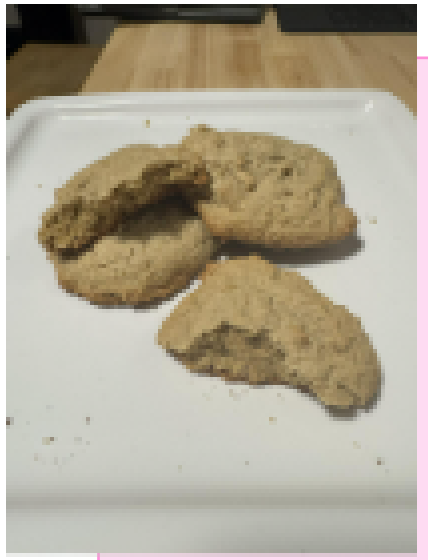
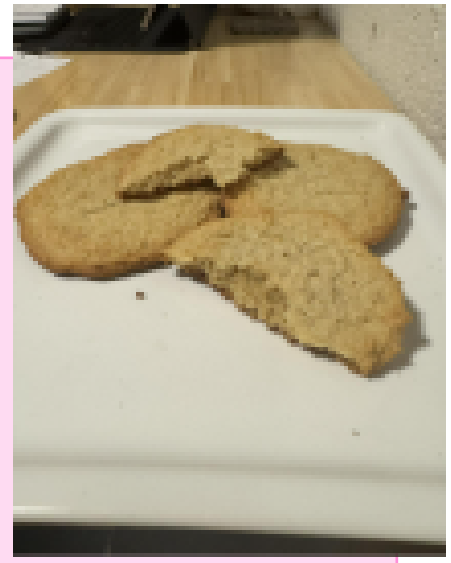
Oat Flour:



Rice Flour:

Almond Flour:



Flourless, yet flawless.

What is the best flour substitute in a cookie?

All-purpose GF Flour:

Research & Introduction

My science fair question “How can I substitute flour in cookies to make the best gluten-free cookie?”. I have decided to test different gluten-free flours because some people are allergic to gluten. One of the article said that rice flour, oat flour, almond flour, and all-purpose gluten-free flour can be good substitutes for regular flour . Another article I read showed some more substitutes for flour, and it says how to use the flours, so I know which ones I could use for the cookies and which ones to not use.

My second resource is a recipe. It shows me other ingredients to use when making the cookie. My fourth resource is a different recipe so I can choose which recipe is better. I will be cooking 4 batches of cookie with all the same ingredients expect the substitutes for the flour.

Question and Variables

Question- What gluten free flour will make the best Gluten free cookie?

Independent variable- the substitute for flour (almond flour, all-purpose gf, rice flour, and oat flour)

Dependent variable- height, width, texture, and taste of the cookie

Control- Cookie Ingredients and Recipe, (Sugar, Butter, eggs)

Hypothesis

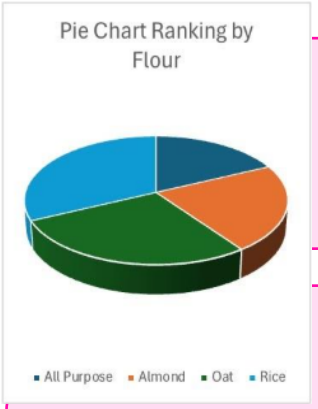
If you substitute regular wheat flour with a gluten free flour to make gluten free cookies then the cookies with be crumblier and break easier because gluten has a protein that gives elasticity to baked goods.

Materials

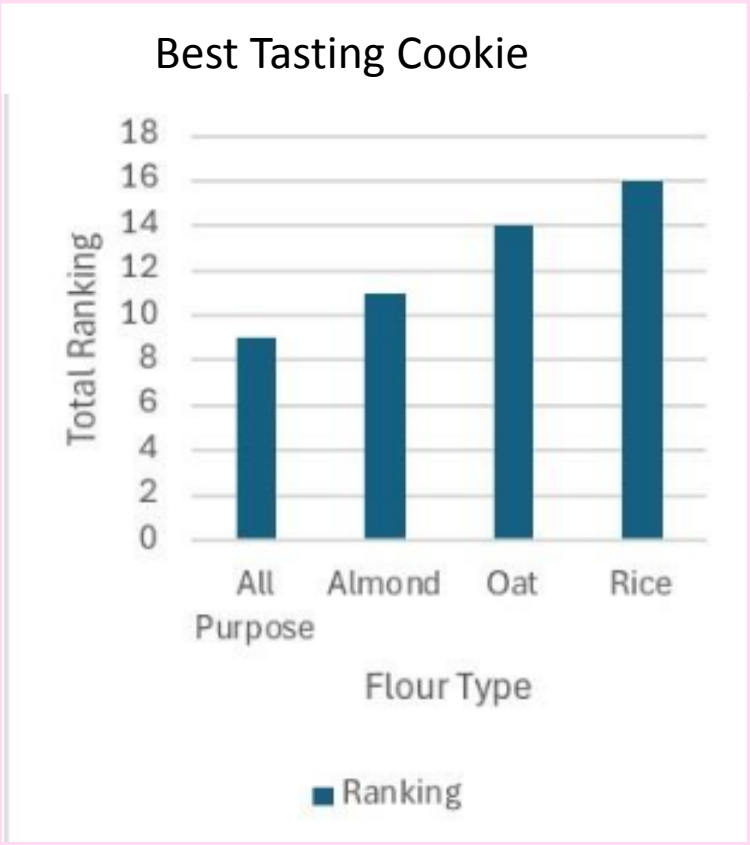
- Flour (500 g)
- Rice flour (500 g)
- Almond flour (500 g)
- Oat flour (500 g)
- Gluten-Free All-Purpose Flour (500 g)
- Sugar (200 g)
- Butter (150 g)
- 2 eggs (per batch of cookie, 10 in total)
- Vanilla Extract (5 mL)
- Baking Soda (5 g)
- Salt (2 g)
- Mixing bowl
- Measuring cups and spoons
- Baking sheet
- Parchment paper
- Oven
- Timer

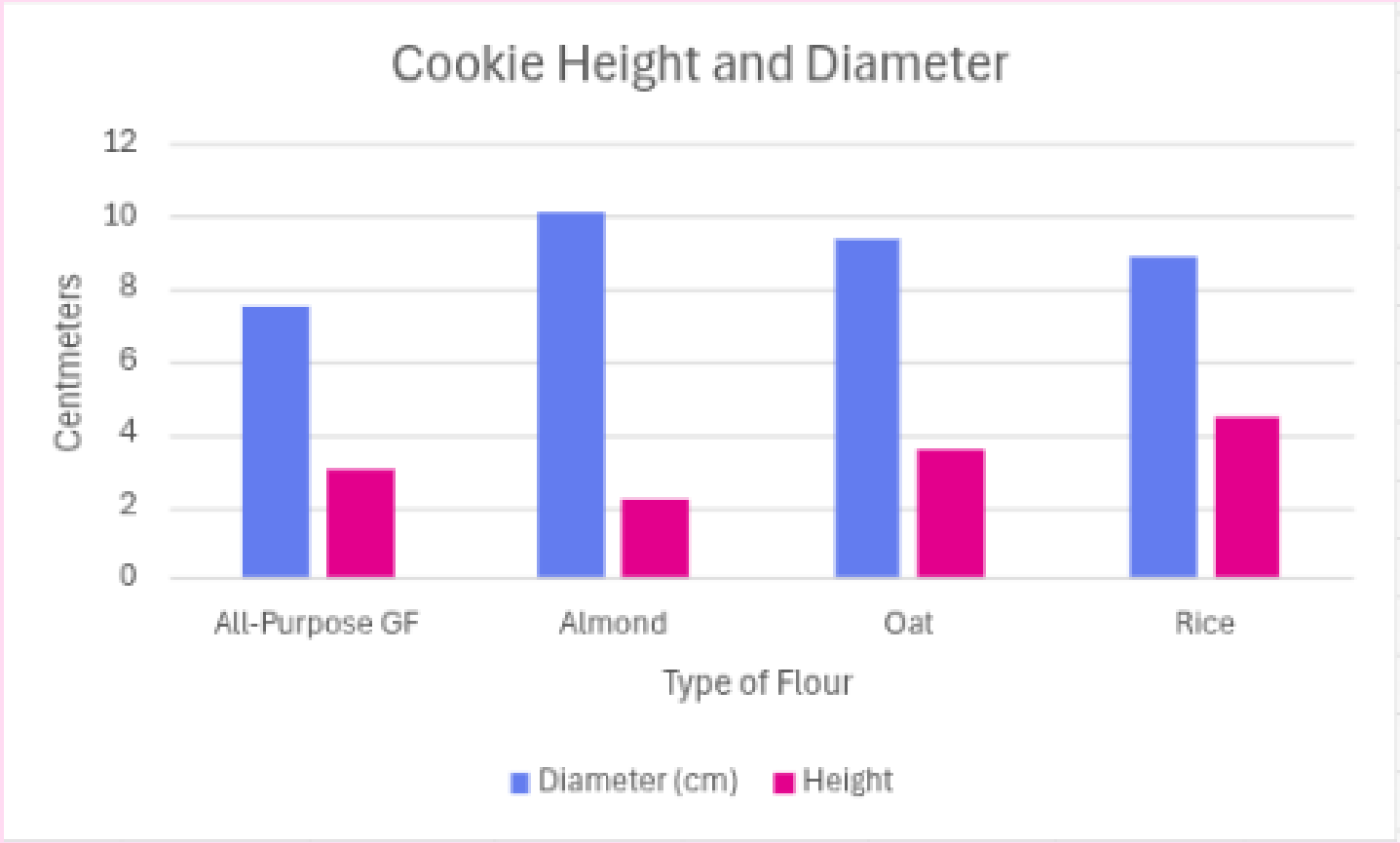
Procedures

1. Preheat the oven to 180 degrees C.
2. Line a baking pan with parchment paper.
3. In a large bowl, combine 150 g of butter and 200g of sugar.
4. Add 5ml of vanilla extract and 2 eggs, mix until fully blended.
5. In a separate bowl mix 500g of gluten-free flour, 5g of baking soda and 2g of salt.
6. Place the cookie dough in portions of about 30 g onto the baking sheet.
7. Bake for18 minutes or until the edges are golden brown.
8. Let cookies cool for 5 minutes.
9. Repeat experiments with the different flours. Keep all the other ingredients the same.
10. Compare the texture, colors, and blind taste testing from 5 people.
11 .Compare the height and the diameter of the cookie as well


Pie Chart Ranking by Flour
All Purpose
Almond
Oat
Rice

Graphs


Best Tasting Cookie
Total Ranking
18
16
14
12
10
8
6
4
2
0
All Purpose
Almond
Oat
Rice
Flour Type
Ranking


Cookie Height and Diameter
Centmeters
12
10
8
6
4
2
0
All-Purpose GF
Almond
Oat
Rice
Type of Flour
Diameter (cm)
Height

Tables

I had 5 taste tester eat the cookies, this is how they rated them. One being the worst 4 being the best.

Flour #	Flour Type	Taster 1	Taster 2	Taster 3	Taster 4	Taster 5	Total
1	All Purpose Gluten Free	1	3	1	2	2	9
2	Almond	3	4	2	1	1	11
3	Oat	2	2	3	4	3	14
4	Rice	4	1	4	3	4	16

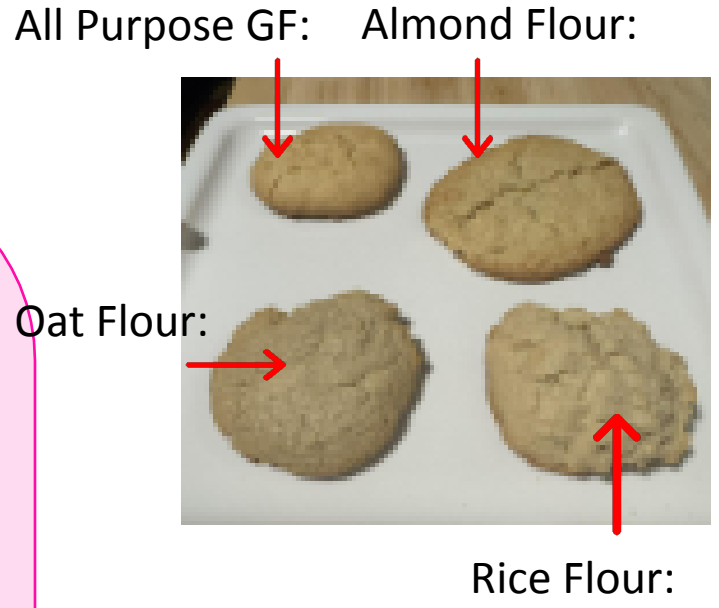
Flour #	Flour Type	Color	Texture
1	All Purpose	Golden brown (edge), Light Brown (top)	Soft, not crumbly
2	Almond	Golden Brown (whole cookie)	Chewy,
3	Oat	Light brown with dark brown spots	Bumpy
4	Rice	Very Light brown	Lumpy

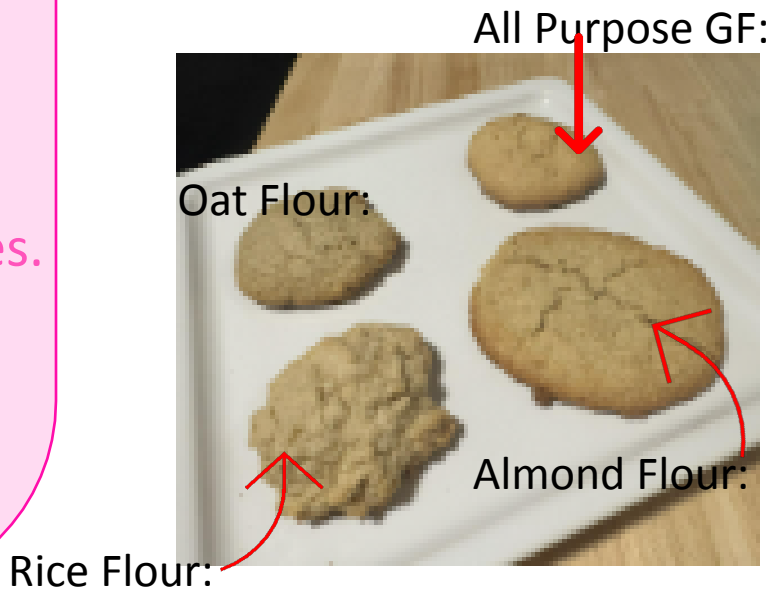
This table shows the height and diameter of the cookie.

Type of Flour	Diameter (cm)	Height
All-Purpose GF	7.5	3
Almond	10.1	2.2
Oat	9.4	3.6
Rice	8.9	4.5

Results

In my experiment, I made observations on the cookie texture and color, I also had 5 blind taste tasters eat the 4 different kinds of cookies (All-Purpose Gluten Free, Almond, Oat, and Rice) to determine the best. Overall, the best cookie was voted to be the rice cookie, and the worst cookie was the All-Purpose. Three out of the 5 taste testers liked the Rice cookie the best. Two of the taste testers had the All-Purpose as their least favorite, and 2 other taste testers had it as their 2nd least favorite. One interesting observation is that almond flour cookie was the only flat cookie; the rest rose in the oven and were rounder. I also measured the height and diameter of the cookie. The tallest cookie was rice cookies. The shortest cookies were the almond flour cookies they were 2.2 centimeters tall, but they were also the widest it was 10.1 cm . The All-Purpose GF was the smallest in diameter, it was 7.5 centimeters.





Conclusion

My hypothesis was "If you substitute regular wheat flour with a gluten free flour to make gluten free cookies then the cookies with be crumblier and break easier because gluten has a protein that gives elasticity to baked goods." My hypothesis was partly incorrect. The almond flour cookies was not very crumbly. The rest were pretty crumbly. An error I could have made was the time I put each cookie in the oven, they were all baked for 18 minutes but for the rice flour cookies I forgot to set the timer for about a minute.

Ideas for Future Research

A possible future experiment could be using the same flours but making cupcakes to see the results. Maybe A certain kind of flour would taste better made in a cupcake recipe then in a cookie recipe. It could be interesting to see how the flours would compare different pastries.

Reference

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