

**PRESERVATIVES: Why do some foods  
and drinks last longer than others?**

**EXPERIMENTAL RESEARCH REPORT**

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**SHELFORD GIRLS' GRAMMAR**

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## Introduction

As I get older and become more aware of making healthier food choices, I often wonder why certain foods and drinks last longer than others. During the school holidays, I took some library books out of my bag to do some reading and realised that I had left my lunchbox inside. It had been in my bag for at least a week, and I removed it with great trepidation. I took it over to the sink and slowly opened it. What I observed made me feel sick! My half-eaten ham sandwich and kiwi fruit had both developed mould and it was everywhere! This got me thinking- would this have happened to potato chips or to a muesli bar? What about a rainbow roll-up? Suddenly, my mind was bombarded with questions such as - are fresh foods more prone to developing mould and deteriorating than processed foods containing preservatives? What about drinks? Which drinks last longer than others and what effects do preservatives have on them? Well, to answer these questions, I decided to undertake experimental research to try and find some solid answers. The following research report explains what I did, how I did it and discusses all research results and conclusions.

## Aim

The aim of this experimental research is to find out why some foods and drinks last longer than others and what role preservatives have to play during this process. A total of 5 different foods and 5 different drinks will be selected, labelled and tested over a 14-day period. A portion of the foods and drinks will be placed in scientific test tubes with stand (see **Diagram A** below) and observed daily.



**Diagram A** – Stand with 10 scientific test tubes

## Hypothesis

My hypothesis will be that over a 14-day period, the foods and drinks containing the most preservatives will last the longest and minimal changes will occur to their physical appearances. Furthermore, I hypothesise that the more natural/fresh foods and drinks (the ones containing the least number of preservatives - the fresh tomato and the full cream milk) will deteriorate the quickest and changes to their physical appearances will be quite noticeable. My reasons for this are based on what I know about food and drink so far and also the example of my lunchbox which prompted me to start investigating why some foods and drinks last longer than others.



**Diagram B – 5 test tubes with food**

## Materials

The following materials were used to conduct the experiment in a safe and effective manner:

- Log sheet (labelled)
  - Folder and pencil
  - 10 scientific test tubes (in a stand)
- 5 different foods (Oreo biscuits, White packaged bread, Nerds Rainbow Candy, Fresh Tomato and Kraft Single Cheese slice) – **Diagram B** above
  - 5 different drinks (Iced Coffee, Coca- Cola, Full Cream Milk, Green Cordial and Fresh Orange Juice from container) – **Diagram C** below



**Diagram C – 5 test tubes with drinks**

## Method

The following steps were taken to conduct the experiment:

1. 10 scientific test tubes with stand were purchased online.
2. 5 different food were carefully selected to place into the test tubes: Oreo biscuits, fresh tomato, Kraft singles cheese, packaged white bread and Nerds rainbow candy.
3. 5 different drinks were carefully selected to place into the test tubes: Iced coffee, Coca-Cola, full cream milk, green cordial, and fresh orange juice from container (fridge section of supermarket).
4. A log sheet was prepared listing all food and drink items, commencement date and Days 1-14 Observations columns.
5. The log sheet was placed in a folder.
6. 25ml of each drink was poured individually into each test tube.
7. Generous amounts of each food sample was placed into each test tube.
8. Each test tube was tightly sealed and placed onto the stand.
9. The experiment commenced at 3.45 p.m. on 21 May 2023.
10. All food and drink items were analysed and observations were recorded on the log sheet. This procedure was repeated at the same time over the next 14 days.
11. For health and safety reasons, observations were limited to changes in physical appearance only (sight). Changes in taste and smell could not form part of the experiment due to the hazardous nature and risk of the food and drinks becoming contaminated and harmful for human consumption during the experiment.
12. When the experiment concluded, the log sheet was analysed and the results were recorded.
13. The final day of the research experiment was 4 June, 2023 at 3.45 p.m.

## Results

**Diagram D** – Log Sheet detailing observations over 14-day period for 5 foods and 5 drinks (see Appendix “1” for larger size)

14 DAY FOOD/DRINK LOG SHEET	Iced Coffee	Orange Juice	Coca-Cola	Full Cream Milk	Green Cordial	Oreo Biscuits	White Sliced Bread	Nerds	Tomato	Kraft Cheese
FIRST DAY OF EXPERIMENT 21/05/2023	25 ml of Iced Coffee	25 ml of Orange Juice	25ml of Coca-cola	25ml of Full cream milk	25 ml of green cordial	test tube full of mini oreos	test tube full of white bread	tube with nerds	tube with fresh tomato	2 slices Kraft cheese
Day 1	SAME	SAME	SAME	MOSTLY THE SAME SLIGHTLY THICKER	SAME	SAME	SAME	SAME	WHITE JUICE FORMING - MOSTLY SAME LIGHTER COLOUR	SAME
Day 2	SAME	SAME	SAME	SLIGHTLY THICKER AND CLUMPY	SAME	SAME	SAME	SAME	MORE LIQUID THICKER, LIGHTER, LOTS OF LIQUID	SAME
Day 3	SAME	SAME	SAME	CHUNKIER, SLIGHTLY SEPARATED	SAME	SAME	SAME	SAME	SOFTER	SAME
Day 4	SLIGHTLY THICKER	SAME	SAME	MUCH THICKER, HARDER TO MOVE	SAME	SAME	SLIGHTLY STALE	SAME	DECOMPOSING	SAME
Day 5	SLIGHTLY THICKER	SAME	SAME	SEPARATING, CHUNKIER	SAME	SAME	SAME - STALE	SAME	DECOMPOSING	SAME
Day 6	SAME	SAME	SAME	24ML - WATERY AND CHUNKY	SAME	SAME	SAME - STALE	SAME	DECOMPOSING	SAME
Day 7	SAME	SAME	SAME		SAME	SAME	MOULD FORMING	SAME	SAME	SAME
Day 8	SAME	SAME	SAME		SAME	SAME	SAME STALE AND MOULD	SAME	SAME	SAME
Day 9	MOULD FORMING/CHUNKIER	SAME	SAME	SAME WATERY AND	SAME	SAME	MORE MOULD FORMING	SAME	SAME	SAME
Day 10	MOULD FORMING AND	SAME	SAME	CHUNKY	SAME	SAME	MORE MOULD FORMING	SAME	SAME - DECOMPOSING	SAME
Day 11	MOULD FORMING AND	SAME	SAME	VERY LIQUIDY AND SEPARATED	SAME	SAME	MORE MOULD FORMING	SAME	VERY WRINKLY AND SMALLER IN SIZE	SAME
Day 12	CHUNKIER	SAME	SAME		SAME	SAME	MORE MOULD FORMING	SAME		SAME
Day 13	SAME SPLIT, SEPARATED, WATERY	SAME	SAME	SAME	SAME	SAME	EXTREME MOULD	SAME	SAME	SAME
Day 14 (4/06/2023) LAST DAY OF EXPERIMENT	SPLIT, SEPARATED, WATERY AND MOULDY	SAME	SAME	VERY LIQUIDY AND SEPARATED AND CHUNKY	SAME	SAME	EXTREME MOULD (GREEN)/DECOMP OSING	SAME	DECOMPOSING	SAME

The results are based on the information recorded on the log sheet. The following results were found:

### Food

When assessing the results, the first food to undergo physical changes from Day 1 of the experiment was the fresh tomato. Day 1 observations recorded some white liquid forming in the bottom of the test tube. The remaining foods (Oreos, White bread, Nerds and Kraft cheese) stayed the same with no physical changes. The fresh tomato continued to undergo more changes on Days 2 and 3 where it was observed to become lighter in colour, look thicker and even more white liquid had gathered at the bottom of the test tube. It was not until Day

4 of the experiment that the White bread started looking stale. The fresh tomato continued to decay. Day 7 revealed mould formation on the White bread. Days 8 to 12 recorded more visible mould formation on the White bread and the tomato had become very wrinkly and smaller in size. Both the White bread and Fresh tomato were undergoing the process of decomposition. The final 2 days of the experiment (Days 13 and 14) recorded extreme mould on the White bread and the overall decomposition of the bread and the tomato. Although the fresh tomato was the first of the foods to start decomposing, the White bread was only a few days behind in doing so.

An analysis of the remaining foods including Oreo biscuits, Rainbow nerds and Kraft cheese singles revealed zero physical changes or any signs of decomposition during the 14-day experiment.

For health and safety purposes, the ten test tubes with contents were safely thrown out as the materials had become a hazard.

**Diagram E** Photos of White Bread (below left) and Tomato (below right) at Day 14



## Drinks

The results show that the Full cream milk and the Iced coffee were the only drinks out of the 5 chosen to undergo visible physical changes during the 14- day observation period. In fact, it was the Full cream milk that first started to change by becoming thicker on Day 1 and also clumpy by Day 3. Changes in the Iced coffee were observed from Day 4 onwards where it became slightly thicker. From Day 4 until Day 14, the Full cream milk continued to deteriorate daily by becoming chunkier, separating, becoming very liquidy and also reducing from 25ml to 24ml in the test tube. Similarly, the Iced coffee was deteriorating and by Day 8, there were visible signs of mould formation, the liquid had split, separated and become watery. Overall, the Full cream milk and the Iced coffee underwent decomposition during the 14 – day period.

The remaining 3 drinks which included Orange juice, Coca – Cola and Green cordial revealed zero physical changes or any signs of decomposition during the experiment.

**Diagram F** – Photos of Iced Coffee (below left) and Full Cream Milk (below right) as they appeared at the end of the experiment (Day 14)



## Discussion

After analysing the log sheet, the results showed that when it came to food, the fresher foods (tomato and white bread) were the first to undergo physical changes as part of the decomposition process.

**Decomposition** or rot is the process by which dead organic substances are broken down into simpler organic or inorganic matter such as carbon dioxide, water, simple sugars and mineral salts.<sup>1</sup> The remaining 3 foods (Oreos, Nerds and Kraft cheese) remained completely unaffected during the experiment and no physical changes were observed at all. When assessing the results for drinks, it was the Milk based drinks (Iced coffee and Full cream milk) that underwent changes and decomposition during the experiment. These results reflected my hypothesis which was that the more natural based foods and drinks (the ones containing no or less preservatives - the fresh tomato and the full cream milk) would deteriorate the quickest and changes to their physical appearances would be quite noticeable. The basis for my hypothesis was that in general, foods containing more preservatives (such as high amounts of sugars) last longer. Before commencing this experiment, I did not check whether the foods and drinks chosen had any preservatives. I simply used my own knowledge and chose random products. Since completing this experiment, I have researched the individual preservative content (if any) of each food and drink used during the experiment and I think it is important to discuss these results in this report. I could have tried to find this information before I started the experiment, but I chose not to because I wanted to see if my own hypothesis was correct from my own personal knowledge.

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<sup>1</sup> [Decomposition process food wikipedia - Search \(bing.com\)](#)



## Preservatives found in Drinks and Foods used in this Experiment

### Foods

**Fresh Tomato** – no preservatives – natural sugars

**White Bread** – no preservatives (low in sugar – 1.6gm per serve)

**Kraft Cheese** – Preservative 200<sup>2</sup> - Preservative 200 is also known as Sorbic acid. It is a food preservative that protects many food varieties from yeast and mould spoilage E.g., Cheese<sup>3</sup>

**Nerds Candy**<sup>4</sup> – Dextrose, Sugars, Glucose Syrup – very high in sugar content (20.5gm for every 22.5 gms)

**Oreos** – Sugar, Fructose Syrup, Soy Lethicin<sup>5</sup> - Soy Lecithin has two main uses: it acts as a preservative, delaying product spoilage and extending shelf life in the marketplace.<sup>6</sup>

This research shows that the tomato and bread used during the experiment contained no preservatives. The other foods contained some form of preservatives (in addition to sugars) to help the food last longer.

### Drinks

**Woolworths Full Cream Milk** – Pasteurised. Pasteurization or pasteurisation is a process of food preservation in which packaged and non-packaged foods are treated with mild heat, usually to less than 100 °C, to eliminate pathogens and extend shelf life.<sup>7</sup>

**Coca – Cola** -Food grade phosphoric acid is used to acidify foods and beverages such as colas and jams. The phosphoric acid also serves as a preservative.<sup>8</sup>

**Daily Juice Pulp Free Orange Juice** – Preservative 202 – Potassium Sorbate - is a white salt that is very soluble in water and is used as a food preservative.<sup>9</sup>

**Farmers Union Iced Coffee** – Sugar (52gms per 600ml) – very high sugar content. Sugar helps preserve the colour, texture and flavour of the food<sup>10</sup>

**Green Cordial** – Green Cordial Concentrate - Preservatives Sodium Benzoate Sodium benzoate is best known as a preservative used in processed foods and beverages to extend shelf life,<sup>11</sup> Sodium Metabisulphite - it is used as a disinfectant, antioxidant, and preservative agent.<sup>12</sup>

Mixed with water from Southeast Water which contains Fluoride for good teeth/oral health<sup>13</sup>

<sup>2</sup> <https://www.justgotochef.com/ingredients/preservative-ins-200>

<sup>3</sup> <https://www.justgotochef.com/ingredients/preservative-ins-200>

<sup>4</sup> [Nerds Grape & Strawberry 46.7g | Woolworths](#)

<sup>5</sup> [is soy lecithin a preservative - Search \(bing.com\)](#)

<sup>6</sup> [is soy lecithin a preservative - Search \(bing.com\)](#)

<sup>7</sup> [Pasteurization - Wikipedia](#)

<sup>8</sup> [https://en.wiki/phosphoric\\_acid](https://en.wiki/phosphoric_acid)

<sup>9</sup> [Potassium sorbate - Wikipedia](#)

<sup>10</sup> [Is sugar used as food preservative? - Reimagining Education](#)

<sup>11</sup> [sodium benzoate preservative - Search \(bing.com\)](#)

<sup>12</sup> [sodium metabisulphite - Search \(bing.com\)](#)

<sup>13</sup> [www.health.vic.gov.au/water/water-fluoridation](http://www.health.vic.gov.au/water/water-fluoridation)

The research shows that apart from the Iced coffee which only contained sugars, the rest of the drinks had other preservatives to help them last longer. The full cream milk underwent pasteurisation which is a way of preserving the milk.

After analysing both the log sheet and the research, it is accurate to say that the findings from both support my hypothesis that the tomato and fresh milk would deteriorate first during the experiment. This is because the tomato had no preservatives and the milk had undergone pasteurisation but did not have any additional preservatives added. I was actually surprised to learn that the Iced Coffee had no additional preservatives (apart from extremely high amounts of sugar). Given sugar acts as a preservative in many foods, it explains why so much would be added to a milk product to try and make it last longer. Even with so much sugar, the Iced coffee did begin to decay from Day 4 onwards. When you compare this to other foods such as Kraft cheese which remained unchanged during the experiment, it makes you wonder how strong these additional preservatives are and whether they are good for us to be eating? I was just as surprised to learn that the Orange Juice, Coke and Green cordial had additional preservatives even though they all had sugar which would act as a preservative anyway. I was surprised that the Orange Juice remained unaffected during the experiment. My reasoning was that although the juice contained sugar, it was a healthy, natural product so I was not expecting to see that it contained Potassium Sorbate (preservative 200) after doing my research. I started asking myself questions – do we really need all of these preservatives? Are these preservatives harmful if we keep having them? Are there better ways of making foods and drinks last longer without having to add so many preservatives?

During the experiment, my observations were limited to what physical changes I could see happening to the foods and drinks. If it were not a health issue, I think having the chance to touch and smell the foods and drinks during the process would have been helpful in trying to figure out what kind of changes they were going through. For example, was the liquid in the bottom of the tomato test tube acidic or was it more like water? Usually when things smell bad means they are decaying. Did the Iced coffee still smell like coffee when it started to decay, or did it smell like something else? Even though the Kraft cheese did not change during the experiment, did it still smell fresh or had the smell changed to something worse? These questions were not able to be answered but they would have helped me when trying to figure out whether a food or drink was beginning to go bad.

One of the most important lessons I learned during this experiment was that good, fresh food and drink will always begin to decay quicker than unhealthy processed foods containing large amounts of sugar and added preservatives such as chemicals and other salts. Fresh food is very important for our health and processed foods are almost impossible to ignore because they are everywhere. Grocery shopping would become very difficult if you were only limited to buying fresh food especially if you don't plan on eating it straight away. Freezing fresh food is always a good option but what about staple foods like biscuits, pasta and breakfast jams? We also need these kinds of foods as they are quick to cook and last for a long time in our cupboards which means we can buy lots of them and not have to worry about them decaying in a few days. It would also be very expensive for big companies if they had to produce food without using any preservatives. Food needs to be delivered to supermarkets and then taken home so it needs to last quite a long time otherwise it would start decaying before it even got into the supermarkets. Companies would be losing lots of money if this happened.

A way in which I could improve this experiment is to increase the number of foods tested (both fresh and processed) to see whether results would be any different. Further, I would be quite interested in researching the preservatives used in foods in Australia and the effects (if any) they have on us. This is something I would really like to investigate in the future. This experiment has really opened up my eyes and my knowledge about sugars and about preservatives and to be honest it has forced me to really think about the foods we eat and what we drink because from what I have found out, there are many unknown chemicals and foreign things going into our bodies every time we take a bite or a sip of something and we should start learning more to make sure we are looking after ourselves and making more informed choices about what we eat and drink overall.

## **Conclusion**

In conclusion, food and drink containing zero preservatives or minimal amounts of sugar will not last as long as food and drinks containing preservatives and/or high volumes of sugar. This conclusion is supported by my experimental research where it was found that the fresh tomato, white bread, iced coffee and full cream milk were the first to undergo physical changes and start to decay. This is further supported by my hypothesis which was that more natural based foods and drinks (the ones containing zero or less preservatives – fresh tomato and full cream milk) would deteriorate the quickest and changes to their physical appearance would be visible. I think further research needs to be done to really understand how preservatives work and how safe they are for us especially since so many foods these days contain preservatives in one form or another.

## Acknowledgements and References

1. I would like to acknowledge my parents who allowed me to buy a set of 10 scientific test tubes online.
2. I would like to acknowledge my dad who helped me draw a Table using the Excel spreadsheet.
3. I would like to acknowledge my mum for showing me how to cut and paste diagrams from one document to another.
4. I would like to acknowledge my mum and dad for helping explain the meaning of scientific words and phrases from the Encyclopaedia Britannica and Wikipedia so that I could better understand my topic and my experiment.
5. I would like to thank and acknowledge my Junior School Teacher, Ms Jacqueline Sidaway for inspiring me and motivating me to take part in this exciting science competition.
6. [Decomposition process food wikipedia - Search \(bing.com\)](#)
7. <https://www.justgotochef.com/ingredients/preservative-ins-200>
8. <https://www.justgotochef.com/ingredients/preservative-ins-200>
9. [Nerds Grape & Strawberry 46.7g | Woolworths](#)
10. [Is soy lecithin a preservative - Search \(bing.com\)](#)
11. [Is soy lecithin a preservative - Search \(bing.com\)](#)
12. [Pasteurization - Wikipedia](#)
13. [https://en.wiki/phosphoric\\_acid](https://en.wiki/phosphoric_acid)
14. [Potassium sorbate - Wikipedia](#)
15. [Is sugar used as food preservative? - Reimagining Education](#)
16. [Sodium benzoate preservative - Search \(bing.com\)](#)
17. [Sodium metabisulphite - Search \(bing.com\)](#)
18. [www.health.vic.gov.au/water/water-fluoridation](http://www.health.vic.gov.au/water/water-fluoridation)

APPENDIX "1"  
LOG SHEET DATED  
21 MAY - 4 JUNE 2023

<b>14 DAY FOOD/DRINK LOG SHEET</b>	<b>Iced Coffee</b>	<b>Orange Juice</b>	<b>Coca-Cola</b>	<b>Full Cream Milk</b>	<b>Green Cordial</b>	<b>Oreo Biscuits</b>	<b>White Sliced Bread</b>	<b>Nerds</b>	<b>Tomato</b>	<b>Kraft Cheese</b>
<b>FIRST DAY OF EXPERIMENT 21/05/2023</b>	25 ml of Iced Coffee	25 ml of Orange Juice	25ml of Coca-cola	25ml of Full cream milk	25 ml of green cordial	test tube full of mini oreos	test tube full of white bread	tube with nerds	tube with fresh tomato	2 slices Kraft cheese
<b>Day 1</b>	SAME	SAME	SAME	MOSTLY THE SAME SLIGHTLY THICKER	SAME	SAME	SAME	SAME	WHITE JUICE FORMING - MOSTLY SAME	SAME
<b>Day 2</b>	SAME	SAME	SAME	SLIGHTLY THICKER	SAME	SAME	SAME	SAME	LIGHTER COLOUR MORE LIQUID	SAME
<b>Day 3</b>	SAME	SAME	SAME	AND CLUMPY	SAME	SAME	SAME	SAME	THICKER, LIGHTER, LOTS OF LIQUID	SAME
<b>Day 4</b>	SLIGHTLY THICKER	SAME	SAME	CHUNKIER, SLIGHTLY SEPARATED	SAME	SAME	SLIGHTLY STALE	SAME	LIGHTER COLOUR, SOFTER	SAME
<b>Day 5</b>	SLIGHTLY THICKER	SAME	SAME	MUCH THICKER, HARDER TO MOVE	SAME	SAME	SAME - STALE	SAME	DECOMPOSING	SAME
<b>Day 6</b>	SAME	SAME	SAME	SEPARATING, CHUNKIER	SAME	SAME	SAME - STALLE	SAME	DECOMPOSING	SAME
<b>Day 7</b>	SAME	SAME	SAME	24ML - WATERY AND CHUNKY	SAME	SAME	MOULD FORMING	SAME	SAME	SAME
<b>Day 8</b>	SAME	SAME	SAME	SAME	SAME	SAME	SAME STALE AND MOULD	SAME	SAME	SAME
<b>Day 9</b>	SAME MOULD FORMING/ CHUNKIER	SAME	SAME	SAME	SAME	SAME	MORE MOULD FORMING	SAME	SAME	SAME
<b>Day 10</b>	SAME	SAME	SAME	WATERY AND CHUNKY	SAME	SAME	MORE MOULD FORMING	SAME	SAME - DECOMPOSING	SAME
<b>Day 11</b>	SAME MOULD FORMING AND CHUNKIER	SAME	SAME	VERY LIQUIDY AND SEPARATED	SAME	SAME	MORE MOULD FORMING	SAME	VERY WRINKLY AND SMALLER IN SIZE	SAME
<b>Day 12</b>	SAME	SAME	SAME	SAME	SAME	SAME	MORE MOULD FORMING	SAME	SAME	SAME
<b>Day 13</b>	SAME SPLIT, SEPARATED, WATERY	SAME	SAME	SAME	SAME	SAME	EXTREME MOULD	SAME	SAME	SAME
<b>Day 14 (4/06/2023) LAST DAY OF EXPERIMENT</b>	SAME SPLIT, SEPARATED, WATERY AND MOULDY	SAME	SAME	VERY LIQUIDY AND SEPARATED AND CHUNKY	SAME	SAME	EXTREME MOULD (GREEN)/DECOMPO SING	SAME	DECOMPOSING	SAME