

Hello Gluten



40 mins

MATERIALS

- 1 cup Wheat flour (2 types of flour).
- ½ cup water.
- 1 food processor/ bowl & mixing spoon.
- 1 mesh sieve/ colander.
- Sink/ access to running tap water.
- Chux cloth.



WHY?



METHOD:

1. Combine 1 cup flour with the ½ cup water to make a dough. Knead for 2 - 3 mins and set aside . Repeat with the other flour.
2. Using a mesh strainer lined with Chux wash your dough to remove any starch under running water. When done the water will run clear.
3. Remove your gluten from the water, dry on paper towel, weigh and make your observations on the worksheet .
4. Compare your results and record your observations.



Wheat flour contains the proteins Glutenin and Gliadin which bond together in the presence of water to form an elastic network. This network of proteins is then called Gluten. Gluten has the ability to trap air as the protein network swells with starch granules and gas which happens as a result of chemical reactions occurring within the dough. This causes the dough to rise and forms the basis of baking. The protein content of wheat flour determines the amount of gluten produced and informs its baking purpose/choice.

Lesson Outline:

Time allocation: 40 mins

Format: Group work.

Student outcomes:

- Visualize the gluten contained within wheat flour.
- Understand that Gluten is comprised of the proteins Glutenin and Gliadin, which in the presence of water bond together to form an elastic network.
- Understand that Gluten content is dependent upon the overall protein content of the wheat flour.
- Understand that the type of baking/ the intended purpose of the flour dictates what Gluten content/wheat flour protein percentage is required.
- Utilise science inquiry skills.
- Enhance literacy and critical evaluation skills.
- Enhance food literacy and food experience skills.

Materials:

FOR EACH GROUP

- Bread making flour >10% protein content
- Cake making flour < 7% protein content
- Measuring cups
- Bowl
- Mixing spoon
- Digital scales
- Paper kitchen towel
- Sieve/ colander
- Chux cloth (to line sieve/ colander)

Optional/ Extra Material:

Preparation:

Print or display experiment set up poster for the groups to follow and print student worksheets if required.

Setup: 2 mins

Assemble all necessary equipment for the children to access when conducting their experiment/s.

Introduction: 8 mins

Ask: Who has heard of Gluten?

N.B Gluten can be an allergen and is avoided in the diet of people who have been diagnosed with Coeliac disease. An allergy is different to an intolerance because an allergy triggers a detectable immune system response along with symptoms whereas an intolerance may cause some symptoms but does not cause any immune response.

Ask: Does anyone know what it is?

Gluten is a protein that is created when two small proteins that are present in wheat flour combine in the presence of water. They are Glutenin and Gliadin. When we use wheat flour to bake and cook with water or liquids containing water like milk are often added and this causes the Glutenin and Gliadin proteins to change shape and bond together. Forming an elastic protein network called Gluten which can stretch and hold gas (air bubbles).

Ask: Why would that be important to baking?

Gluten is important to baking because its ability to stretch and hold gas/ create air bubbles means it can make cakes or dough rise, giving structure to baked goods. The amount of gluten created by a wheat flour also contributes to the texture of baked goods.

Investigation: 20 mins

Working in small groups of 2 or 3 ask the students to follow the instructional poster to conduct their experiment and fill out their worksheet.

Discussion: 5 mins

Ask: Was there a difference in the amount of Gluten produced by the two flours?

Ask: Does anyone think they know why?

The overall amount of protein in the flour will affect how much Gluten can be produced. High protein flours are very good at holding strong structure full of air and rise well as in the higher protein flour whilst the lower protein flour produces less Gluten providing a more delicate crumbly texture and lighter, less robust dough/ batter.

Conclusion: 5 mins

Ask the students to pack away their experiments.

Take away messages:

Chemical reactions can create changes we can see and are involved in many familiar processes.

- The creation of Gluten when baking with wheat flour is a chemical reaction.

Glutenin and Gliadin proteins bond together in the presence of water to make Gluten.

- The protein percentage of various wheat flours influences how much Gluten will be produced by the flour when used in baking. This in turn informs which flour to use for which baking purpose.

Gluten can be an allergen for some people.

- An allergy to Gluten is different to an intolerance to Gluten because a food allergy involves an immune response which can be detected using skin prick or blood tests whilst an intolerance does not involve the immune system. Common symptoms of a food allergy include: wheezing, skin rashes, intestinal disorders and in severe cases - life threatening anaphylaxis

Foods are comprised of vitamins, minerals and molecular compounds which means they too can undergo chemical reactions.

- Gluten is the product of a chemical reaction between wheat flour and water.

Further Topic Inquiry

This experiment can be further explored within the context of the Health and Physical Education Curriculum. Providing an opportunity for students to develop strategies to ensure safety and wellbeing at home and at school, such as identifying and choosing healthier foods and drinks for themselves.

Refresh.ED provides unit resources for specific year groups within their Food & Drink Choice and Food, Drink & Health focus areas. Of particular interest in relation to extending learning within this area is the unit.

- Year 8 Food Allergies & Intolerances.
Promoting Staple Foods.
- Year 9 Food Labels Exposed.

Hello Gluten Worksheet

Type of Flour	Grams of Protein/ 100g	Grams of Gluten Recovered	Observations

1. What two proteins combine to form Gluten?

2. What does Gluten do in baking?

Hello Gluten Experiment

Overview

In this experiment students visualize the Gluten contained within two different types of wheat flour. Two doughs are prepared using wheat flour of varying protein contents and suited to different baking processes (bread and cake flour). The doughs are then washed to remove the starch, revealing the Gluten contained within each flour.

Some key new vocabulary students will be introduced to includes: Gluten, Glutenin, Gliadin, Knead, Dough, Starch, Protein, Allergen.

Key Messages

- Glutenin and Gliadin are proteins contained in wheat flour.
- In the presence of water Glutenin and Gliadin bond together to form an elastic protein network known as Gluten.
- The amount of Gluten in wheat flour is determined by the flour's overall protein content and will affect how it performs when baked.
- Gluten in baking provides structure and creates texture.
- Gluten can be an allergen.

Learning Outcomes:

- Visualize the gluten contained within wheat flour.
- Understand that gluten is comprised of the proteins Glutenin and Gliadin, which in the presence of water bond together to form an elastic network.
- Understand that Gluten content is dependent upon the overall protein content of the wheat flour.
- Understand that the type of baking/ the intended purpose of the flour dictates what wheat flour protein percentage is required.
- Utilise science inquiry skills.
- Enhance literacy and critical evaluation skills.
- Enhance food literacy and food experience skills.

General capabilities:

Literacy, Critical & creative thinking, Personal & social capability.

Year 9 Australian Curriculum Links

Strand/ Sub- strand	Curriculum content descriptions
SCIENCE	
<p>Science understanding. <i>Chemical sciences.</i></p> <p>Science inquiry skills. <i>Planning & conducting.</i></p> <p><i>Processing & analysing data & information.</i></p> <p><i>Communicating.</i></p>	<p>Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed. Identifying reactants and products in chemical reactions (ACSSU178).</p> <p>Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods. Explaining the choice of variables to be controlled, changed, and measured in an investigation. Identifying the potential hazards of chemicals or biological materials used in experimental investigations (ACSI165).</p> <p>Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSI169).</p> <p>Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSI170).</p> <p>Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions, and representations (ACSI174).</p>
ENGLISH	
<p>Literacy. <i>Interacting with others.</i></p>	<p>Use interaction skills to present and discuss an idea and to influence and engage an audience by selecting persuasive language, varying voice tone, pitch, and pace, and using elements such as music and sound effects. Participating in pair, group, class, school, and community speaking and listening situations, including informal conversations, discussions, debates, and presentations (ACELY1811).</p>
TECHNOLOGY	
<p>Design technologies. <i>Knowledge & understanding.</i></p>	<p>Investigate and make judgements on how the principles of food safety, preservation, preparation, presentation, and sensory perceptions influence the creation of food solutions for healthy eating. conducting sensory assessment testing of a range of foods to determine how these characteristics might be used to enhance food solutions, for example taste testing a variety of milks, comparing freshly squeezed juice to commercial juices (ACTDEK045).</p>

Additional Year 9 WA Curriculum Links

Strand/ Sub- strand	Curriculum content descriptions
TECHNOLOGY	
Design technologies. <i>Knowledge & understanding: Food specialisations.</i>	Principles of food including safety, nutrition, preservation, preparation, presentation, physical and sensory properties, and perceptions (ACTDEK045).

External Supporting Resources for Teachers

- The chemistry of eggs & eggshells infographic.



<https://www.compoundchem.com/2016/03/26/eggs/amp/>

- Experiment demonstration.



<https://www.youtube.com/watch?v=zDEcvSc2UKA&t=1s>