

Cookie Science 101

Ingredients and utensils

For about 24 large cookies:

- 300 grams (2 cups + 1 heaped tablespoon) flour (100 grams white flour, 100 grams rye flour, 100 grams gluten-free flour)
 - 200 grams butter at room temperature
 - 120 grams ($\frac{1}{2}$ cup + 1 heaped tablespoon) white (granulated) sugar
 - 120 grams ($\frac{1}{2}$ cup + 1 heaped tablespoon) dark brown sugar (preferably not demerara)
 - 300 grams chocolate chips
 - 2 eggs
 - 1 egg white or 2 tablespoons milk
 - 1 level teaspoon baking powder
 - 1 teaspoon vanilla extract
 - $\frac{1}{2}$ a teaspoon of salt
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- An oven
 - 2 large pans lined with parchment paper
 - Mixing bowls
 - A wooden mixing spoon
 - A whisk (or a mixer with a flat beater)
 - Plastic wrap

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The scientific explanation

The cookies' fluffiness is affected by the wheat protein, known as gluten. What is gluten and what is its role in creating light and fluffy pastries?

Gluten consists of families of proteins called glutenins and gliadins. When the dough is processed and kneaded, the molecules of these proteins can link up with each other into very long chains, forming the protein network known as gluten. This network provides the dough with elasticity and airiness, because it traps gas bubbles that form during the leavening (in our recipe, baking powder breaks down and carbon dioxide is formed).

The flours we used in this experiment differ in their protein content: 10% in the white flour versus the rye flour's 8%. And that's not the only difference. The protein chains in the rye flour are shorter, so the network formed is less efficient at capturing gas bubbles - resulting in dense, thick cookies. Gluten-free flour contains no gluten, of course, and the main leavening agents in this case are the eggs and other ingredients added to provide the required amount of lift. As expected, there is a difference in the cookies' degree of leavening; the puffiest cookies are those made from white flour.