Effect of different flours and salt amounts on sourdough activity and pH

Grade level 4

Background Knowledge:

I chose this project because…

I wanted to figure out if using different flour types affects sourdough sourness and sourdough rising, and seeing if adding different salt percentages affects how sourdough develops.

In my research I found out that…

1. Sourdough starter contains a mixture of wild yeast and bacteria from the environment.
2. Different bread doughs have different recipes that ask for different kinds of flour and different amounts of salt.
3. Yeast in the sourdough produces acids, and the dough can have different sourness levels depending on the recipe, ingredients and amounts.
4. Sourness is a sign of acidity and pH scale is used to measure acidity.
5. I learned that Rye is another type of grain, like wheat but the type of protein in Rye is more stretchy and less strong. It also has lots of nutrients and sugars that help sourdough grow.
6. White flour is made by removing the bran and germ from wheat kernel before grinding. Whole Wheat has all 3 parts, the bran, endosperm and germ. The endosperm has lots of nutrients.

This project is important to me because...

I want to learn about baking and sourdough, learn how pH works, and see how salt amounts affect yeast. My family has a sourdough starter named Gus and it is 13 years old. It is our “pet”.

Testable Question:

How does different flours and salt amounts affect the way how sourdough starter grows and changes acidity levels?

Hypothesis:

If there is a difference in the kinds of flour and salt amounts, then it will impact how fast the sourdough grows and its acidity levels.

Constant Conditions:

Independent Variable:

Type of flour:
1. White All Purpose Flour
2. Whole Wheat Flour
3. Rye Flour

Salt amounts:
1. 0% Salt (White All Purpose Flour)
2. 2% Salt (White All Purpose Flour)
3. 10 % Salt (White All Purpose Flour)

Dependent Variable:

Rise levels of dough (percent change in height)
pH levels (how much acidity/sourness)

Constant Conditions:

1. Same shape and type of jars the whole time
2. Same amount of weight flour, water and starter
3. Same day, time and indoor temperature and humidity

Figure 1. The jars used to experiment and grow the yeast.

Procedure:

1. For each jar, we put 10 g of starter (existing White All Purpose flour starter with pH of 3.5), 10 g of water, and 10 g of flour. I used different flour for each set of 3 jars. The flours were White All Purpose Flour, Whole Wheat Flour, and Rye Flour.

2. I also did salt amounts, 2 sets of 3 jars, 2% (0.6 g) salt, and 10% (3 g) salt. For the salt jars, I used White All Purpose as the flour, following the same 10 g of starter, 10 g of water, and 10 g of flour.

3. Then I mixed the flour, water and starter (if salt, then mixed that too) together in the jar, until it became sticky and one color.

4. We put measurement lines on the jar as a starting point for measuring the rise. Then we dipped the pH test paper in the dough then placed it on a paper and compared it using the pH acidity scale. We did these at time points 0, 6, 12, 18, 24 hours (I didn't measure pH at 18 hours).

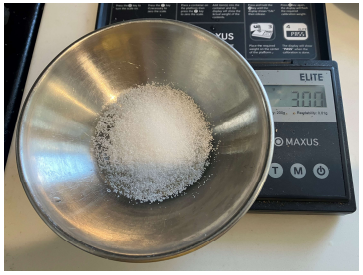
5. After 24 hours, I measured the rise markings on the jars and compared them.

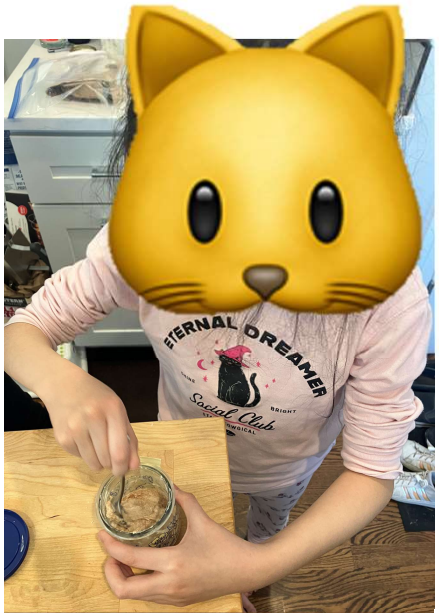
Procedure (continued)

Step 1: Put 10 g of sourdough starter in a jar, over a scale. Then put 10 g of water in the jar.

Step 2: Measure 10 g of flour and put it in the jar with the starter and water.

Measure salt (3 g for 10% salt jars and 0.6 g for 2% salt jars).

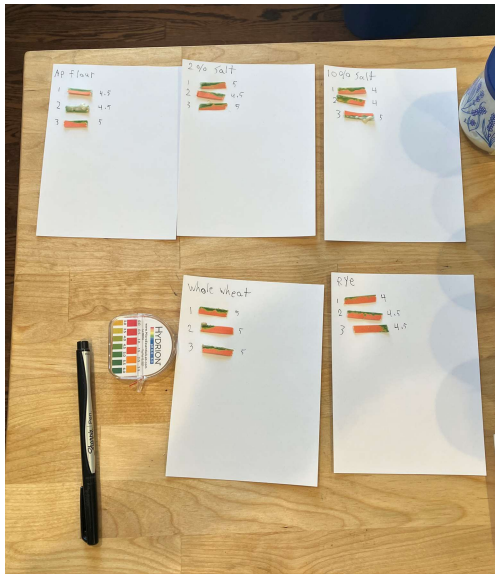




Step 3: Mix the starter, flour and water together. Mix until only one color remains and all the ingredients are mixed.

Step 4: Measure the height of the dough, draw a line, this is the starting point of the rise.

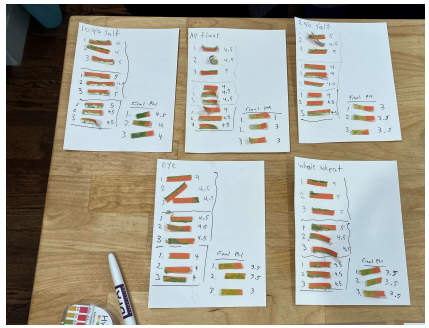
Procedure (continued)



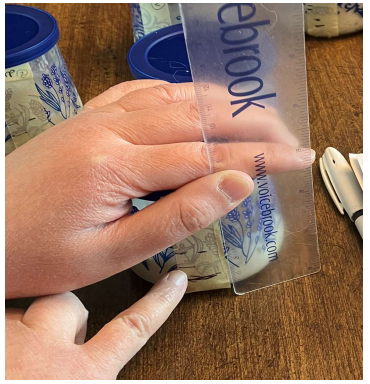
Step 5: Dip the pH test paper in the dough, this is to measure acidity levels in the dough. The paper should turn a different color. (0 being the most acidic and 6 being the least on the scale we used)

Step 6: Cover the jar and wait for 6 hrs for the sourdough to rise and the pH to change.

Step 7: Repeat steps 4-6. When you come back this will be time point 6 hrs, then wait another 6 hrs, time point 12 hrs, do steps 4-6, then another 6 hrs, time point 18 and then the last 6 hrs of waiting, time point is now 24! Make sure to do steps 4-6 after every 6 hrs of waiting.



Step 8: You now have sourdough that you measured the rise and took the pH of!



Results:

Table 1: Rise of Sourdough within 24 hours

Timepoint	0 hr	6 hr	12 hr	18 hr	24 hr
	Rise (cm)	Rise (cm)	Rise (cm)	Rise (cm)	Rise (cm)
White Flour #1	1.2	2	2.7	2.7	2.7
White Flour #2	1.1	1.7	2.4	2.4	2.4
White Flour #3	1.1	1.7	2.3	2.4	2.4
Whole Flour #1	1.1	1.6	2	2	2
Whole Flour #2	1.1	1.7	2.3	2.2	2.2
Whole Flour #3	1	1.3	2.1	2.1	2.1
Rye Flour #1	0.9	1.1	2	2	2
Rye Flour #2	0.9	1.3	2.1	2	2
Rye Flour #3	1	1.2	2.2	2.2	2.2
White Flour 2% Salt #1	0.9	1.4	2.1	2.4	2.4
White Flour 2% Salt #2	0.9	1.4	2.1	2.4	2.4
White Flour 2% Salt #3	1	1.3	1.8	2.2	2.2
White Flour 10% Salt #1	1.2	1.2	1.4	1.5	1.5
White Flour 10% Salt #2	1	1.2	1.3	1.4	1.4
White Flour 10% Salt #3	1	1.1	1.2	1.3	1.3

Table 2: pH of Sourdough within 24 hours

Timepoint	0 hr	6 hr	12 hr	18 hr*	24 hr
	pH	pH	pH	pH	pH
White Flour #1	4.5	4	4	-	3
White Flour #2	4.5	4.5	4.5	-	3
White Flour #3	5	4.5	4.5	-	3
Whole Flour #1	5	5	4.5	-	3.5
Whole Flour #2	5	4.5	4.5	-	3.5
Whole Flour #3	5	4.5	4.5	-	3.5
Rye Flour #1	4	4.5	4	-	3.5
Rye Flour #2	4.5	4.5	4	-	3.5
Rye Flour #3	4.5	4.5	4	-	3
White Flour 2% Salt #1	5	4	4	-	3
White Flour 2% Salt #2	4.5	4	4.5	-	3.5
White Flour 2% Salt #3	5	4.5	4.5	-	3.5
White Flour 10% Salt #1	4	5	5	-	4.5
White Flour 10% Salt #2	4	4.5	4.5	-	4
White Flour 10% Salt #3	5	5	4.5	-	4

*I did not take pH at 18 hr time point

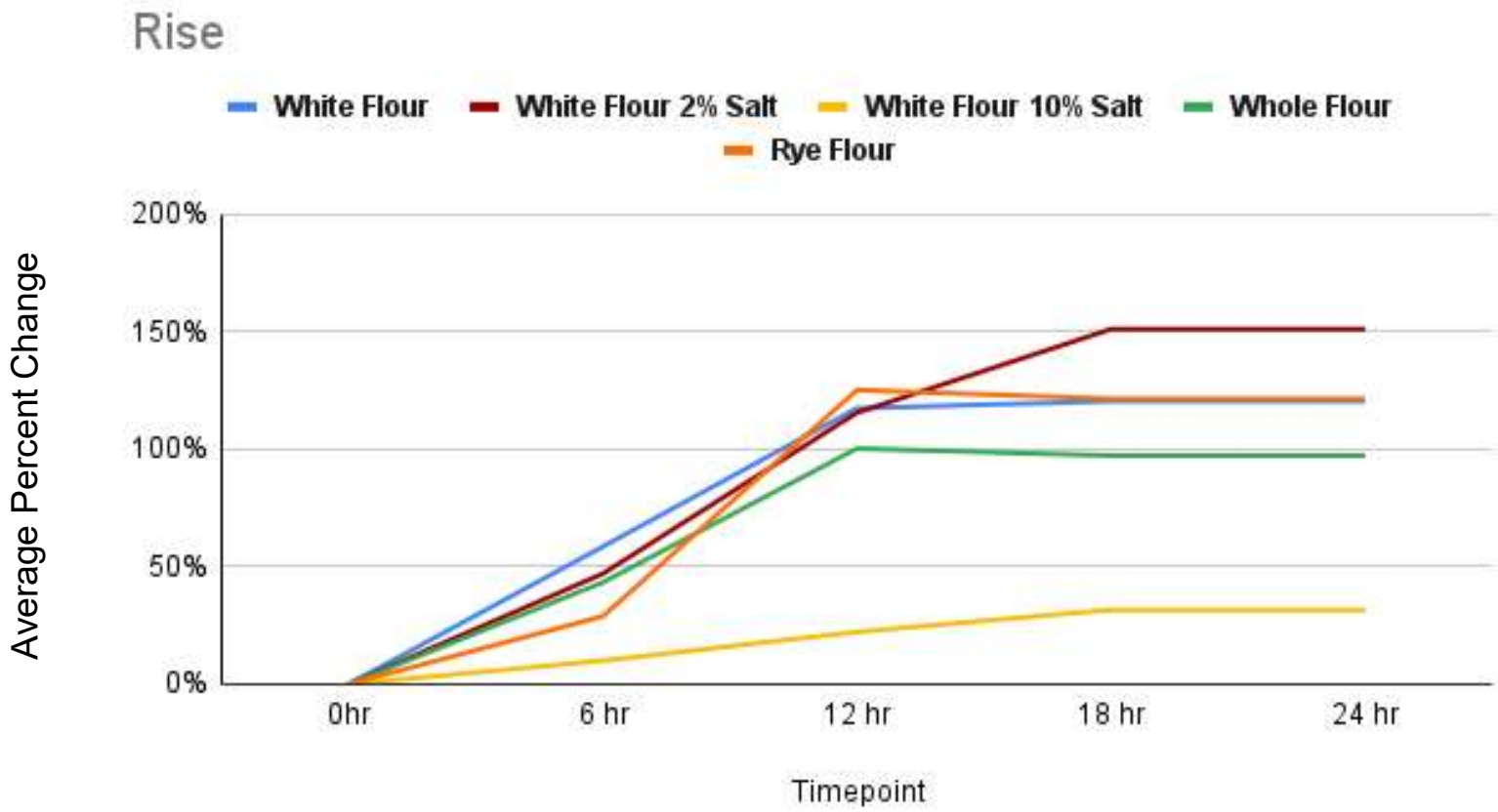
Results (continued)

Table 3: Calculated Percent Change in Rise

Percent Change in Rise (Averaged)					
Timepoint	**0hr**	**6 hr**	**12 hr**	**18 hr**	**24 hr**
White Flour	0%	59%	117%	120%	120%
White Flour 2% Salt	0%	47%	116%	151%	151%
White Flour 10% Salt	0%	10%	22%	32%	32%
Whole Flour	0%	43%	100%	97%	97%
Rye Flour	0%	29%	125%	121%	121%

Percent Change = ((Time point height – 0 hour height) / 0 hour height) x 100

Results (continued)



Conclusion and Reflection:

I found out that…

That 10% of salt (3 g) was too much for the yeast to handle and that 2% salt (0.6 g) was slow to rise at first, but caught up at the end. Some of the flours (whole wheat and rye) deflated between 12 hours and 18 hour timepoints.

The pH steadily changed from jar to jar with different flours and salt amounts. The most acidic (lowest pH) were the White All Purpose Flour jars and White All Purpose Flour with 2% salt jar #1. The least acidic (highest pH) were the jars with 10% salt, which was probably too much salt for the yeast to handle.

I was surprised that…

That 2% salt started slower but in the end caught up and had the highest rise.

After my experiment, I read that there is some reaction between salt and gluten that makes the risen dough stronger. (Bread Science: The Chemistry and Craft of Making Bread by Emily Buehler)

If I did this project again…

I would do more research on pH. I focused a lot on how yeast grows and how salt and flour affected it, but less on acidity/pH.

Bibliography

1. Buehler, Emily. (2006). *Bread Science: The Chemistry and Craft of Making Bread*. Carrboro, North Carolina: Two Blue Books.

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3. Pallant, Eric. (July 4, 2024). *The Whys of Ryes.* The Perfect Loaf. https://www.theperfectloaf.com/the-whys-of-ryes/

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