How does your cookie crumble?

The chocolate chip cookie is a perennial favorite. Chewy, soft, crisp, thick or thin? What is the difference? The science is how the cookie is prepared and the materials used to make the cookie...

INGREDIENTS

- Fat (shortening, butter)
- Sugar (white, molasses)
- Eqq(s)
- Vanilla
- Leavening agent
- Flour
- Water
- Salt
- Semisweet chocolate chips
- Nuts (optional)

Leavening agents release carbon dioxide gas to puff the cookie. Thin cookies are made with less leavening agents and a particular mix of flour and fats to spread while the cookie is heated. Baking powder is a typical leavening agent. Caked cookies need to spread less,

do not harden and have a source of gasses to expand during cooking.







Crisp or chewy? Sugar and the protein content in flour will influence if a cookie is crisp or chewy when cooked and cooled.

Chocolate

Chip Cookies

Water - Just enough from eggs, fats or added liquid can provide the expanding gasses for a puffy cookie or ruin the mix with a runny batter. Egg whites will bind and dry out a cookie and must be balanced by the right amount of water.

require sugars and proteins undergoing the Maillard reaction creating dark brown colors and flavorful molecules.

Directions

Flour Power The protein level of flour makes a difference. High protein flour will produce a flat darker cookie while a low protein flour will make for lighter colored and puffier cookies

Fat Spread --

Butter is the most popular ingredient for buttery flavor but will make a cookie spread. Reduced fat spreads makes for a more puffy and soft cooki



Preheat oven to 177°C (350°F)

Mix together 2 $\frac{1}{2}$ cups all-purpose flour and $\frac{1}{2}$ tspbaking powder.

In a separate bowl, combine 1 cup room -temperature butter with ½ cup sugar and 1 packed cup brown sugar, whip until light and

While mixing, add 1 tsp salt, 2 tsp vanilla, and 2 eggs. Beat until well mixed.

Add the dry flour mixture until just combined, then stir in 2 cups semi-sweet chocolate chips.

Bake 8 to 10 minutes on parchment paper until golden around the edges, but still soft in the

Soda or Powder?

The influence of baking soda (bicarbonate) helps the Maillard reaction and makes the cookie darken with less time and lower heat. Without an acid, baking soda cannot leaven. Baking powder will leaven or raise the cookie by generating carbon dioxide

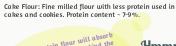
Sticky Buisiness A greased pan will help spread the dough while cooking making a thin cookie. Denatured protein from eggs will stick to the nooks and cracks of a pan. Fither wait for 2-3 min after the cookies are out of the oven or use parchment paper to limit spreading.

Cookie Science

Brown Color and Flavor - Maillard Reaction

The Maillard reaction is the combination of amino acids from proteins and simple sugars. Some sugars like glucose, mannose and ribose react better than others. The more protein and sugar present the more brown and flavorful the cookie. The trick is time and temperature.

- The Maillard reaction requires high heat at the surface of the cookie, and this won't happen until most of the water has evaporated. During early stages of baking much of the energy is used by water to escape from the liquid to gas phase.
- The reaction happens at a greater rate when the pH is more alkali to keep the sugar in the correct open-chain form. Thus addition of baking soda and reduction of water helps brown your cookie without over heating.



Protein content ~8-11%

High protein flour will absorb more water and help bind the cookie into a tighter form. Low protein flour will not absorb as much water leaving the water to much water leaving a raised puffy cookie.

More Protein? It's in the Flour

There are many different types of wheat flour and the

main distinguishing characteristic is the amount of protein in the flour. The protein is called gluten.

All Purpose Flour: Often used for cookies and baking.

Bread Flour: also a "hard flour" has a higher protein content needed to capture the gasses of bread. Protein content ~ 12-14%



Sugars are essential for the browning Maillard reaction. Sugars contribute to browning and

- Corn syrup is made from corn starch and is broken down to glucose with some maltose. This browns faster and will make the surface of the cookie a little more crunchy.
- Table sugar (sucrose) will not brown as well but makes for hard crystalized crispy cookies
- Brown sugar (light or dark) contains molasses which is mostly a mix of sugars and a few other compound including fats. These sugars absorb water easily and help soften a cookie.
- Honey is a mixture of fructose and glucose and easily absorbs water keeping the cookie soft when stored.

Fats and Sugar

The type of fat the world of difference. A slow melting fat like shortening reduces spreading, while a fat like butter melts quickly...

- Shortening (vegetable) is nearly water-free and has a higher melting point of 117°C than butter 90°C. Cookies made with lard won't spread until the fat melts giving time for the protein to connect and form a solid network during baking.
- Butter his a higher water content ~20% water and low melting point 90°C. The steam made from butter's water will contribue to puff, but the lower melting point of butter will cause spreading well before the cookie sets.
- Margarine has more water than shortening but a higher melting point than butter. Missing some of the butter flavor it can serve as a nice compromise or part of an experiment!!!

Did you know?

Queens cookies

