 45 000 years ago.

Compared to wheat we have been confronted with the consumption of milk and dairy products for example for a much shorter period of time. Originally, only babies and infants who were still being nursed could process and use lactose from breast milk with the help of a particular enzyme (lactase). Usually, the formation of lactase decreases with age and, then, consumption of dairy products will lead to indigestion. Along with domesticating cattle, sheep and goats about 7500 years ago, Northern Europeans have developed the ability to digest lactose in adulthood as well. A reason for this development might be the fact that Northern Europe doesn't see a lot of sun, especially during fall and winter, so that Vitamin D production, which is necessary for our bone structure (calcium resorption), becomes insufficient. Lactose can take over this task and help keep up calcium intake. People in sunnier parts of the world don't need that. This correlates with the fact that 98 % of Scandinavians have no problem digesting dairy products throughout their entire lives, 80 % in Germany, only 30 % in Southern Italy and close to the equator and in several Asian societies a meager 2 %. It also shows that lactose intolerance is no disease but actually normal. Those who have no trouble digesting dairy products throughout their lives represent a relatively recent genetic variation.

A similar phenomenon exists with alcohol, where Europeans developed a much better enzyme

for digestion (alcohol dehydrogenase) than most Asians. The reason for this could be an intense selectivity pressure during the Middle Ages, where people with a higher tolerance for alcohol were clearly preferred. Bearing in mind the bacterial contamination of water at the time, light alcoholic beverages were quite simply life prolonging. In Asia on the other hand alcohol played a less important role as people were drinking tea made with boiled water. So (Northern) Europeans as well as most modern-day Americans, Canadians, and Australians have managed to physiologically adapt to entirely new agricultural products such as dairy products and alcohol, and this within a relatively short evolutionary timeframe. Why shouldn't the same have happened with wheat, seeing as people in Europe and Southwest Asia have been eating it frequently for tens of thousands of years? Not to mention the even shorter evolutionary time within which people have adapted to tropical fruit or even technically modified food such as reduced fat, reduced sugar or similar such products.

These bestselling authors seem to blend very little knowledge with their own interpretations and often false causal connections. Furthermore, they hide clear scientific discoveries or misinterpret them. But suffering most from this popular demonization of wheat are those who actually have been diagnosed with one of the diseases associated with wheat, because they are no longer taken seriously by society, by doctors or even in restaurants or everyday life. On top of all that, these few authors' opinions are in stark contrast to nutrition recommendations given by numerous renowned institutions and scientists all over the world, such as the Food and Agriculture Organization (FAO), the World Health Organization (WHO), the European Food Safety Authority (EFSA) and the American Food and Drug Administration (FDA). All of them frequently stress the immense significance of whole grain wheat and whole grain cereal in general for a healthy human diet.

A gluten free diet helps in losing weight

This is impossible from a scientific point of view. In contrast, patients with celiac disease welcome a certain weight gain when they change to a gluten-free diet because they can finally absorb and use all of the nutrients in their food again. And everybody else will probably gain in weight as well when adapting to a gluten-free diet, but for a different reason: Gluten free baked goods usually contain more fat and sugar in order to compensate for the missing gluten.

(Whole grain) Wheat is an integral part of a healthy diet

Wheat supplies about 20% of calorie requirements worldwide. What's more is that wheat is an important provider for numerous essential nutrients that our human bodies cannot produce themselves and that we, therefore, need to ingest through our food. Wheat contains major mineral nutrients such as iron, zinc, selenium and manganese as well as important amino acids, trace elements, secondary compounds and lipids. Whole grain wheat flour and wheat germ oil are actually one of the most important sources for vitamin E in our nutrition. Considering the enormous amounts of wheat that all of us humans consume on a daily basis through baked goods, cereal and noodles, these ingredients in wheat play a significant role in our diet. It's essential to be aware that most of these important ingredients are located in the outer layers of the grain and in the seedling. Consequently the intake of these ingredients is only possible by eating whole grain products.

Numerous medical studies have shown the positive effect whole grains have on human health. We are showing just one example of a wide-ranging study carried out by the group of Tao Huang at Harvard School of Public Health in Boston. This study tracked almost 370 000 Americans on a medical as well as nutritional basis. One group was put on a diet with very few whole grain products and very little dietary fiber, while the other group received an equivalently high amount.

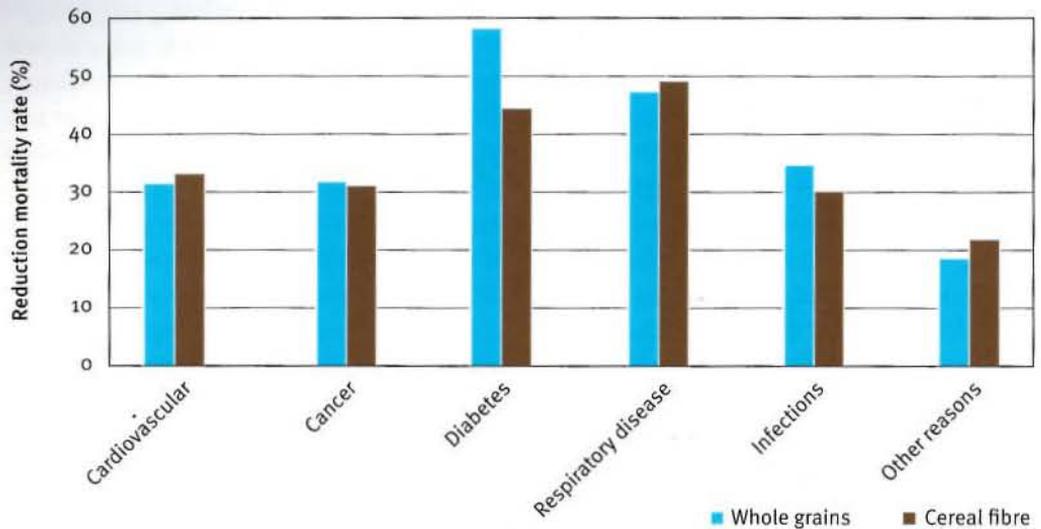


Fig. 7-5: Reduction in mortality rate in patient groups who were given higher amounts of whole-grain cereal and cereal fibers, in comparison to the group given lower amounts of both; source: Huang et al. 2015, modified.

Throughout the 14 years of this study about 46 000 participants died. The group that had frequently eaten whole-grain cereal and cereal fibers had, on average, a 30% lower death rate (Fig. 7-5)! And this held true not just when it came to mortality from any cause, but it also consistently applied with regard to specific causes of death as well.

Although there is dietary fiber in fruit and vegetables as well, their concentration is usually much lower and has less of an effect on our health. Besides, most gluten-free diets are rich in fat, sugar

and hidden sugar, and the intake of a sufficient amount of dietary fiber is nearly impossible. Based on such clear scientific discoveries, people who do not suffer from celiac disease, wheat allergies or wheat sensitivity should not abstain from wheat – abstinence harms for those people more than it helps! And considering the difficulty of feeding a growing world population with decreasing land availability, we can hardly afford to forego wheat, especially as it is easily and effectively produced compared to many other plant and animal species.