

# Baking Science:

## Cookie Science: Thin, Crisp and Chewy

In this lab students research the question:

What ingredients and methods will make a cookie thin, crisp or chewy? They will:

1. Bake the Whole Wheat Sugar Cookie recipe and three to six of the variations to determine what gives the result—crisper, softer or chewier.
2. Control fat temperature in the creaming procedure.
3. Hold a Tea Party to discuss the reasons for their results. (See Tea Party guidelines in Appendix.)
4. Option: View Alton Brown's "Three Chips for Sister Marsha," on-line (You-Tube™) or order DVD.
5. List five tips for baking cookies, found at [chsugar.com](http://chsugar.com) and [dominosugar.com](http://dominosugar.com) – Baking Tips/Everyday Baking/Cookies and Brownies [chsugar.com/recipe-result?filter\\_by\\_tid=831%201242&type=tips](http://chsugar.com/recipe-result?filter_by_tid=831%201242&type=tips)

### State a hypothesis for each cookie variable.

Suggest ingredient and/or method change(s) that might result in a chewier, softer or crisper cookie.

Chewy Cookie:

Substitute \_\_\_\_\_

Increase \_\_\_\_\_

Decrease \_\_\_\_\_

Method change (s): \_\_\_\_\_

Crisp Cookie:

Substitute \_\_\_\_\_

Increase \_\_\_\_\_

Decrease \_\_\_\_\_

Method change(s): \_\_\_\_\_

Soft Cookie:

Substitute \_\_\_\_\_

Increase \_\_\_\_\_

Decrease \_\_\_\_\_

Method change(s): \_\_\_\_\_

# Whole Wheat Sugar Cookie

Preparation time: 10 minutes Baking time: 10 minutes

Yield: 2 dozen (1 oz/28 g) cookies

Ingredients	Measurements	Weights
Granulated sugar, divided	1 cup	7 oz/200 g
Butter or margarine	½ cup (1 stick)	4 oz/115 g
Large egg	1	1.67 oz/50g
Whole white wheat flour	2 cups	8.5 oz/240g
Baking powder	1 teaspoon	4.75g
Baking soda	½ teaspoon	2.4g
Ground nutmeg	½ teaspoon	2.25g
Low-fat milk	3 tablespoons	1.5 oz/42ml
Vanilla extract	1 teaspoon	3.5g
Orange peel, grated*	1 ½ teaspoons	3.5g
<b>To coat each drop cookie:</b>		
Sugar	2 tablespoons	0.9 oz/25g
Ground cinnamon	1 teaspoon	0.08 oz/2.25g

\***Baker tip:** Orange peel should be grated – “zested” – just to, but not into, the white that’s under the colored peel.

### Directions:

1. Line half-sheet pans (18 X 13-inch baking pans) with parchment paper. Preheat oven to 375° F.
2. Cream the sugar and butter together until light. Add egg; beat until light.
3. In separate bowl, whisk the dry ingredients together to mix thoroughly. Add to creamed mixture.
4. Add milk, vanilla and orange peel. Blend well.
5. Drop 1-inch cookie dough balls into cinnamon/sugar mixture. Place on lined cookie sheets about 2 inches apart; flatten evenly with a glass or cup.
6. Bake at 375° F. 8 to 10 minutes or until golden brown. Cool on wire racks.

Source: Stafford County Flour Mill,  
[hudsoncreamflour.com](http://hudsoncreamflour.com)  
Kansas Wheat, [kswheat.com](http://kswheat.com)

Nutrition Facts	
Serving Size (28g) Servings Per Container	
Amount Per Serving	
Calories 110	Calories from Fat 35
% Daily Value*	
Total Fat 4g	6%
Saturated Fat 2.5g	13%
Trans Fat 0g	
Cholesterol 20mg	7%
Sodium 80mg	3%
Total Carbohydrate 17g	6%
Dietary Fiber 1g	4%
Sugars 9g	
Protein 1g	
Vitamin A 4%	Vitamin C 0%
Calcium 2%	Iron 4%

\*Percent Daily Values are based on a diet of 2,000 calories per day. Your daily values may be higher or lower depending on your calorie needs.

Calories	2,000	2,500
Total Fat	Less than 65g	80g
Saturated Fat	Less than 20g	25g
Cholesterol	Less than 300mg	300 mg
Sodium	Less than 2,400mg	2,400mg
Total Carbohydrate	300g	375g
Dietary Fiber	25g	30g

Calories per gram:  
Fat 9 • Carbohydrate 4 • Protein 4

## Teacher: Assign variables to test for puffy/softer, thinner/crisper and chewier cookies.

**NOTE:** Need two-day or longer option? Freeze cookie dough, [landolakes.com/expert-advice/make-ahead-cookie-baking-tips-freezing-cookies/](http://landolakes.com/expert-advice/make-ahead-cookie-baking-tips-freezing-cookies/)

**Lab Team 1:** Bake control recipe above.

**Lab Team 2:** (Soft/Puffy)

**Variable:** Prepare recipe, substitute shortening for butter (higher melt point, more fat = more rise)

**Lab Team 3:** (Soft/Puffy)

**Variable:** Prepare recipe, substitute cake flour for all-purpose flour (lower protein flour ties up less moisture = more steam, more puff)

**Lab Team 4:** (Thinner/Crisper)

**Variables:** For ½ cup fat: cream 5 tablespoons butter with sugar; while creaming, drizzle in 3 tablespoons vegetable oil

**Lab Team 5:** (Thinner/Crisper)

**Variables:** For egg, substitute ½ beaten egg + 1 tablespoon milk

**Lab Team 6:** (Chewier)

**Variable:** Melt or brown the butter before creaming/mixing with sugars; use dark brown sugar

**Lab Team 7:** (Chewier)

**Variables:** Use bread flour instead of all-purpose (creates more gluten); use egg yolk only mixed with 1 tablespoon milk (egg white dries/stiffens baked goods, so omit egg white, use milk)

**Teacher note:** If time allows, add another method variable will make a difference: chill the scooped cookie dough – place baking sheet with scooped cookies in freezer, covered, for a half hour before baking to make cookies puffier and chewier.

# Cookie Lab Results Chart

**Record results:** Place an X where you would best describe the cookie.

	Chewiest	Chewy	Soft/Puffy	Soft	Thin/Crisp	Crispest
Team 1						
Control cookie _____						
Team 2:						
Shortening _____						
Team 3:						
Cake flour _____						
Team 4:						
Oil for part of butter _____						
Team 5:						
Less egg/milk _____						
Team 6:						
Melted butter _____						
Team 7:						
Bread flour/ egg yolk + milk _____						

Compare the results to your hypothesis ideas with the actual results in a verbal or written discussion.

## First Experience: Low-Fat Spice Snack Cake



### For Teacher:

Before you begin, hand out the following terms to students and have them hold a Sweet Tea Party (See Appendix/Tea Party) OR describe and use each term in a descriptive sentence, story or paragraph.

Crystals	Tenderizes	Low-fat
Flavor	Yeast food	Caramelization
Powdered sugar	Attract moisture	Aeration
Stabilizer	Drizzle	Spread
Creaming	Maillard reactions	Dark corn syrup

**Supplies Needed:** For each recipe prepared or each team provide:

**For Comparison:** One package Spice Snack Cake mix (9X9-in) with price

Nutrition Facts Label from ready-to-spread frosting

### In this lab students will:

1. Confirm knowledge on the function of sugars in baking.
2. Apply the use of two sugars, granulated and dark corn syrup, to produce a cake suitable for breakfast, coffee or tea, or snacking.
3. Create a more tender product by blending wheat flour and corn starch to reduce the gluten strength in the flour.
4. Learn and apply the Food and Drug Administration's definition of low-fat and reduced-fat used for product labeling.
5. Create a drizzle and apply it as a simple glaze effect that has fewer calories than a fully frosted cake.



New Resource  
from the  
Home Baking  
Association

Today's "low-fat" is called Smart Snack baking!  
Go-to recipes for in-school culinary Bake  
Sales, [HomeBaking.org/PDF/smart\\_snacks\\_bakersdozen.pdf](http://HomeBaking.org/PDF/smart_snacks_bakersdozen.pdf)