



Prize Winner

Scientific Inquiry

Year 5-6

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Do bicarbonate soda or baking powder make bigger cookies?

Questioning and predicting-

Question

Does bicarbonate soda, baking powder or none of them make baking expand more?

Background

I chose to do this experiment because I love baking and thought it would be interesting to find out whether baking powder, bicarbonate soda or nothing would make the cookies rise or expand more.

It was fairly easy to find some information on the effects of baking powder, bicarbonate soda and nothing mixed with other ingredients, so I could make an educated hypothesis

Aim

My aim is to determine the size of the cookies in the presence of bicarbonate soda, baking powder or nothing.

Hypothesis

My hypothesis is that Bicarb soda will make it rise more, while baking powder will make it expand more. I also anticipate that using nothing will make the baking flat and the same shape as it was put in the oven.

Baking powder is made out of baking soda, cream of tartar (a dry chemical) and cornstarch. It releases CO₂ through the baking. Bicarbonate soda is released by contact with water, raising the powder.

Variables

My independent variable is changing if I'm using bicarbonate soda, baking powder or none.

The dependent variable is what will make the cookies rise and spread out the most

I am measuring (using a measuring tape) what ingredient (out of baking powder, bicarbonate soda or nothing) will make the cookies expand and rise the most.

My controls that I keep the same are-

- brand of the ingredients
- recipe
- oven temperature
- amount of ingredients
- cooking equipment

Method

- Collect materials and equipment
- Preheat oven to 180°C
- Place butter, sugars and vanilla in the thermomix bowl.
- Cream together for 1 minute on speed 3-4.
- With the Thermomix still running, add egg through hole in lid and continue mixing on speed 3-4 for 30 seconds.
- Add flour and salt, knead on interval speed for 30 seconds.
- Add chocolate chips, stir through with spatula.
- Divide mixture into thirds, have one third with nothing in it, one third with baking powder in it and one third with bicarbonate of soda in it.
- Drop teaspoonfuls of mixture on trays, leaving room for spreading. Bake in a moderate oven for 10-12 minutes.
- Cut half of the cookies in half to measure the height and the other half for the width.

Fair test

This test will be a fair test because I will:

- use a rolling pin that makes a consistent width
- Make the cookies the same weight
- Cook them for the exact same time
- Make the same number of cookies
- Place the cookies on the same tray
- Place the cookies on the same level of the oven

Materials

- 125 g Butter
- 110 g white sugar
- 110 g brown sugar

- 1/2 tsp vanilla
- 1 egg
- 260 g self-raising flour
- 1/2 tsp salt
- 150 g chocolate chips
- Oven
- Thermomix
- Thermomix spatula
- Set square
- Ruler
- Scales

Risk Assessment

See separate attachment

Processing and analyzing data and information

Observations

I observed that the results were close and consistent, but clearly Bicarb soda made the biggest and widest cookies, even without measuring. I also observed that control generally was not bigger than Bicarb soda, or baking powder.

Results

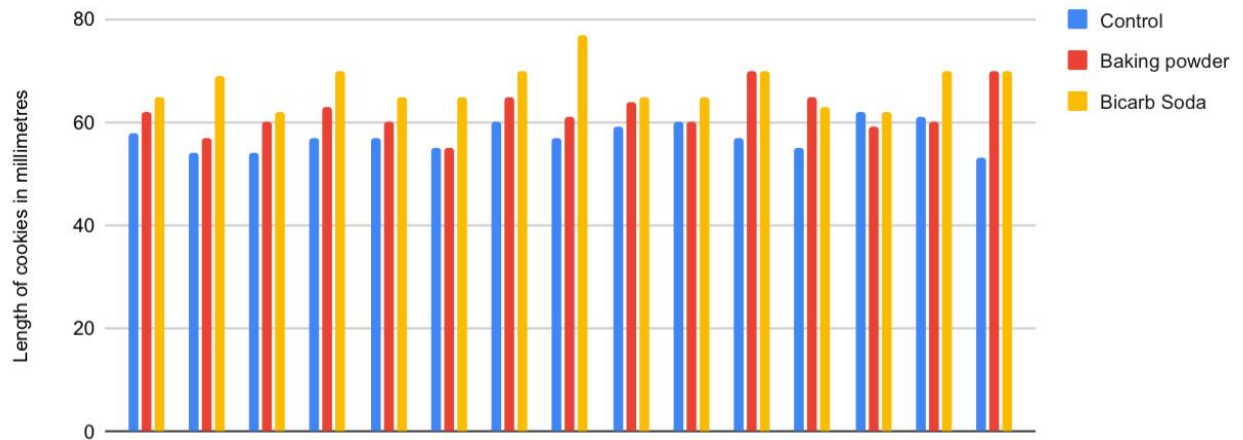
The results were fairly close, but it was clear to see that Bicarb soda made the tallest and the widest cookies. Baking powder was close, but not quite as big as Bicarb soda. Control occasionally was bigger than them, but in the averaged results was the smallest.

The initial dimensions of the cookies before going in the oven were 50 millimeters in length and 20 millimeters in height.

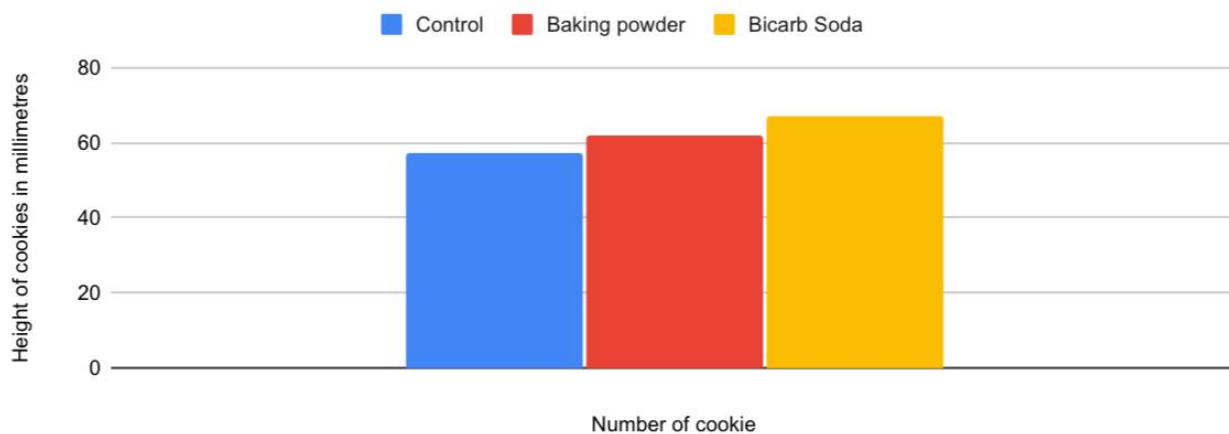
Length of cookies in mm

	Batch A					Batch B					Batch C				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Bicarbonate soda	65	69	62	70	65	65	70	77	65	65	70	63	62	70	70
Baking powder	62	57	60	63	60	55	65	61	64	60	70	65	59	60	70
Control	58	54	54	57	57	55	60	57	59	60	57	55	62	61	53

The Length of Cookies when using Bicarb soda, baking powder or nothing.



Averaged length of cookies when using Bicarb soda, baking powder or nothing in millimetres

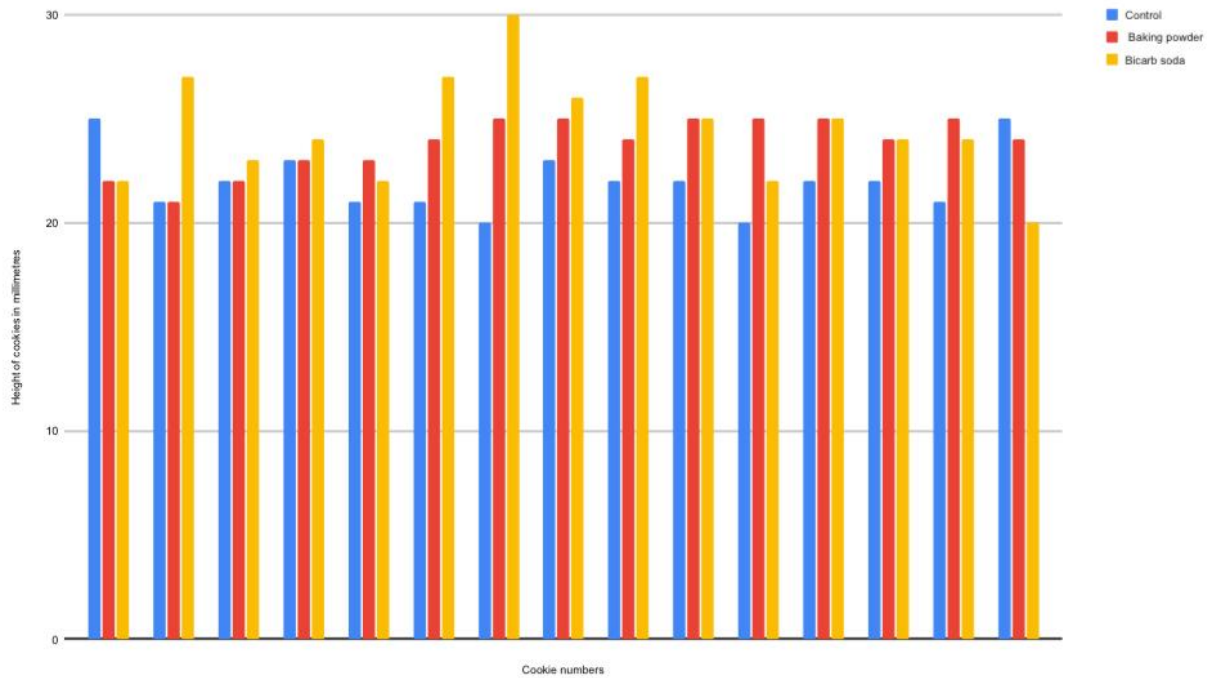


Height of cookies in mm

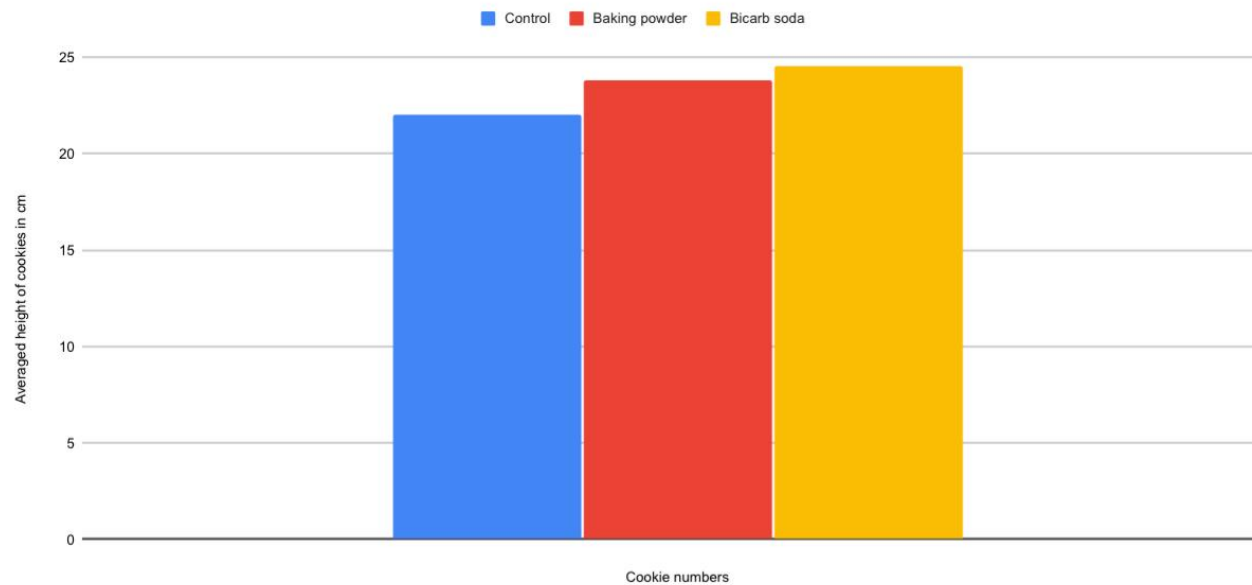
	Batch A					Batch B					Batch C				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Bicarbonate soda	22	27	23	24	22	27	30	26	27	25	22	25	24	24	20
Baking powder	22	21	22	23	23	24	25	25	24	25	25	25	24	25	24
Control	25	21	22	23	21	21	20	23	22	22	20	22	22	21	25

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Height of cookies in millimetres when using Baking powder, Bicarb soda or nothing



Averaged height in millimetres of cookies when using Baking powder, Bicarb soda or nothing



Concluding and evaluating data

Evaluation

The experiment was a fair test, all controlled variables were constant. The only thing that couldn't be controlled was how much the cookie dough ball was depressed. As some of the instruments required to measure force are not readily available in residential kitchens, this was a variable that could not be controlled.

The results of this experiment were accurate because measuring instruments were used correctly, avoiding parallax error, and the measuring instruments had a small limit of reading (in millimeters). When the cookies were being measured precise measurements were taken, using either a ruler or a set square.

The results of this experiment were reliable because each independent variable was tested 15 times. This was done over 3 batches, with each batch having 5 of each independent variable. The range of the batches were interesting, since control had a smaller range whilst Bicarb soda had a larger range.

The results of this experiment were valid because it had an experimental control, to compare the results to. It is accurate and reliable, and also valid.

The results of the experiment may be of interest to the home baker, and recipe developers.

Conclusion

The results of this experiment supported half of the hypothesis. Bicarb soda did make the cookie expand more, but it also made them rise more. Not significantly, but still enough to get results. Just as predicted in the hypothesis, control made the smallest cookies. Therefore Bicarb soda is best to use when trying to bake bigger cookies.

Log Book

March the 6th

Today I decided my topic for the competition. I decided to do a baking experiment, on the differences between using baking powder, bicarbonate soda or nothing. I think I'm going to bake cookies for the experiment, then measure their size. This will show me which ingredients make bigger cookies.

March the 20th

Today my class was talking about what makes a question a good science question. Here are a few things a good science question must be. It must be.....

testable

closed

worthwhile

safe

useful

measurable

completable in time

and indicates how to carry it out.

When I took these helpful prompts into mind I thought of a few ideas of how to phrase my question.

- a) Does bicarbonate soda, baking powder or none of them make baking expand more?
- b) Does bicarbonate soda, baking powder or none of them affect the taste in baking?

- c) Does knowing if bicarbonate soda, baking powder or none of them was used in baking change your opinion on the taste?

March the 26th

Today I was looking up recipes for chocolate chip cookies and found a possible option I will consider. It is a thermomix recipe, because it makes it more convenient for me to make. I looked at all my possible questions and decided on question a).

April the 3rd

Today we learned how to plan a fair test and use variables. To plan a fair test you must make everything the same except the things you need to change for your experiment. We learned an acrostic poem-like thing for variables. It is-

C ows - (We Change the independent variable. This sets the test Conditions of the experiment)

O ften - (Observe and

M oo - Measure the dependent variable)

S oftly (Same) - We keep the Controlled Variables the same.

April the 10th

Today we made our report lay out. I learned how to make tables to show my data and information. I confirmed I was measuring the height and width of the cookies.

Mrs F used an example for the number of times we should test it. Her example was “ if you were dying and there was a medication that had been tested on one person and they hadn’t died and there was a medication that had been tested on 100 people and they hadn’t died which one would you choose”.

I would choose the one that had been tested on 100 people, because it has been tested more and is more likely to be proved or unproved. What I got out of that example was the more times you test it the more likely your answer will be correct.

April the 27th

Today I went to the shops with my dad and my sister and bought all the ingredients I needed for my experiment.

After that I had an idea on how I was going to do the batches. I decided that each batch after I've added all the ingredients will be split into thirds and one will be my control group, one I'll add baking powder to and one I'll add bicarbonate soda to.

May the 1st

My class watched a Mythbusters episode, and had to write out the question, aim, hypothesis, materials, method, result and conclusion of the experiment they were doing, so we could have practice before we wrote in our report.

May the 5th

Today I baked all my batches of cookies, and collected all the data.

I baked them one after another, and used as many controlled variables as possible, since some variables were uncontrollable. The uncontrollable variable was how far I pushed down on the cookies.

I collected all the data using a ruler and a set square, and recorded it.

Here is a photo of them before they went into the oven.



May the 5th

Today my dad helped me make an official table of my raw data, using his laptop. We worked together to record the data in it, he typed it in, I said it. We put it on my report that night.

May the 29th

Today I filled out the risk assessment and did my background. It was fun to really think about why I was doing my experiment, and required me to really think. I guess I did it because I like baking, and measuring!

June the 12th

Today I learned how to use sheets to make a chart using my data. I made two for the height and two for my length. I chose to do primary colours for the colours, as they are distinctive and easy to tell apart. When I looked at the averaged data it was clear to see that Bicarb soda made the tallest and widest cookies. Oh well, only half my hypothesis is correct.

June the 19th

Today we talked about how to write an evaluation for our data. We had a look at 3 slide shows, about reliability, accuracy and validity.

June the 23rd

Today my dad helped me do my evaluation. He told me to not use pronouns or any words relating to myself in it, because that's what scientists do. I also filled out my conclusion, which was fairly easy, when I looked at my data.

I also had some ideas I could do for next year, based on the results of my experiment. It will have to wait though, until next year.

June the 26th

Today I started to edit my document, to get ready to upload it. I did find a few errors, and so did my friends. Tonight I'm going to get my parents to check it, then I will submit it as soon as I get a chance.

I also did a bit of research on why my hypothesis was only half right, and this is some information I found.

I did a bit of research to support my hypothesis, and I found out that baking powder is a raising agent, because of these websites: [Baking powder - BBC Good Food](#)

[What Is Baking Powder? - The Spruce Eats](#)

I also researched baking powder, and found out it was a raising and expanding agent. I wonder if that is why it rose and expanded the most? These are the website I used:

[Bicarbonate of soda - BBC Good Food](#)

[BI-CARB SODA - goodfoodz](#)

OSA RISK ASSESSMENT FORM

for all entries in Models & Inventions and Scientific Inquiry

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

STUDENT(S) NAME: Quinn Hansen

ID: O694-013

SCHOOL: Stirling East Primary School

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

I will be baking cookies to find out whether baking powder, bicarbonate soda or nothing makes the cookies rise and expand more. I will measure the length of the cookies, then the height.

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? **Only batteries can be used for Models & Inventions entries*
- 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
-cutting my finger with a knife -spill hot water onto my hands -burn myself on the oven -slipping in spilled ingredients -drop a knife on my foot -drop heavy objects (like the cooking tray) on my foot	-get one of my parents to use the knife for me -have the tap on cold to manage any burn/hot things -use oven gloves -keep the floor clean -put knives away after use -get one of my parents to move heavy stuff for me

(Attach another sheet if needed.)

Risk Assessment indicates that this activity can be safely carried out

RISK ASSESSMENT COMPLETED BY (student name(s)): Quinn Hansen

SIGNATURE(S):



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

TEACHER'S NAME:

Sarah Finney

SIGNATURE:



DATE:

26/6/24