



Prize Winner

Scientific Inquiry

Year 3-4

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Pulteney Grammar School



Question

Which flour does wild yeast like to eat the most.

Prediction

The flour with the largest amount of simple sugar will cause the yeast to grow the most.

Background

My family bakes sourdough bread at home on most weekends using a starter that we “grew” at home. Sourdough starter is a mix of flour and water made over several weeks. In this process, natural yeasts and bacteria from the flour and the environment feed on the flour and form a living culture of useful organisms that we can use instead of commercial yeast to make bread. The sourdough starter is stored in the fridge when not needed and we use some of it each week when we bake bread. Once a week we need to “feed” the yeast in the starter with some more flour even if we do not bake a loaf. I want to investigate if the type of flour I use to feed the yeast makes a difference to the activity of the yeast starter and makes the starter bubble more. If I can feed the yeast in the starter its favourite food then we can boost the yeast in the starter and use it to make better bread.

Planning

In my reading I found that the yeast feeds on simple sugar (glucose) from the flour, When the yeast breaks down the sugar for energy, the carbon dioxide (CO₂) gas which is produced forms bubbles in the flour mixture causing the mixture to become frothy and rise.

I decided that if I could measure the amount of CO₂ produced by the yeast we could find out which flour the yeast worked best with. One way to measure CO₂ is to measure the change in the height of the starter mixture in a container (that is, measuring how much CO₂ is produced and trapped in the flour mixture). If I mix several different types of flour with portions of starter and I know the amount of sugar each flour contains, I can find out which flour the yeast “likes the best”.

The variables are the type of flour (with different amounts of sugar listed on the label) and the height of the starter measure over a period of time.

Equipment

Sourdough starter (prepared 3 weeks earlier from instructions in the book The Sourdough Whisperer p 13)

Flour - 5 different types of flour with nutritional information available (see 2 tables)

Water - boiled and then cooled to temperature of 28 degree Celsius

Electronic kitchen scales

5 identical tall, clear, colourless glasses

5 measuring cups for flour

5 measuring glasses for water

5 clean metal stirring rods (we used metal chopsticks)

Cling film plastic

Thermometer

Timer

Ruler (measuring scale to mm)

Flour type	Brand
White	Manildra Bakers Flour
Wholegrain	Kialla Pure Stoneground Plain Flour
Spelt	Four leaf Wholemeal Spelt Flour
Chickpea	Mckenzie's Chickpea Flour
Rye	Kialla Pure Organic Wholegrain Rye Flour

Table 1. The flours used in the experiment

Nutritional information Avg quantity per 100 grams	White flour	Wholegrain plain flour	Spelt flour	Chick pea flour	Rye flour
Energy	1460kJ	1450kJ	1414kJ	1570kJ	1400kJ
Protein	11.6g	11.3g	14.6g	21.9g	9.6g
Fat, total-	1.6g	2.2g	2.4g	8.3g	2.4g
-saturated	0.2g	0.4g	<1.0g	1.2g	0.4g
Carbohydrates	72.2g	64.5g	70.2g	47.7g	59.7g
-Sugars	1.9g	0.6g	6.8g	3.4g	0.9g
Dietary fibre	3.5g	7.6g	Not listed	10.1g	2.5g
Sodium	1mg	2.6mg	8.0mg	13mg	4.7mg
Gluten		0.6g		0	

Table 2 . The nutritional information for the flour used in the experiment (including sugar content)

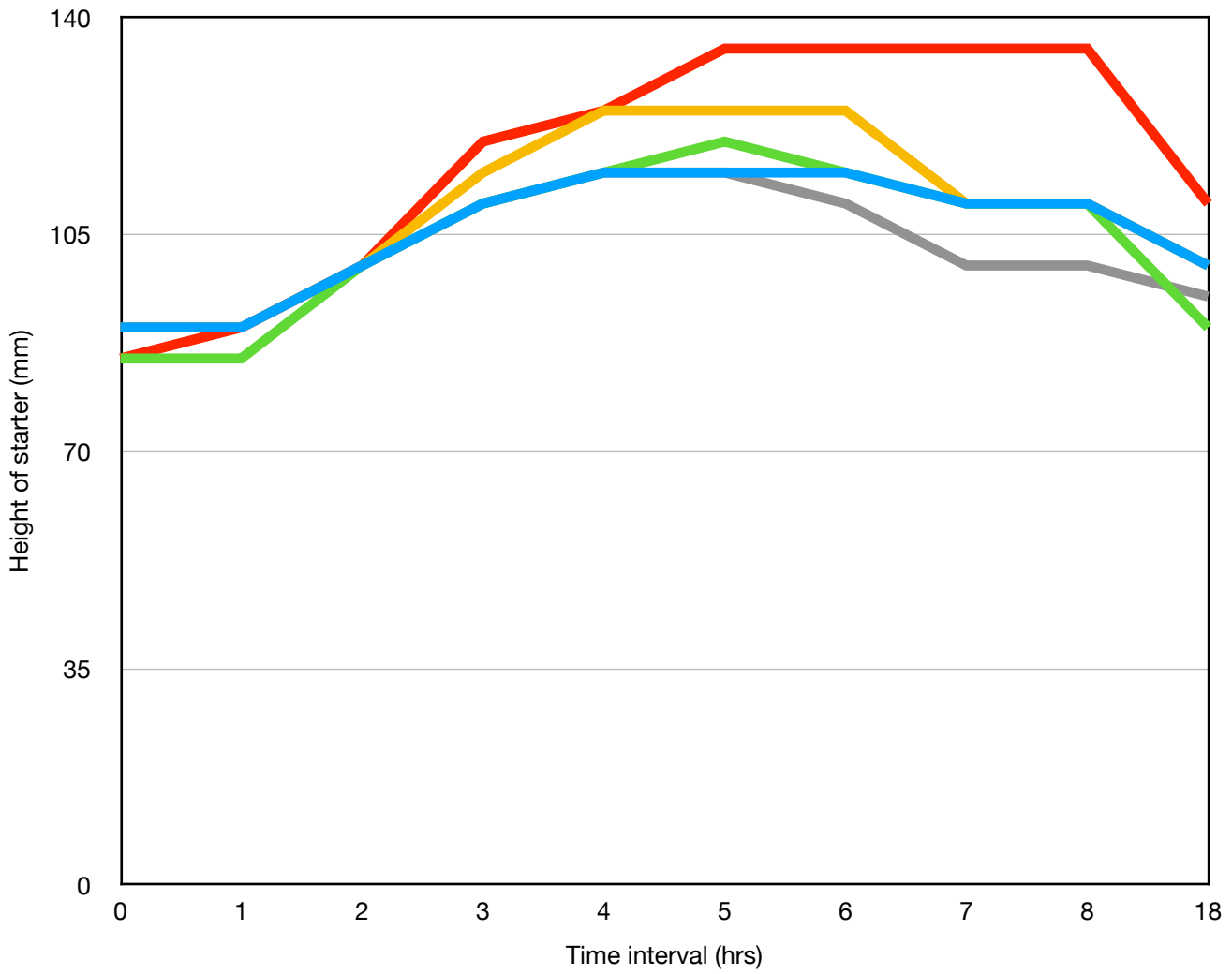
Method

1. Remove the starter from the fridge, remove the container lid, allow the starter to warm to room temperature over a minimum 3 hours.
2. Using kitchen scales, set the weight of a glass to 0 grams then weigh 80 grams yeast starter, repeat for the other 4 glasses.
3. Place a measuring cup on the scales then set the weight to 0 grams next add 40 grams of flour, repeat with the other 4 flours placing each of the flours on a label.
4. Using warmed water from the kettle (temperature of 28 degrees Celsius), weigh out five portions of water each weighing 40 grams.
5. Pour 40 grams of water carefully into each glass of starter.
6. Slowly add each flour to the glass of starter and water mixture, stir with a rod until it's well mixed and place on name label.
7. Place a large piece of clingfilm over the top of each glass and press to seal.
8. Measure each starter height, record the starting height then set a timer for at intervals of 1 hour.
9. Each time the timer goes off, measure the height of each starter, round the measure to the nearest 5mm, record the height and measure the temperature of the room to keep at constant 22 degrees C.

Results Table

TIME (hour)	Time Interval (hr)	White (mm)	Whoiemeal (mm)	Spelt (mm)	Chickpea (mm)	Rye (mm)
1330	0	90	85	90	90	85
1430	1	90	85	90	90	90
1530	2	100	100	100	100	100
1630	3	110	110	110	115	120
1730	4	115	115	115	125	125
1830	5	115	120	115	125	135
1930	6	115	115	110	125	135
2030	7	110	110	100	110	135
2130	8	110	110	100	110	135
730	18	100	90	95	100	110

Results Graph



— White — Wholemeal — Spelt — Chickpea — Rye

The Results

All of the starters rose in height. The rye flour rose the most followed by the chickpea flour. The rise stopped around 8 hours after the start of the experiment and when left overnight and measured at 18 hours several starters had collapsed back in the glass after the CO₂ has escaped. The rye flour contains the lowest amount of sugar but rose the most. The spelt flour contains the most sugar but was still behind rye and chickpea flour.

I think that the yeast uses the simple sugar first but then must feed on something else to keep making CO₂ over the time of the test.

When I did more research I found out that rye flour is thought to be a super food for wild yeast starters and some people think that rye flour contains more of the enzymes called amylase and maltase that break down starch (a type of linked sugar) in the flour to simple sugars or glucose for the yeast to eat. Maybe the chick pea flour also contains more of these enzymes.

Problems with my experiment

The cold temperatures at the time of my experiment caused problems for my yeast starter to work properly.

The experiment needed to be done in narrow containers to make the CO₂ bubble through the flour mixture and rise rather than the CO₂ escaping too quickly into the air. The ability of the flour to trap and hold the CO₂ changes with each flour type and affects the rise of my starter.

Measuring the rise of the starter was difficult through the glass as the shape of the surface flour was not always level and changed a lot over the test.

Summary

It can be useful for home bakers to find out which flour is a super food for wild yeast because a more active yeast starter can bake better and larger loaves of bread. The next experiment could use each of these "fed" starters to make a loaf of bread and measure the results in the baked breads.

References

Books

Boddy, E. 2022. The Sourdough Whisperer.

Kayser, E. 2015 The Larousse Book of Bread. Recipes to make at home.

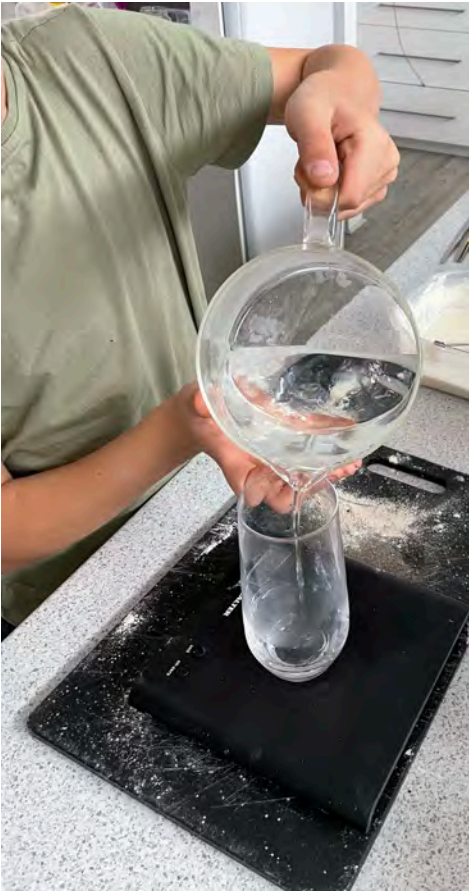
Carracciolo, B.E. 2018. Crusts. The Ultimate Bakers Book.

Website

<https://www.pantrymama.com/how-to-increase-the-wild-yeast-in-your-sourdough-starter/>

I received help from my mother for preparing the tables for the results and from my father for taking photos and uploading them to my report.

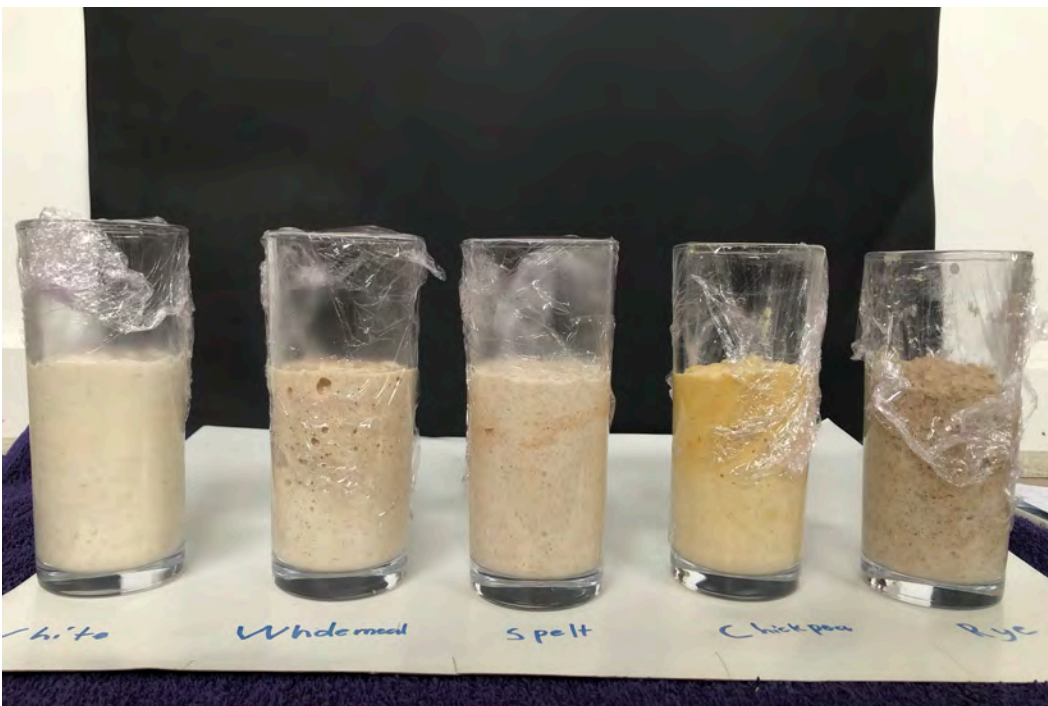
Photo Gallery



Measuring the warm water



The 5 different types of flour weighed



The wild yeast starter with the different flours mixed

Photo Gallery



The Rye flour starter



The Rye flour starter collapsed at 18 hours

Log Book

Date: . . .

Page: . . .

Date	Activity and Reflection
4/5/24	Research about sourdough and yeast. How we can measure which flour the yeast likes the most. Choose the flours.
16/5/24	Launched entry forms
18/5/24	Prepared a starter (followed instructions from Sourdough whisperer).
25/5/24	Trial experiment with my dad's starter (mine wasn't ready). Used 4 different flours after feeding measured starter height over 12 hours.
Problems	House temperature - too cold 14°C, Flour batter hard to stir with spoon, Starter had set on equipment if I didn't wash them immediately.
30/5/24	prepared report and did more research.
8/6/24	Experiment 1. With narrow glasses and 5 flours. House temperature 22°C (constant results reported)
9/6/24	Experiment 2. in wide plastic containers with extra water (5 flours) Problems - containers too wide to force the rise of the flour.
15/6/24	Wrote up results of the
16/6/24	experiments.
21/6/24	Risk assessment sheet signed by teacher.
22/6/24	Parents and my brother read my report and gave feedback.

OSA RISK ASSESSMENT FORM

for all entries in Models & Inventions and Scientific Inquiry

This must be included with your report, log book or entry. One form per entry.

NAME: Daniel Maddern ID: _____

SCHOOL: Pulteney Grammar School

Activity: Give a brief outline of what you are planning to do.

Make sourdough starter from flour and water.
Test different flours and measure the
height of the starter over a period of
time.

Are there possible risks? Consider the following:

- Chemical risks: Are you using chemicals? If so, check with your teacher that any chemicals to be used are on the approved list for schools. Check the safety requirements for their use, such as eye protection and eyewash facilities, availability of running water, use of gloves, a well-ventilated area or fume cupboard.
- Thermal risks: Are you heating things? Could you be burnt?
- Biological risks: Are you working with micro-organisms such as mould and bacteria?
- Sharps risks: Are you cutting things, and is there a risk of injury from sharp objects?
- Electrical risks: Are you using mains (240 volt) electricity? How will you make sure that this is safe? Could you use a battery instead?
- Radiation risks: Does your entry use potentially harmful radiation such as UV or lasers?
- Other hazards.

Also, if you are using other people as subjects in an investigation you must get them to sign a note consenting to be part of your experiment.

Risks	How I will control/manage the risk
<u>Adding warm water to mixture.</u>	<u>Measuring the heat of the water (parent to help)</u>
<u>Accidentally getting bacteria in my mixture.</u>	<u>I will wash my hands and equipment before use.</u>
<u>Contaminate me or my environment with yeast/bacteria.</u>	<u>I will wash my hands and equipment immediately after use.</u>

(Attach another sheet if needed.)

Risk Assessment indicates that this activity can be safely carried out

RISK ASSESSMENT COMPLETED BY (student name(s)): Daniel Maddern

SIGNATURE(S): Dem

By ticking this box, I/we state that my/our project adheres to the listed criteria for this Category.

TEACHER'S NAME: Sarah Richards

SIGNATURE: Richards DATE: 21/8/24