



SCIENCE FAIR PROJECT 2020
Glenridge Elementary School

MACARON MADNESS

Discovering when the right time is to add liquid
food dye in macaron batter.

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Question

When is the correct time in the process of making macaron shells to add food coloring?



Hypothesis

I predict that the macaron shells will get the correct feet if the food dye is added with either the dry ingredients, or after the eggs are beaten till foamy.

A correct french macaron foot is a textured ring around the base of the shell¹.

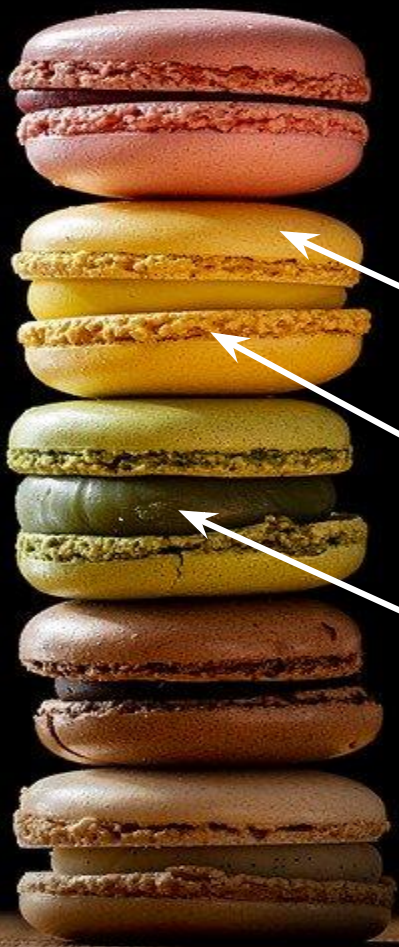


Background

What is a Macaron

macaron [ma·ca·ron| \ ,mä-kə-'rōn\]

A macaron is a light, sandwich cookie consisting of two rounded disks made from a batter of egg whites, sugar, and almond flour.² It is often filled with jam, buttercream, or ganache.³ The cookie dates back to the 1500's.⁴



Background

Parts of a Macaron

Shell

Foot

Filling



Background

Why Was This Project Selected

I chose this project because I like baking and eating macarons. I tried making them a few times with different recipes and they didn't come out correctly. I presumed that something was wrong with the egg whites and food coloring mixtures. I wanted to find out when the correct time would be to add the food coloring to achieve the proper foot and cookie texture.



Procedures

Tools & Materials

- Medium-sized colander (for sifting)
- Hand mixer with two chilled mixer attachments
- Medium-sized chilled glass bowl
- Medium sized general mixing bowl
- Rubber spatula
- Kitchen scale
- Adjustable teaspoon measuring spoon
- ¼ cup measuring cup
- Oven
- Two sheet pans
- Two sheets of parchment paper
- Flexible ice pack



Procedures

Tools & Materials





Procedures

*Ingredients*⁵

- 100 grams almond flour
- 100 grams powdered sugar
- 70 grams ($\frac{1}{3}$ cup) egg whites
- $\frac{1}{4}$ teaspoon cream of tartar
- $\frac{1}{4}$ cup sugar
- liquid food coloring



Procedures

Ingredients





Procedures

Recipe for Macarons⁵

1. Line two baking sheets with parchment paper.
2. Sift together almond flour and powdered sugar, twice.
3. In a clean chilled glass mixing bowl, beat the egg white on low speed with a hand mixer and chilled mixing attachments until foamy. Add cream of tartar and increase the speed to medium.
4. Slowly add sugar one tablespoon at a time. Continue to beat the egg whites on high speed until hard peaks form. Place glass mixing bowl on flexible ice pack.
5. Sift almond flour mixture over whipped egg whites, and gently fold it with a spatula until batter is just combined. About 50 folds.



Procedures

Recipe for Macarons, continued⁵

6. Transfer the batter into a pastry bag with a round tip. Pipe about 3.81cm (1.5 inch) rounds about 2.54 cm (1 inch) apart on prepared baking sheets.
7. Tap baking sheets firmly on the counter a few times to get rid of any air bubbles.
8. Let macarons sit out on the counter for at least 15-30 minutes. When you lightly touch the macarons, and the batter does not stick to your finger, then it's ready to go into the oven.
9. Bake at 150°C / 300°F for 18-20 minutes
10. Cool the macaron shells on sheet for 10-15 minutes, then transfer to wire rack to cool completely.



Trials & Samples

- Four drops of yellow food coloring, and three drops of red food coloring were added at three different times during the making of the macaron shells.
- Three trials were performed for each of the addition times.
- The macaron feet were measured after each trial, and an average height was determined.



Trial & Samples

- Trials 1, 2, & 3: the food coloring was added during step 2 (stirred in with the sifted almond flour and powdered sugar)
- Trials 4, 5 & 6: the food coloring was added during step 3 (with the egg whites before they were beaten till foamy)
- Trials 7, 8, & 9: the food coloring was added during step 4 (after the egg white mixture was whipped to hard peaks)



Conditions & Variables

Independent Variable:

- when to add the food coloring

Dependant Variable:

- how tall the foot is

Constant Condition

- recipe, baking time and temperature, materials, ingredients, drop of food coloring

Trial Data Table

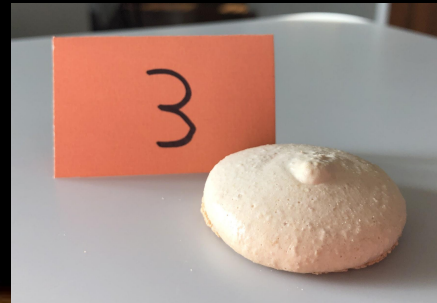
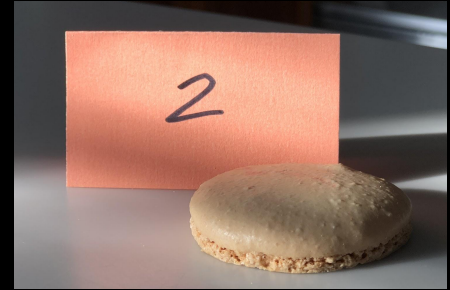


TRIAL	STEP ADDED	FOOT HEIGHT	AVERAGE HEIGHT	OBSERVATIONS
1	2	1 cm		Spotty color, surprised at feet
2	2	½ cm	0.61 cm	Bad color
3	2	⅓ cm		Small feet, bad color
4	3	No feet		Good color, longer dry time
5	3	No feet	0.16 cm	Lots of cracks, light color, no flavor
6	3	½ cm		Spongy texture
7	4	1 cm		When folding batter, could tell color was good
8	4	1 cm	1 cm	Over baked
9	4	1 cm		Perfect



Trial Examples 1-3

Liquid Food Dye Added in Step 2





Trial Examples 4-6

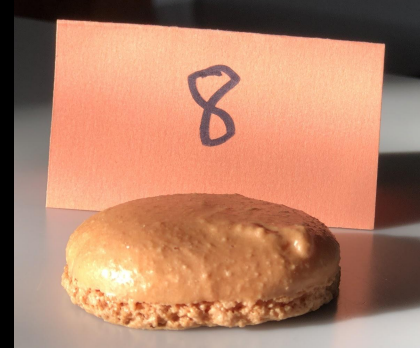
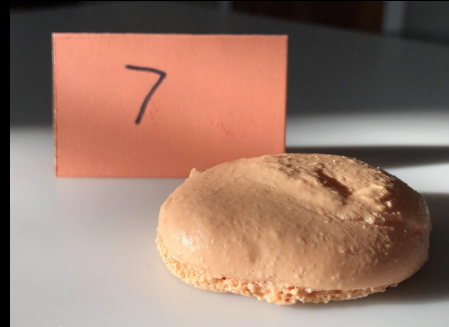
Liquid Food Dye Added in Step 3





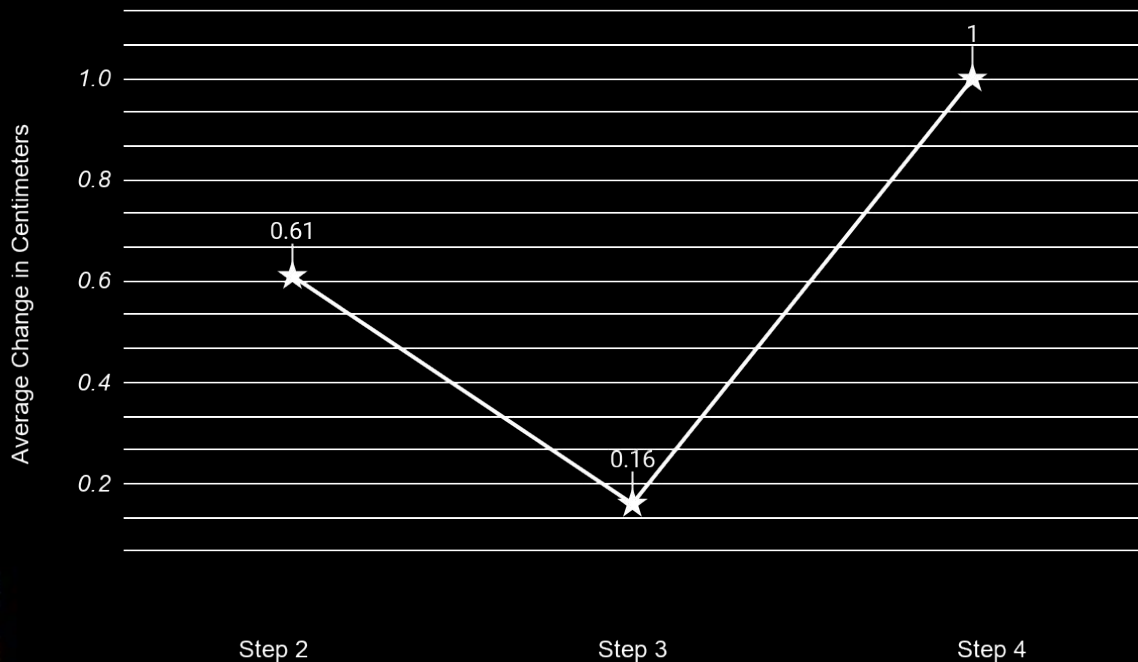
Trial Examples 7-9

Liquid Food Dye Added in Step 4





Trial Data Average Change





CONCLUSION

I thought that the macaron shells would get the correct feet if the food dye was added with either the dry ingredients, or after the eggs were beaten till foamy. My hypothesis was partially wrong. When the food dye was added with the dry ingredients (step 2), the feet were suitable, but the color was not vibrant. When the food dye was added after whipping (step 4), the feet and color were both much better. But, the color varied by batch.



REFLECTION

I was surprised with the result. I thought the food dye wouldn't affect the feet height at first.

If I were to do the experiment again, I would look into the timing of adding flavoring rather than food dye because I think it would change the overall appearance, texture and feet height of the cookie less than food dye affects it.

This is an important research project because not everyone knows about or how to make macarons. People confuse macarons with macaroons, which are a shredded coconut cookies. Macarons are now popular in many countries; like South Korea, the United States, and France.

I love baking and eating macarons, and I hope you do too!



BIBLIOGRAPHY

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5. Shinee D. “Basic French Macarons.” 10 May 2019.
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