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## Gluten: Characteristics, properties and uses

Gluten is made up of a combination of proteins present in the grains of such cereals as wheat, spelt, emmer, rye, barley, oats and their relative varieties and hybrids.

Gluten lends elasticity and consistency to various types of dough, including those for making bread.

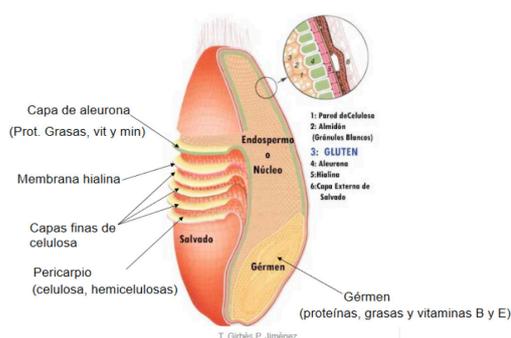
### The importance of gluten

Gluten lends a compact and spongy character to bread and to dough used to make baked goods such as biscuits and cakes. In addition, it prevents dough from becoming sticky during baking. The quality of gluten determines the characteristics of the dough, including its elasticity, gas retention, expandability and compactness.

Gluten is present in all products made from the flour and bran of the cereals mentioned above. It is also found in beverages made from malt, such as beer, and in distilled or fermented drinks derived from these cereals. In addition, its characteristics make it useful as a binder and homogenizer in industrially produced foods such as cured meats, processed cheeses and salted roasted nuts. Gluten may also be present in cosmetics, personal hygiene products, modelling putties and biodegradable plastics. Finally, it is used as a support or protein substitute (in dietary products) and as an excipient in some drugs.

### Where is gluten found?

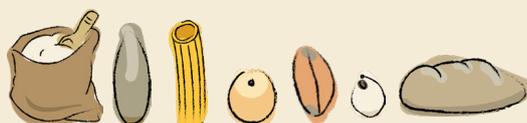
The formation of gluten is affected by several factors, including temperature and the quantity of liquid, fats, sugar, acids and salt in the dough.



Cereal grains are composed of three parts: bran, endosperm and germ (the embryo). Proteins that form gluten are found in the endosperm.

To distinguish between the different proteins present in wheat, we use the Osborne classification, which categorizes them on the basis of their solubility (see Table 1). Four protein fractions are differentiated: albumins and globulins (15-20% of total proteins) play a structural and metabolic role, while the so-called gluten proteins (prolamins and glutenins) make up 80-85% of total proteins.

Figure 1. Structure of the cereal grain. Source: T. Girbés P. Jiménez in [https://alojamientos.uva.es/guia\\_docente/uploads/2013/470/45809/1/Documento9.pdf](https://alojamientos.uva.es/guia_docente/uploads/2013/470/45809/1/Documento9.pdf)



| Protein fraction  | Soluble in               | Part of gluten? | Biological Role                   | Where they are found  | Function                                |
|---|--------------------------|-----------------|-----------------------------------|---|---|
| Albumins  | Water                    | NO              | Structural and metabolic proteins | In the outer layers of grains and in very low concentrations in the endosperm | Varies                                  |
| Globulins   | Diluted saline solutions |                 |                                   |   |   |
| Prolamins<br>gliadin (wheat),<br>hordein (barley),<br>secalin (rye), avenin<br>(oats) | Alcohol at 70%           | YES             | Storage proteins                  | In the endosperm (together with starch)                                       | Lends viscosity and elasticity to dough |
| Glutenins   | Diluted acetic acid      | YES             |                                   |   | Lends elasticity and tenacity to dough  |

Table 1. Osborne classification of cereal grain proteins. In De la Vega, G. "Proteínas de la harina de trigo: clasificación y propiedades funcionales" ("Wheat flour proteins: classification and functional properties")

## Composition of gluten

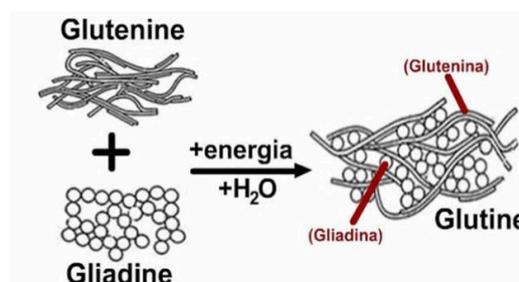
The formation of gluten is due to the interaction between glutenin and prolamin (mostly in wheat, and to a lesser degree in rye, barley and oats) in the presence of water and mechanical energy. In other words, when dough is made changes are caused in the configuration of these proteins, producing gluten.

The quantity of proteins present in the grain provides information about the quantity of gluten, though not about its quality and functions.

## Gluten-related disorders: labelling and norms

Three types of disorders linked to gluten have been defined: wheat allergy, celiac disease (an autoimmune disorder) and non-celiac gluten sensitivity.

Because of the high incidence of the number of patients with gluten-related disorders, some countries have passed legislation requiring labelling that indicates whether packaged products contain gluten, other significant allergens or their by-products. This is the case in the European Union (EU), which adopted Commission Implementing Regulation (EU) No. 828/2014 of 30 July 2014 "on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food." With the increase in the number of cases of celiac disease, gluten-free diets have become fashionable. Nonetheless, nutritionists recommend that people not eliminate gluten from their diets if they do not have a gluten-related disorder.



Formation of wheat gluten (which occurs through the interaction between gliadin, glutenin, water and energy). Source: <http://www.gastronosfera.com/>

## Processed bread, local varieties and gluten

Industrial bread producers have great clout in Spain and the EU: they influence the selection criteria of cereals while seeking greater adaptability to processes without necessary considering nutritional aspects. Some studies suggest that modifications of wheat varieties in modern times have altered their protein proportions, increasing gluten content to facilitate industrial processing. By contrast, these same studies maintain that there are local and ancient wheat varieties with low gluten content.

### Recommended reading

Castá, P. "Resultados de calidad de nuevas variedades de trigo. Campaña 2008-2009", Instituto Tecnológico Agrario de Castilla y León, 2008.

De la Vega, G. "Proteínas de la harina de trigo: clasificación y propiedades funcionales", Temas de Ciencia y Tecnología, vol. 13, no. 38, May-August 2009, pp. 27-32.

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