Oklahoma Ag in the Classroom

What is Gluten?

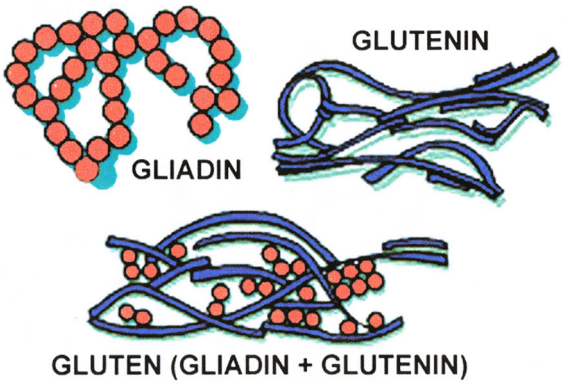
Objective

Students will conduct scientific experiments to compare the presence of gluten in different kinds of flour.

Background

The word "gluten" is the Latin word for glue. Gluten is a protein that gives elasticity to dough, helping it rise and keep its shape. It often gives the final product a chewy texture.

When bakers add water to wheat flour and begin to knead it into dough, two smaller proteins—gliadin and glutenin—change shape and bind to each other, forming long, viscoelastic loops of what we call gluten. The more gluten in the flour, the more the dough will stretch, and the spongier it will be once baked.



The fruit of most flowering plants have endosperms with stored protein to nourish embryonic plants during germination. True gluten, with gliadin and glutenin, is limited to certain members of the grass family, including wheat, barley and rye.

Gluten is important in breadmaking because it holds the carbon dioxide gas produced by the yeast that makes the bread rise, much like the rubber of a balloon holds air. The stronger the gluten, the more gas it can hold. Different flours contain different amounts of gluten. A high-protein flour will make a dough with strong gluten, which is good for hearty yeast breads. Pastry chefs prefer low protein flours with less gluten, for delicate, tender doughs. The flour from hard, red winter wheat grown by most Oklahoma wheat producers is a high-protein flour.

The many whole grains that contain gluten offer special nutritional benefits. They are rich in an array of vitamins and minerals, such as B vitamins and iron, as well as fiber. Studies show that whole grain foods, as part of a healthy diet, may help lower risk of heart disease, type-2 diabetes, and some forms of cancer. The US Department of Agriculture's 2010 Dietary Guidelines for Americans recommends that half of all carbohydrates in the diet come from whole grain products.

Oklahoma Academic Standards

GRADE 7
Physical Science: 1-1,2

GRADE 8
Physical Science: 1-3,5

Materials

whole wheat flour

bread flour

all-purpose flour

pastry flour

water

bowls

balloons

yeast

sugar

Procedures

1. Students will work in groups to conduct the following demonstration to find the gluten in various kinds of flour.
   —Measure 1 cup each of at least three different kinds of flours (all-purpose, bread, whole wheat, cake, etc.) into separate bowls. Label the bowls according to the kind of flour.
   —Slowly add 1/2 to 3/4 cup water to the flour in each bowl and knead each mixture until it forms a soft, rubbery ball of dough. Let the dough balls sit for about 10 minutes.
   —In a sink, run cold water over one of the dough balls. Be careful not to let the dough disintegrate. Cup your hands around the ball and squeeze gently to remove the starch. With low-gluten cake or pastry flours, you may need to put the dough in cheesecloth to hold it together.
   —You will notice the water turning milky as it washes away the starch in the dough. Keep pouring out the cloudy water that collects in the bottom of the bowl. Slowly your dough ball will become a gummy, slimy network of gluten strands.
   —When the water is no longer milky, there is no more starch in the dough ball, leaving nearly pure gluten. Notice how much smaller your ball has become and how much more stretchy.
   —Repeat with each of the flour types. How does the texture of each one differ as you wash away the starch? Does it take the same amount of time for each one? Are the gluten balls all the same size or are some larger than others.
   —Now bake the gluten balls for 15-30 minutes at 450 degrees. When you take them out of the oven, you will notice they have puffed up and hardened. This is what happens to the gluten in a loaf of bread as it bakes.
   —Students will repeat the experiment with cornmeal or other flour that does not contain gluten. Students will record and discuss their observations.
2. Gluten acts like a balloon to trap the carbon dioxide gases inside when used in baking bread. Students will conduct an experiment to demonstrate how this works.
   —Provide each group with a balloon, a funnel, an empty 16-ounce soda or water bottle, a packet of yeast, 1 teaspoon of sugar, and 1/2 cup of warm water.
   —One student in each group will blow up the balloon and let the air out.
   —Students will use the funnel to put the yeast, sugar and warm water into the soda bottle.
   —Students will place the balloons over the soda bottles.
   —Students will observe and record their observations for about 10 minutes.