

Cookies and Diameter: Batter Temperature and Kitchen Science

Grade 2



Testable Question:

How does the temperature of butter as an ingredient affect the quality of the cookies?

Sometimes when we make cookies they spread out and sometimes they stay in little balls. I think it might be because of the temperature of the butter. In this experiment, I vary the temperature of the butter (as a key ingredient) and measure the diameter of the cookies to see if the temperature of the butter will affect the diameter of the cookies.

Prediction: I think the hotter the butter, the more the cookie will spread out, and the colder the butter, the more the cookie will stay clumped up.

Procedure:

1. Mix together all the ingredients we need for chocolate chip cookies except for the butter. This includes 2.5 cups of flour, $\frac{3}{4}$ cup white sugar, $\frac{3}{4}$ cup brown sugar, 1 tsp vanilla, 2 eggs and 1 tsp baking soda. Mix with a standing mixer.
2. Warm (or cool) the butter, depending on the experimental test, and measure the temperature of the butter using a thermometer. I use the refrigerator to keep the butter cool and the microwave to melt the butter into a liquid. Then, I measure the temperature of the butter with a thermometer.
3. Split the dough into half, and mix one stick of butter to each half of the dough. Vary the butter temperature so as to be able to test the effect of butter.
4. Using a preheated oven (to 350 degrees F) and an identical cookie sheet, put 1 tablespoon of batter per cookie on a cookie sheet, repeat 12 times, and place in the oven. Bake for 8 minutes.
5. Have a grownup remove the cookies from the oven for safety.
6. Using a ruler, measure the diameter of each cookie and record in the logbook.
7. Repeat the experiment with varying temperatures of butter.
8. Once all the data is collected, calculate the average diameter of the cookies for each butter temperature.



Batter measurement
tool

A cookie before it is
baked



Baked cookies



Background:

I chose this project because I love cookies and I am generally interested in food science. There are a lot of things you can change in the kitchen to make your food taste better.

In my research I found out that it was the opposite of my prediction: cool butter spread the cookies out more.

This project is important because if you apply science, you can get your food to taste better. This is especially important with cookies.



Constant Conditions:

Independent Variable: The temperature of the butter. It is either cold (the temperature it is in the refrigerator is 40 degrees F) or melted (the temperature when it comes out of the microwave is 106 degrees F).

Dependent Variable: The diameter of a cookie from each batch of cookies.

Constant Conditions: For each butter test, I put together all the other ingredients and then split the batter in half so that the batter is otherwise the same for each batch of cookies. I use the same cookie sheet for each test, and I cook each batch of cookies for precisely 8 minutes. It is also important to make sure that I measure the amount of batter that I put on the tray for each cookie so that they are the same size before they are baked.



Data and Trials: I made a total of six batches of cookies: 3 with butter heated to 106 degrees F and 3 with butter at 40 degrees F. Because I wanted to use the identical cookie sheet, I placed exactly 12 cookies on each sheet using my measuring spoon. This means I have a total of 72 cookies, 36 in each butter temperature category. I wrote the data in a notebook and then recorded that data in Google sheets so that I could calculate the average diameter.

HOT (trial 1)	HOT (trial 2)	HOT (trial 3)	COLD (trial 1)	COLD (trial 2)	COLD (trial 3)
9	7	7	9	7	8
7	6.5	6	7.5	8	7
8	7	6	7	6	7
6	7	6	7	9.5	6
7.5	8	7	7.5	6.5	7
7	7	7	6	7	8
7	6	8	7.5	8	6
6.5	6	8	6.5	8	9
7.5	6	8	7.5	6.5	8
8	8	7	8	7	6.5
6	6	7	6	6	7
9	7	7	7	6.5	8
HOT average:		7.055555556	COLD average:		7.222222222



Conclusion and Reflection:

I found out that the cold butter spread out a little more than the hot butter. The difference was small: only 1.5 cm on average. Yet this is kind of a lot for a cookie.

I was surprised that the cold butter spread out more. I would have expected the opposite.

If I did this project again I would make more cookies. Since the effect was small, too, I'm not sure that the butter temperature is really the only thing that affects how much the cookies spread. If I did the experiment again I would try varying some of the other ingredients and alter the recipe in different ways.

