

GLUTEN

INFORMATION SHEET



BAKING INDUSTRY
RESEARCH TRUST

WHAT IS GLUTEN?

When water is added to flour and mixed, the two proteins present in flour – gliadin and glutenin – combine to form the protein called gluten. Gliadin is very sticky when wet and very extensible and acts like a glue, while glutenin is a large and complex protein which gives dough strength and elasticity. Hence, gluten is a tough, rubbery and elastic substance, which can stretch and rise due to the action of baking powder or yeast. When flour is mixed with water, the gluten swells to form a continuous network of fine strands. This network forms the structure of bread dough.

WHICH GRAINS CONTAIN GLUTEN?

When people say gluten they usually mean wheat gluten, but there are other grains which contain the protein as the list below highlights.

Grain	Information
Rye	Rye grain is a dark-coloured, fibrous flour with a low gluten content and strong flavour. Although not often used alone, it is the only non-wheat flour with enough gluten for bread making. However, it is usually mixed with strong wheat flour to produce a lighter loaf of bread. Used to make traditional bread like pumpernickel.
Barley	A cereal grain derived from the annual grass <i>Hordeum vulgare</i> . Barley contains all eight essential amino acids. Some amino acids have to be received from the diet as the body cannot produce them.
Triticale	A hybrid or combination of wheat (<i>Triticum</i>) and rye (<i>Secale</i>) with the best attributes of both of these cereals. It has grayish-brown oval-shaped kernels that are larger than wheat but plumper than rye, and a nutty flavour similar to wheat.
Oats	Are the seed of the cereal plant <i>Avena sativa</i> or <i>A. byzantina</i> . Although they do not contain gluten they do contain the protein avenin which is similar to gluten. Most people who react to gluten do not react to this protein but some people can react. Due to the high possibility of cross-contamination during planting, harvesting and processing many brands of oats do have detectable amounts of gluten in them. To be safe and avoid any issues, oats are usually grouped with the grains containing gluten; however, in reality oats may have a place in a gluten-free diet.

USES OF GLUTEN

Grains containing gluten are used as ingredients in a wide range of prepared and commercial foods. Wheat flour alone is found in thousands of products due to its ability to give products structure and assist with the thickening and coating of products.

Gluten is used in the bread industry to supplement the gluten proteins already found naturally in flour and dough. To the baker gluten adds valuable properties, such as:

- increased dough strength
- better gas retention and elasticity, which gives products good structure and a uniform shape
- better water absorption and retention, improving yield, product softness and extending the shelf life of bread
- enhanced flavour.

Gluten can also be a useful ingredient in products other than bakery products:

- Batter: Ensuring a durable adhesion of batter crusts to foods is a quality problem, especially in frozen foods. Dusting food with gluten powder before applying the batter vastly improves the adhesion in both hot and cold temperatures and the results are comparable to (more expensive) egg.
- Pasta: Pasta manufacturers prefer to use semolina made from Durum wheat as it produces better quality pasta. However, the addition of gluten to semolina made from other wheat varieties can improve suitability for pasta dough.
- Meat products: Gluten is widely used in processed meats as a binding and enriching ingredient. It is used in beef, pork and chicken sausage products and as a common ingredient of pizza toppings.

HOW IS GLUTEN MANUFACTURED?

Commercial gluten is available as a dried powder or in wet form, and different strengths are available.

First step: The flour and water are mixed together. The resulting dough is left to rest to allow the protein components time to absorb the water.

Second step: The dough is then put in a long horizontal water-filled tank containing screw-type conveyors, which knead the dough until all the starch is suspended in the wash water.

Third Step: All that remains between the screws is the gluten mass which is then forced through fine openings, chopped into small pieces and dried in a hot turbulent air stream ready for bagging.

The approximate composition of dry gluten is:

Moisture	8%
Protein	70–75%
Fat	5–8%
Starch	11–16%
Fibre	1%

When compared with flour, commercial gluten is an expensive product at about six times the price, so only enough should be used to meet product quality requirements. To make a useful improvement in the dough structure, approximately 4% extra gluten is added (based on cereal weight). One and half times the weight of gluten in additional water needs to be added to a bread formula when using dried gluten.

THE ROLE OF GLUTEN IN BAKERY PRODUCTS

BREAD	<p>Bread flour does not contain large amounts of protein (10.5–13%) but it is very important for the bread making process.</p> <p>KNEADING: During kneading (high speed mixing in bakery) the addition of water to flour causes hydration of the gliadin and glutenin proteins and leads to the formation of gluten. The gluten swells to form a continuous network of fine strands. This network forms the structure of bread dough and makes it elastic and extensible. Stress induced by mixing breaks bonds between protein chains, allowing the chains to move and become realigned. The new bonds that are formed allow relaxation of the dough. Gluten strengthening (or oxidising) agents, such as ascorbic acid, stimulate the formation of these new bonds, strengthening the dough structure.</p> <p>PROOFING: During this stage starch breaks down and fermentation occurs. As bread dough ferments and proves, the yeast produces carbon dioxide gas that causes the gluten network to expand. This leaves an open cellular structure with the gasses trapped in pockets. The quality of gluten in dough is very important. If gluten is too weak it can't stretch in thin films around the air bubbles produced during fermentation. The gas bubbles would then swell and burst, causing the loaf to lack volume.</p> <p>BAKING: As bread bakes, the gluten coagulates, which sets the gluten so that it is no longer elastic. This setting of the gluten determines the bread size and shape. This change does not reverse when bread is cooled. The end result after removal from the oven and cooling, should be a firm but open and light-textured loaf of bread.</p>
CAKE	<p>There is no need to develop the gluten network during cake mixing as this would make a cake tough. The mixing step in cake making is to combine the ingredients and incorporate air into a uniform batter to give a light, desirable cake texture.</p>
BISCUITS	<p>Biscuit mixing tends to be a single step, all-in system, or mixed in two steps where fat and sugar are creamed first. Gluten development is generally regarded as undesirable as it can lead to problems such as excessive shrinkage or distortion and checking, which causes biscuits to break or crack after baking.</p>

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