

Food Explorations Lab II: Globs of Gluten

STUDENT LAB INVESTIGATIONS

Name: _____

Lab Overview

In this investigation, your class will determine the relative amounts and characteristics of the gluten formed by three different types of flour.

Lab Objectives:

In this lab, you will learn how to...

1. Describe the effect of stirring and kneading dough on the formation of gluten.
2. Determine the relative amount of gluten formed by different flour types.
3. Determine factors that affect the formation of gluten.
4. Identify high protein (gluten) flours.

Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron. It is important to avoid getting chemicals on your hands. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands *prior* to beginning an investigation.

Lab Question

Which flour type will form the most gluten (protein)? (Circle your answer.)

Bread Flour

Cake Flour

All-Purpose Flour

Predictions: I think _____ flour has the most gluten (protein) because...

Experimenting with Flours Types with Varying Gluten Concentrations

MATERIALS

safety goggles	1 large bowl
aprons (optional)	1 plastic fork
1 small bag containing 1 cup of assigned flour type	1 paper plate
1 small plastic bowl	1 kitchen timer or stopwatch
¼ cup of water	1 metric ruler
1 liquid measuring cup	warm water to fill the large bowl (step 6)
	1 strainer (wide mesh)

Obtain your flour assignment from you teacher. Record your group's flour type below (all-purpose, bread, or cake).

My group's flour type is: _____

PROCEDURE

1. Pour ½ the bag of flour into the small plastic bowl.
2. Describe the color and texture of your flour type. Record your answers in Table A for your assigned flour type.

TABLE A: Characteristics of Flour Types

Flour Type	Color	Texture
All-Purpose Flour	White	Very Smooth
Bread Flour	Cream or Off-White	A little grainy but smooth
Cake Flour	White	Very Smooth

3. Prepare your flour type using the directions below.
 - **Bread Flour:** Add $\frac{1}{4}$ cup of water. Stir your flour/water mixture with a plastic fork. Gradually, the flour should begin to form a small ball.
 - **All-Purpose Flour:** Add $\frac{1}{4}$ cup of water. Stir your flour/water mixture with a plastic fork. Gradually, the flour should begin to form a small ball.
 - **Cake Flour:** Add $\frac{1}{8}$ cup of water. Stir your flour/water mixture with a plastic fork. Gradually, the flour should begin to form a small ball.
4. Sprinkle some of the leftover flour on your work surface. Rub some of the flour into your hands to prevent stickiness. Your hands and work surface should be lightly dusted with flour.
5. Place the flour ball onto your work surface. Using your timer, knead the flour ball for 15 minutes. Add the remaining flour from the zip-lock bag to the flour ball as you are kneading. The final flour ball should not be sticky, should have a consistent texture, and should maintain its shape.
6. Allow your flour ball to rest in its bowl for 10 minutes. While you wait, clear your materials and kneading surface. Also, obtain enough warm water from your teacher to fill your large bowl.
7. After 10 minutes have passed, place the flour ball in the strainer and lower it into the large bowl filled with water. If there is sufficient sink space, your teacher may have you use the sink instead of a large bowl.
8. Knead the flour ball in the strainer under the water until the water-soluble parts (starch) wash away as a milky white liquid, leaving behind the protein (gluten). The gluten should be yellow-brown in color and feel like wet clay. Continue washing your ball until only a stringy, sticky ball remains. This process may take 10-15 minutes to complete.
9. Once you have created your gluten ball, place it on the paper plate. With a ruler, measure the diameter of the gluten ball. Record your measurement in Table B.
10. Share your findings with other groups. Be sure to record observations and data missing from your tables (A and B) for the flour types not assigned to your group.
- 11. Optional:** Place the gluten ball in a plastic sandwich bag to be stored overnight in the refrigerator.

Table B: Flour Ball Measurements

Flour Type	Flour Ball Diameter (cm)
All-Purpose Flour	Actual size will vary
Bread Flour	Actual size will vary Largest
Cake Flour	Actual size will vary Smallest

Conclusion:

1. Compare and contrast the gluten balls formed.

The bread flour formed a strong ball, but larger than the all-purpose flour. The cake flour did not produce a gluten ball (nothing more than what you could hold between two fingers).

2. Place the flours in order from greatest amount of protein formed (1) to least amount formed (3).

1. Bread Flour

2. All-Purpose Flour

3. Cake Flour

3. Using your observations and the “Flour Power” reading, describe what factors have an effect on the strength of gluten in flour.

The strength of gluten can be affected by the amount of flour, water, and agitation.

4. Explain the effect of “washing” the dough ball. What substances were removed and what was left behind?

The starch was washed away leaving only the gluten bonds (protein).

5. Based on the reading and your data, infer which flour type would be the best for baking breads and which would be best for baking cakes and pastry. Explain.

The best flour for baking breads would be bread flour or all-purpose flour because they have more gluten that will help provide the structure needed for these products. The best flour for baked goods (cakes and pastries) would be cake flour because it has less gluten that will make a more tender product.

6. If the gluten ball was refrigerated overnight, describe what changes occurred.

The gluten ball becomes stiffer.