SASTA OLIPHANT SCIENCE AWARDS

SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Prize Winner

Scientific Inquiry

Year R-2

Audrey Hyde

Annesley Junior School

Oliphant Science Awards 2023 - Scientific Inquiry

ID: 0018-003 Cooking Up a Storm

Questioning and Predicting

I like to eat brownies but they can be very different. I wondered why. I also wondered if I could change the recipe at home to bake it like my favourite brownie – one that is cake like. I like baking and I like science.

My questions for my project were:

- Why are some brownie's cakey, some gooey and some chewy?
- How can I make a brownie the way I like them? Or choose the recipe that will make a brownie turn out the way that I like them?

I predicted that I would be able to make a brownie the way I like them by trying different recipes and learning more about the science of baking.

Planning and Conducting

I looked at different brownie recipes and the difference between them with my Mum.

I found so many differences in the recipes:

- Type of ingredients:
    - Plain flour or self raising flour.
    - White sugar or brown sugar or caster sugar
    - Baking powder or no baking powder
    - Cocoa powder or cooking chocolate
- The amount of each ingredient
- The steps of how to bake them
- The temperature of the oven
- Whether to use room temperature eggs or cold (straight out of the fridge) eggs

My Mum and I read a book about the science of baking (Beaty and Griffith, 2022) and also some information on websites about why there are the differences between brownie recipes.

What we found out was:

- Cakey = more flour compared to oil / fat
- Gooey = more oil / fat than flour
- Chewy = melt the ingredients together

We also found out that the egg would help hold the mixture together and also help the brownie to rise if we mix the mixture a lot to add air in. We also found out that cooking chocolate has a higher fat content than cocoa, so it would be different than just using cocoa.

I chose a recipe that said it would make a cakey brownie because that is my favourite type.

I decided to bake the recipe and then change one part of that recipe at a time to try to answer my questions:

Change 1: what happens if I use cocoa powder instead of cooking chocolate?

Prediction – I think it will be more chewy and not as sweet

Change 2: what happens if I use brown sugar instead of white sugar?

Prediction – I think it will be sweeter

Change 3: what happens if I use water instead of eggs?

Prediction – I think it will fall apart

Equipment and Materials

The possible risks of the baking were:

- being burnt by the hot stove top and hot oven (or the hot ingredients)
- sharp knife to cut the butter and cut the brownies
- standing on a stool to reach the kitchen bench to put in ingredients and to reach the stove top
- overload of brownies

The risks were controlled by my Mum helping me with the baking. She used the sharp knife and put things into and out of the oven. My Mum also watched me while I stirred on the stove top.

The equipment and materials and ingredients I used for my experiments were:

- Kitchen scales
- Bowls
- Saucepans
- Whisks
- Baking paper
- Baking tin
- Stove top
- Oven
- Oven mitts
- Timer
- Note pad and pencil
- Pens
- Baking paper
- Cooling rack
- Cutting board
- Knife
- Camera
- Plain flour
- White Sugar
- Brown Sugar
- Eggs
- Cocoa powder
- 70% Dark Cooking Chocolate
- Salt
- Vanilla extract
- Spray canola oil

Photo: Some of the materials and equipment I used

The recipe I used was:

142g Unsalted butter

200g White sugar

80g Cooking chocolate (70%)

2 Eggs (~100g)

63g Plain Flour

½ teaspoon Salt

1 teaspoon Vanilla extract

Method:

Step 1: Get all of the equipment and ingredients out (except for the eggs – leave them in the fridge)

Step 2: Chop the butter and weigh the right amount and put it in a saucepan while weighing it

Step 3: Measure the white sugar and add it to the saucepan

Step 4: Measure the chocolate and put it into the saucepan

Step 5: Put the saucepan on the stove top and turn on stove top to heat “4” (induction cooktop)

Step 6: When the ingredients start melting, start mixing them together

Step 7: When all melted, turn off the stove top. Let the mixture cool for 5 minutes

Step 8: While the mixture is cooling, turn the oven on to 160^{o}C to warm up.

Step 9: Prepare the baking tins. Spray with oil, line with baking paper and lightly spray with oil again.

Step 10: Take the eggs out of the fridge, and weigh the eggs

Step 11: Add the eggs to the cooled mixture and whisk for a few minutes

Step 12: Add the vanilla extract and mix again

Step 13: Measure the flour and put it into the mixture and mix again for a few minutes

Step 14: Add the salt to the mixture and mix

Step 15: Put the mixture into the prepared baking tin

Step 16: Put the baking tin into the oven

Step 17: Bake for 20 minutes at 160^{o}C and 5 minutes at 180^{o}C

Step 18: To check if cooked, use a skewer to poke the mixture and if the skewer comes out clean it is cooked

Step 19: Take out of oven and let cool completely before taking out of the baking tin

Repeat three times by changing one of the following ingredients each time:

- Replace the cooking chocolate with the same weight of cocoa powder
- Replace the white sugar with the same amount of brown sugar
- Replace the eggs with the same amount of water as the weight of the eggs

Processing and Analysing Data and Information

I looked at what was happening when I was melting and mixing ingredients, when they were baking, when they came out of the oven and when I tasted them. There were differences in colour, in taste and how high they were. What I found out is in the table and shown in the photos.

Mixture	**How hard was it to mix?**	**What was the colour when cooked?**	**Was it chewy?**	**Baked Height**	**Taste**
Chocolate	Medium	Medium brown	A bit chewy	17 mm	Sweet
Cocoa	Hard	Dark brown	Very chewy	15 mm	Bitter
Brown Sugar	Medium	Medium brown	A bit chewy	17 mm	Not as sweet as the white sugar
Water	Easy	Dark brown	Fell apart, hard to cut	10 mm	Like chocolate pudding


Photo: the chocolate & white sugar mixture compared with the cocoa & white sugar mixture

Photo: water (left) and egg (right) mixture before going in the oven

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Photo: the brown sugar brownie (left) and the water brownie (right) when out of the oven

Photo: The four different brownies that I baked (from left to right: cocoa, chocolate, brown sugar, water)

Photo: Taste testing - finding the one that I like the best

The chocolate and white sugar and the chocolate and brown sugar brownies were almost the same. The only difference was in the taste.

The colours of the mixtures were almost the same before being baked but then some of them were different after being baked. I did not know why.

My prediction was right that the cooking chocolate would make a brownie that was more cakey than white sugar. My prediction that brown sugar would be sweeter than white sugar was wrong. My prediction that the brownie made with water would fall apart was right.

I conclude that there are more questions and a lot more to test.

Evaluating

I think it was a fair test for the different questions that I had.

I think the experiment could be improved. Some things we didn't measure were:

- the number of stirs / whisks given to each saucepan
- the temperature of the mixture when the eggs were added
- how much the brownie weighed when it was cooked

There are a lot more questions that could be tested.

Everybody likes a different type of brownie. The information from this experiment could help people understand how to make a brownie the way that they like it or choose the right recipe. Or question the recipe that they use.

This inquiry could encourage other people to try experimenting in the kitchen and understanding why the ingredients are there and how much of them are in a recipe .

References

Book:

Andrea Beaty and Dr Theanne Griffith, 2022, Ada Twist Scientist The Why Files, The Science of Baking

Websites:

https://foodcrumbles.com/chemistry-brownie-science-recipe/

https://www.youtube.com/watch?v=HIonKbKM-tE

https://getpocket.com/explore/item/this-is-how-temperature-butter-and-sugar-affect-your-brownies

Acknowledgements

I acknowledge the help of my Mum in the research, baking and writing of my report.

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.

STUDENT(S) NAME: Audrey Hyde ID: 0018-003

SCHOOL: Annesley Junior School

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

I am planning on doing some experiments in the kitchen to understand the science of baking brownies

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
Thermal risk - oven	I will ask my Mum to put things into and out of the oven. I will ask my Mum to look over me while using the stove.
Sharp risk - knife	I will ask my Mum to use the sharp knife.
Standing on a stool - heights	I will ask my Mum to be next to me when on a stool.

(Attach another sheet if needed.)

Risk Assessment indicates that this activity can be safely carried out

RISK ASSESSMENT COMPLETED BY (student name(s)): Audrey Hyde

SIGNATURE(S): Audrey Hyde

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

TEACHER'S NAME: Christiana Schammer

SIGNATURE: cschammer DATE: 01/06/2023

My Oliphant Diary

10th May

I love eating brownies.

I ate a brownie at School.

Why is it different to my mum's brownies?

17th May

I looked at some brownie recipes with my mum.

They are all different.

I am surprised.

Why are they different.

23rd May

I decided the recipe to use.

I decided the ingredients to change.

30th May

I wrote my recipe, changes and predictions

Many birthday parties on weekends meant I could not bake ....

24th June

Baking day

I got everything ready.

I mixed and put the ingredients in the pans.

I made notes about the mixtures and the pans.

I tasted the brownies I baked