Association des Amidonniers et Féculiers
European Starch Industry Association

Factsheet on wheat gluten and gluten related disorders

Wheat Gluten is a natural protein derived from wheat or wheat flour

The main constituents of cereal grains are starch and proteins. Cereal grains also contain fibers, lipids and minerals. The proteins that are naturally present in wheat form wheat gluten. Gluten is also present in other cereals such as rye, barley and oats. The amount of wheat gluten in wheat and its properties depend on variety, growing conditions and climate, but generally the proteins that form wheat gluten constitute about 80% of the total proteins in wheat. Once extracted (as described in section 1 below) the dried wheat gluten is an insoluble high protein powder, which regains its original characteristics after rehydration and mixing. It has unique functionalities (for more on its functionalities, click here http://www.iwga.net/what_is_wg.htm#) and can serve many applications in food and feed products.

It is estimated that EU consumers consume approximately 10 million tonnes of wheat gluten per annum, of which approximately 375,000 tonnes (3.75%) is in the form of wheat gluten extracted by the starch industry. The remainder is in the form of the wheat gluten which is naturally present in wheat and wheat flour.

1. How to extract wheat gluten

Wheat flour is mixed with water. The starch is washed out and the gluten remains behind, because it is not soluble in water

The starch industry extracts the components of cereals: starch, proteins, fibers and lipids. The components of wheat are extracted in a multi-stage process, as follows:

1. Wheat is transformed into flour through a process called “dry milling”. This means that the wheat grains are crushed and sieved in a mill to remove the bran, and separate the flour.
2. Drinking water is added to the flour to provide for a dough like structure.
3. Through a process called centrifugation the major constituents of the flour are separated. The starch and other constituents dissolve, but the gluten, which is not water soluble, does not.
4. Once starch and gluten are separated by centrifugation, the gluten is washed thoroughly and dried. The temperature never exceeds 70 degrees Celsius, in order to protect the gluten’s functional properties, known as “vitality”. In this form, the gluten is called “vital wheat gluten”.
5. Additional processing of vital gluten through the addition of enzymes produces modified wheat gluten.

2. The applications and properties of wheat gluten

As a plant-based protein, wheat gluten can provide high nutritional values supplementing or partially replacing animal proteins in both human and animal nutrition. In addition to being a natural source of proteins, wheat gluten’s other functionalities can help improve the texture, shelf life etc. of the food to which it is added

AAF AISBL - Avenue des Arts, 43 - B – 1040 Bruxelles - BE 0878.908.981
Tel : +32-2-289.67.60 - Fax : +32.2.513.55.92 - E-mail : aaf@aaf-eu.org - Website : www.aaf-eu.org

Some examples of food for humans and animals that contain wheat gluten (for a more detailed overview click here (http://www.iwga.net/21applications.htm):

Food

- **Bakery products** - Bakery products are the product category which enjoy the greatest benefits from wheat gluten use. The viscoelastic properties of wheat gluten improve significantly dough strength and its water absorption capacity improve product yield, softness and shelf-life. For example, if the flour in bread does not contain enough gluten, the bread collapses, has little volume and its crumb is irregular.
- **Breakfast cereals** – in particular as wheat gluten provides a major source of protein, which is one of the reasons why breakfast cereals are consumed
- **Meat preparations** (also including fish, poultry and sourimi-based products) and certain cold cuts, primarily for its binding properties.
- **Pasta** – for example, to reduce stickiness in cooked pasta, amongst others.

Feed (food for animal)

- **Aquaculture** – wheat gluten is used to feed animals such as fish and crustaceans. The fact that gluten does not dissolve in water, allows the feed in which it is used to stay more compact when it is fed to aquatic animals.
- **Pet foods –** Nutritional properties, high digestibility, and contribution to maintaining the texture of the food product, make wheat gluten an important ingredient of pet food.

3. Gluten-free diets and coeliac disease

For the large majority of consumers, about 99% of European and US citizens, gluten is entirely safe[1]. Removing gluten from the diet may lead to nutrient deficiencies, and lower the dietary fibre content of the diet[2]. However consumers who have been diagnosed with a gluten-related disorder, are advised to follow a strict gluten-free diet.

Gluten is a protein that can be found in the natural state, as said above, in wheat, barley, oats, and rye. There is no benefit to removing it from the diet for consumers who do not suffer from a gluten related disorder. Gluten related disorders fall currently into three categories:

- **Coeliac disease (or "gluten intolerance")** – this is a permanent intolerance by genetically predisposed people towards certain gluten protein fractions (these fractions are called "gliadins", for wheat). In practice, when gluten comes into contact with the intestine after ingestion, it triggers a reaction that gradually damages the gut leading to nutrient mal-absorption and severe chronic inflammation. Well known symptoms of untreated coeliac disease are: stomach ache, diarrhea and bloating. If one does not absorb nutrients properly, this can lead over the long term to undernourishment and weight loss in adults, delayed growth in children, anemia, bone pain, etc. Coeliac disease should not be considered as an allergy.

[1] Opinion issued by the French 'Conseil National de l'Alimentation', "« Comment mieux cerner et satisfaire les besoins des personnes intolérantes ou allergiques à certains aliments ? », 2010.
[2] Doctor Patrick Serog, nutritionist, speaking at the « Le Gluten en Questions ? » Symposium in Paris, 22 January 2013, speaking of the consequences of a bread-free diet.

- **Allergy to wheat proteins** – Some people are allergic to the proteins of wheat. The reaction that allergies cause in the body is different to the one caused by coeliac disease. Allergies typically cause the secretion of antibodies, which can result in the immune system causing various reactions and in worse cases breathing difficulties and even anaphylactic shock (a serious medical reaction caused by someone eating a product they are allergic to).
- **Gluten hypersensitivity** – this is an emerging condition, and to date, is not based on a specific diagnosis, (unlike coeliac disease and allergy). Some people show digestive disorders which can correspond to those seen in people with coeliac disease but their antibodies are negative and intestinal biopsies are normal (*i.e. the body parameters based on which a proper diagnosis is typically made to detect coeliac disease or gluten allergy are normal; yet, the person presents the symptoms linked to either condition*). There is very little known about gluten hypersensitivity and further scientific insight into the phenomenon is ongoing.

4. Diagnosis and Treatment for coeliac disease

Diagnosis is based on a specific medical examination (no self-diagnosis is possible). Currently, the only treatment for coeliac disease and wheat allergy is to have a gluten-free diet

Diagnosis is based on three medical examinations:

- Screening for disease-specific anti-bodies in the blood, which are called "anti-transglutaminase" antibodies.
- Identification of intestinal scars through a specific test on the intestine (intestinal biopsy).
- An assessment of the reduction in symptoms after the gluten-free diet.

It is important to highlight that diagnosis is impossible when a gluten-free diet has started before the medical screening[i].

Treatment – People who have been diagnosed with any of the conditions above should remove wheat, barley, rye, oats etc. and all foods containing them from their diet. This nutritional regime has to be followed for life and should be supervised by a dietician.

"Gluten-free" food cannot contain more than 20 mg/kg of gluten in the end product
"Very low gluten" food is food having a gluten content of between 21 and 100 mg/kg [ii]

More information on Coeliac Disease and a gluten free diet is available at http://www.aoecs.org/, the website of the Association of European Coeiliac Societies

[i] AFDIAG, Association Française Des Intolérants Au Gluten, http://www.afdiag.fr/
[ii] In the EU, Regulation 41/2009 concerning the composition and labelling of foodstuffs suitable for people intolerant to gluten, OJ L16, 21 January 2009, page 3, sets the rules for the use of "gluten-free" and "very low gluten" claims.

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