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Procedure:

- Procedures:
  Each person that was participating washed their hands and put on a pair of gloves and an apron. The oven was preheated to 350 degrees celsius, then materials and ingredients were gathered in the kitchen. 1 cup of white sugar and ½ cup of unsalted butter were added and mixed until combined in the first mixing bowl. Two eggs were added, one at a time, and mixed until combined with the mixture in the mixing bowl. 2 teaspoons of vanilla extract were added and mixed until combined with the mixture in the mixing bowl.

In the second separate bowl with a separate spatula ¼ teaspoon of salt and 1 ¾ teaspoons of baking powder were added, then mixed until combined. 1 ½ cups of whichever type of flour is being used in the recipe is added then was mixed until combined.

Dry ingredients were poured into and mixed until combined with the ingredients from the first bowl. ½ cup of whole milk was added and mixed until combined with the other ingredients. Cake batter was poured and spread into the 8x8 cake pan that was lined with parchment paper. The cake was placed in the oven once it was completely preheated. The cake was taken out in intervals after 5, 15, 25 and 35 minutes to measure if it was baked using a kitchen thermometer to measure internal temperature. The cake was also measured in centimeters (cm) using a ruler before and after it was baked to see height changed. The cake was also measured in grams using a kitchen scale, before and after it was baked to determine density change and moisture loss. All of the previous was repeated with each individual independent variable of flour for data to be collected. At the end the dish soap and sponge were used in the sink to clean up after the experiment.

- Data Analysis Procedure:
  Internal temperature data was collected by measuring the cakes internal temperature using a kitchen thermometer. The cake was taken out in timed intervals: 5, 15, 25, and 35 minutes into baking and once before baking. The height change data was collected by measuring the unbaked cakes height then the baked cakes height. The density data was collected by measuring the weight in grams using a kitchen scale from the unbaked cake then the baked cake. The moisture loss data was collected by measuring the weight in grams using a kitchen scale from the unbaked cake then the baked cake.

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Data Tables: Changes in the cake

Cake Height Change:

Flour type:	Height before baking:	Height after baking:	Height Change:
All Purpose flour (control):	2.5cm	4.0cm	+1.5cm
Almond flour:	2.3cm	3.5 cm	+1.2cm
Oat flour:	2.5cm	3.5cm	+1.0cm
Whole wheat flour:	3.0cm	3.9cm	+0.9cm
Pumpkin flour:	1.7cm	5.0cm	+3.3cm
'Gluten Free' Flour Blend:	3.0cm	3.5cm	+0.5cm

Cake Density Change:

Flour type:	Density before baking:	Density after baking:	Total density change:
All Purpose flour (control):	0.747 g/cm³	0.449 g/cm³	-0.298 g/cm³
Almond flour:	0.787 g/cm³	0.506 g/cm³	-0.281 g/cm³
Oat flour:	0.723 g/cm³	0.493 g/cm³	-0.230 g/cm³
Whole wheat flour:	0.644 g/cm³	0.476 g/cm³	-0.168 g/cm³
Pumpkin flour:	1.037 g/cm³	0.337 g/cm³	-0.700 g/cm³
'Gluten Free' Flour Blend:	0.653 g/cm³	0.542 g/cm³	-0.111 g/cm³

Cake Moisture Loss:

initial weight final weight

Flour type:	Moisture before baking:	Moisture after baking:	Total moisture loss:
All Purpose flour (control):	771 g	741 g	-3.89%
Almond flour:	747 g	731 g	-2.14%
Oat flour:	746 g	712 g	-4.56%
Whole wheat flour:	798 g	767 g	-3.88%
Pumpkin flour:	728 g	696 g	-0.04%
'Gluten Free' Flour Blend:	809 g	783 g	-3.21%

$\frac{\text{mass}}{\text{volume}} = \text{density}$

$\text{mass} = \text{density} \times \text{volume}$

$412.9\,\text{cm} \times \text{weight}$

$\frac{\text{initial weight} - \text{final weight}}{\text{initial weight}} \times 100 =$ moisture loss

Cake Temperature Table

Cake Internal temperature:

Flour Type:	Cake internal temperature before baking:	Cake internal temperature after 5 minutes	Cake internal temperature after 15 minutes	Cake internal temperature after 25 minutes	Cake internal temperature after 35 minutes
All Purpose flour (control):	63°F	86°F	114°F	138°F	162°F
Almond Flour:	68°F	87°F	110°F	130°F	139°F
Oat Flour:	62°F	89°F	117°F	135°F	141°F
Whole Wheat Flour:	68°F	85°F	102°F	139°F	141°F
Pumpkin Flour:	85°F	99°F	116°F	126°F	139°F
'Gluten Free' Flour Blend:	70°F	85°F	111°F	137°F	143°F

Material List

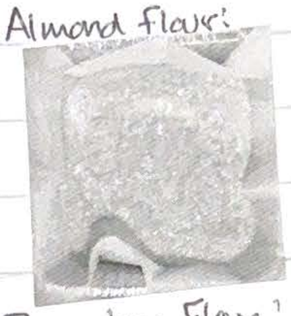
- Material List:
- One Ruler: Utensil of measurement used to measure the rise of the cake, to determine height change for data collection.
- One food thermometer: Utensil of measurement used to measure internal temperature of the cake, to determine when the cake is baked for data collection.
- One kitchen scale: Utensil of measurement used to determine weight of cake, to determine density and moisture loss for data collection.
- One 8x8 Cake Pan: 8 inches by 8 inches a deeper square shaped cake pan for when the cakes are being baked.
- One roll of parchment paper: material that is placed in the cake pan to prevent the cake from sticking to the side of the pan.
- Set of Measuring Cups: Utensil used to measure ingredients to make cake batter.
- Set of Measuring Spoons: Utensil used to measure smaller portions of ingredients to make cake batter.
- Two Spatulas: Utensil used to mix and combine ingredients into batter.
- Two Mixing bowls: Location where ingredients will be added and combined to make batter.
- One Oven: Location where cake batter in the 8x8 cake pan will go to be baked and the experiment is conducted.
- Two Aprons: Apparel used to protect clothes from being dirtied with batter.
- One bottle of Dish soap: Substance used to clean dirty dishes post-experiment.
- One Sponge: Utensil used to clean dirty dishes post-experiment.
- One Sink: Location where dirty dishes will go post-experiment to be sanitized.
- Two pairs of Gloves: Apparel used to protect hands while cleaning, cooking during various steps throughout the experiment.
- 1 cup White sugar (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- ½ Cup Unsalted butter (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- 2 Eggs (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- 2 teaspoons Vanilla extract (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- 1 ¾ teaspoons Baking powder (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- ¼ teaspoon Salt (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- ½ cup Whole Milk (per each batch according to recipe): Food item that is used as an ingredient in the cake recipe that helps create the cake batter.
- 1 ½ cup All purpose Flour (per each batch according to recipe): Ingredient (independent variable) that will affect the cake's bake time.
- 1 ½ cup Almond Flour (per each batch according to recipe): Ingredient (independent variable) that will affect the cake's bake time.
- 1 ½ cup Oat flour (per each batch according to recipe): Ingredient (independent variable) that will affect the cake's bake time.
- 1 ½ cup Whole wheat flour (per each batch according to recipe): Ingredient (independent variable) that will affect the cake's bake time.
- 1 ½ cup Pumpkin flour (per each batch according to recipe): Ingredient (independent variable) that will affect the cake's bake time.
- 1 ½ cup 'Gluten free' flour blend (per each batch according to recipe): Ingredient (independent variable) that will affect the cake's bake time.

Images

Cakes Before Being Baked:

All purpose flour:

Almond Flour:



Oat Flour:

Whole Wheat Flour:

Pumpkin Flour:

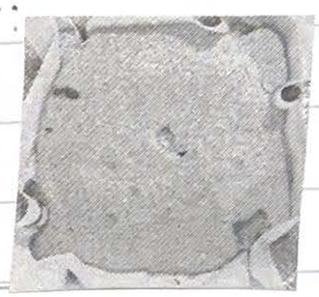
'Gluten Free' Flour:

Cakes ~~Before~~ After Being Baked:

All Purpose Flour:

Almond Flour:

Oat Flour:



Whole Wheat Flour

Pumpkin Flour:

'Gluten Free' Flour:

Baking Utensils:

Ingredients:

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n = ?
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