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The image features a dark brown background with a yellow silhouette of a child's head and shoulders on the left side. The text is centered in a bold, white, sans-serif font. To the right of the text, there are two yellow decorative elements: a wavy, scribbled line above a large, thin-lined circle.

HOW DOES CAFFEINE AFFECT A CHILD'S MEMORY

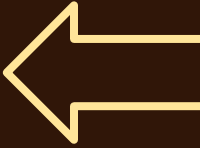


INFORMATION

WHAT IS CAFFEINE?

Plants and flowers naturally contain caffeine, it is a neurostimulant and a psychoactive drug that affects the the brain and nervous system which is a bitter substance. Among these are coffee beans, tea leaves, kola nuts, etc. It is common to find caffeine in many foods. Caffeine can be found in a variety of energy drinks and soft drinks, including Gatorade, Coca-Cola, Prime Energy, Soda, and 5-Hour Energy Extra Strength. Caffeine is enjoyed around the world in its liquid forms such as Coffee, Tea, Hot Chocolate, Green Tea, Bubble Tea, Black Coffee, Lattes, and Espressos. Etc.

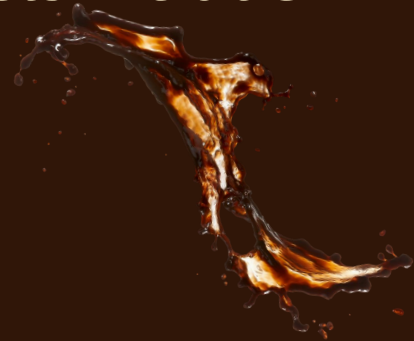
WHICH PART OF THE BRAIN DOES IT AFFECT?



Using coffee, or drinking coffee can alter the way that you think. As listed above, it can make you hyper or more alert. This is because it affects your brain in many ways. It affects the lateral prefrontal cortex, the default mode network (DMN), the visual cortex, and the motor network. The lateral prefrontal cortex, or the LPFC is the part of the brain that is responsible for cognitive thinking, planning, choice (selecting between things), and working memory. The DMN does something similar, with it being able to use memory and think about the future. The visual cortex is used to integrate visual information or put together things you see to form a whole or to come to a conclusion, and the motor network sends messages to execute reactions and responses. The LPFC and DMN work with memory, so caffeine affects your memory in one way or another.

EFFECTS OF CAFFEINE:

The effects of caffeine usually last around 3-5 hours, but the effects will not be too drastic because we will be serving milk tea, not your regular coffee, so the effects would last around 2-4 hours. That's just enough for us to conduct the experiments properly and well. We will list these in a around 3-4 slides. These Effects Include:



WHAT ARE SOME EFFECTS?

We have researched that it is possible to get a shorter memory from caffeine. Our research is how much caffeine will affect your mind. Using Google and trusted resources, we have found that research DOES show that caffeine in certain amounts does affect a child's brain in one way or another. As most people know, caffeine can make you hyper and can help you stay awake if you drink it, but there can be other things that coffee can be accused of doing to you. This includes:

- Increased energy metabolism
- Increased activity in the brain and nervous system
- Increased alertness
- Etc.

NEGATIVE THINGS CAFFEINE CAN DO TO YOU

We've been focusing a lot on the mind and its connections to caffeine; But what about its impact on our bodies and impact on people? Almost every day, millions of people rely on caffeine to wake them up or to keep them awake. Caffeine is one of the most used ingredients in the world in everyday foods. Caffeine, like us, is usually talked about by many because of its bad effects on your body. But, a lot of studies have shown that there are also positive effects of it. (Mentioned before) Such as:

- Increased restlessness and shakiness
- Fast Heart Rate
- Insomnia
- Increased breathing
- Gout
- Diarrhea
- High blood pressure
- Loss of pregnancy

(Do note, these effects are not guaranteed to happen)



WHAT ARE THESE NEGATIVE THINGS

- Increased restlessness and shakiness is when you are more tired and shakiness is when it is harder to stay still
- Fast heart rate is when your heart beats faster.
- Insomnia is when it is harder to sleep.
- Gout is a type of arthritis that affects people's joints.
- Increased breathing is when you breathe too fast, too much or too hard
- Diarrhea is a condition when human feces comes out of the bowels as a liquid.
- High blood sugar is when the glucose in your blood reaches too high which can cause things like diabetes.
- Loss of pregnancy is when the baby that is in the womb passes away before the twentieth week of pregnancy. (Do note, these effects are not guaranteed to happen)

WHAT POSITIVE THINGS DOES IT DO FOR YOU?

But aside from these, some things benefit the human body such as:

- An alert brain
- Decreased risk of oral cancer
- Improved brain function
- Reduced different types of diseases such as Alzheimer's and Parkinson's disease
- Reduces chance of cataracts
- Reduce the chance of skin cancer
- Lower chance of getting kidney stones
- Reduce chance of Stroke
- Excitement
- More "Awake"



WHAT ARE THESE THINGS THOUGH?

- An alert brain is when you are more careful and alert about things.
- Oral cancer is a type of cancer that affects the back of the mouth as well as any other part of the mouth.
- Improved brain function is when you think, see better breathe better, etc. (anything that relates to the brain).
- Alzheimer's and Parkinson's disease are both brain diseases that are caused by destruction of brain cells.
- A stroke is when something blocks blood from going to the brain.
- Kidney Stones are hard stone-like salt and mineral deposits that form in the kidneys.
- Cataracts are a clouded area of your eye lenses.
- Skin Cancer is abnormal growth of skin cells in some areas.

WHAT IS MEMORY THOUGH?

All this talk about tea and caffeine, what about memory?

Memory is the psychological process of storing and retrieving information in the brain. Some things can improve how you remember things and memory in general, while other things, like age, greatly affect how much you remember and store memory. Memories are made when the brain finds information and approves that it will be useful in the future. Without memory, our body would not function at all. Your body would not function at all.

MORE ABOUT MEMORY

Adding on to the last paragraph, memory is important because if we did not have memory at all, we would not be able to do normal things; Such as: Eat, Talk, Walk, Or anything you need to live. Another important thing about memory is that it's beneficial for you. You won't remember anything if you don't have memory. Without memory, you would most definitely die.



COMMONLY USED TERMS

Although some of them explained before, there will be some terms that we will use a lot.

- Long-Term Memory - Memory that involves the storage of information over a long period of time.
- Short-Term Memory - Memory that involves the storage of information over a short period of time.
- Caffeine - A chemical compound, bitter tasting, found in plant's.
- Effects - Something that happens inevitably after a event.
- Energy - An Athletic/Dynamic property.

OTHER OPINIONS

Another thing that we have noticed is that [Caffeine: Benefits, risks, and Effects \(medicalnewstoday.com\)](https://www.medicalnewstoday.com/articles/322822) has stated that "Research from Johns Hopkins University suggests that a dose of caffeine after a learning session may help boost long-term memory." This shows that caffeine can improve memory for up to 24 hours but this is long-term memory, we are researching short-term memory so we would like to figure out if caffeine affects this instead of long-term memory.

The image features a dark brown background with several abstract yellow and white elements. On the left, there is a large yellow rounded rectangle with a white oval shape overlapping its right side. In the top right corner, there is a white grid-like structure consisting of several squares. In the bottom right corner, there are two white, hand-drawn, wavy lines. The text 'THE EXPERIMENT' is centered in a bold, white, sans-serif font.

THE EXPERIMENT

RATIONALE

Why did we choose this topic? Well, as the future nears, more and more consumer goods contain caffeine and most parents don't know what their children are eating or drinking. But with the help of our experiment, we can know what effect it has on our brain and what were actually risking by drinking caffeine. This information can help parents have a better understanding of what caffeine is and its negative effects on the human body.

HYPOTHESIS

We think that caffeine will not show any increase in the amount of things remembered, but rather decrease the amount of things remembered. We think this because after doing some research, caffeine as stated before only affects 3 parts of the brain. The LPFC, DMN, And VC. Although these have some ties to memory, we feel as if these parts of the brain and their connections to memory are not as significant as actually remembering things as opposed to using memory to think about the future. So, our hypothesis is that it will not show any increase.

EXPERIMENT METHOD

Most Psychologists use a simple list method to test memory; There is a list of random items that the “player” has a few seconds to study, and then they are told to repeat the list in the same order it was. This method is commonly used on people of all ages, and because it is more accurate. So, when we test people on their memory capabilities with and without caffeine, we will indeed be using this method. In the future, we will call this the “list test”

PROCEDURE

1. Give a person 1 cup of water to drink. Explain instructions briefly, and motivate them.
2. Use randomlists.com to list 10 everyday items (e.g. baby, chalk, banana, pencil etc.). The person will be given time (~15 seconds) to study and examine the list.
3. The list will become hidden and the person will be asked to read the list from memory.
4. Look at the accuracy and rate /10
5. Ask the person to drink one cup of tea (containing caffeine). Make sure They drink it slowly, at a rate which they can finish.
6. Give them time to do other activities (games, video games, running etc.) for about 10 minutes.
7. Ask the user to come back and take another list test and rate out of 10.
8. Compare the results.

VARIABLES

Controlled variables (Something that stays the same)

- Amount of caffeine

Manipulated variable (What is being manipulated/changed)

- Age of people

Responding variable: (Results)

- Effect of caffeine on the brain



OBSERVATIONS (BEFORE ANSWER)



As of right now, the tests that we ran with the person drinking caffeine are doing better than the tests without caffeine. In the future, this may prove that caffeine improves short-term memory. For some people, the results were the same. This could mean that this caffeine tactic works only on some people better than others. A few people got lower results as they drank a second serving, which could mean that too much caffeine could result in it being more difficult for them to remember certain things and objects.





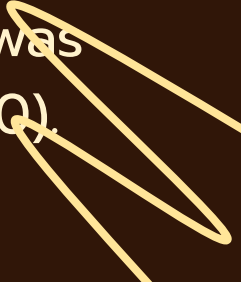
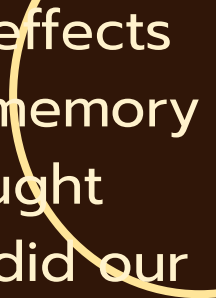


CONCLUSIONS

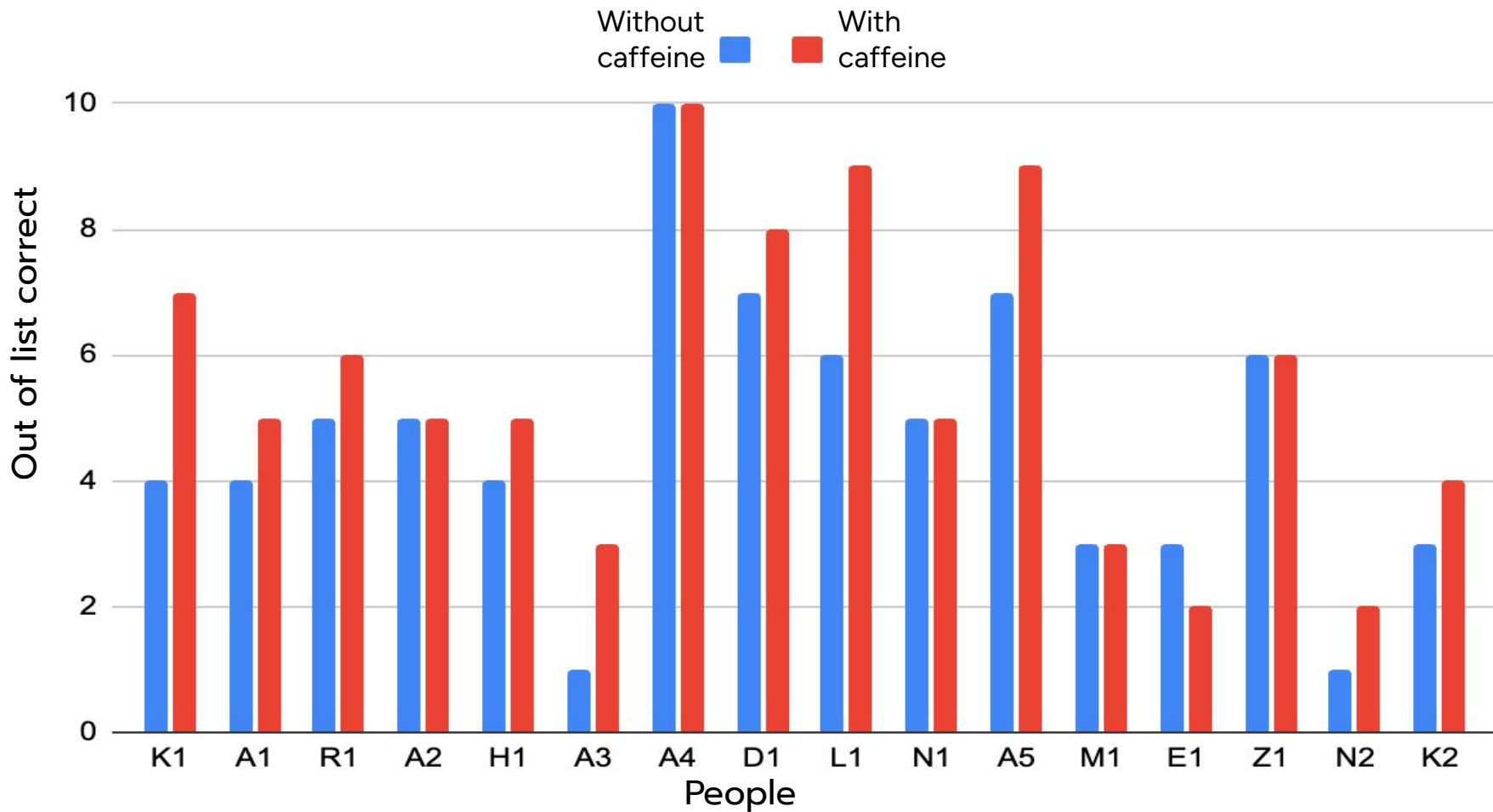
CONCLUSION



Caffeine is a bitter substance, and it has many positive effects along with many negative effects. Caffeine does affect memory as we did research earlier on this topic. At first, we thought that caffeine would not help with memory but after we did our 16 tests we were proven to be wrong with 62.5 percent of the people having increased results than when they didn't drink any caffeine. Also, the average is higher than when they didn't drink caffeine/tea. (The average before drinking caffeine was 4.58/10 and the average after drinking caffeine was 5.47/10).



RAW RESULTS - Data for Each Person



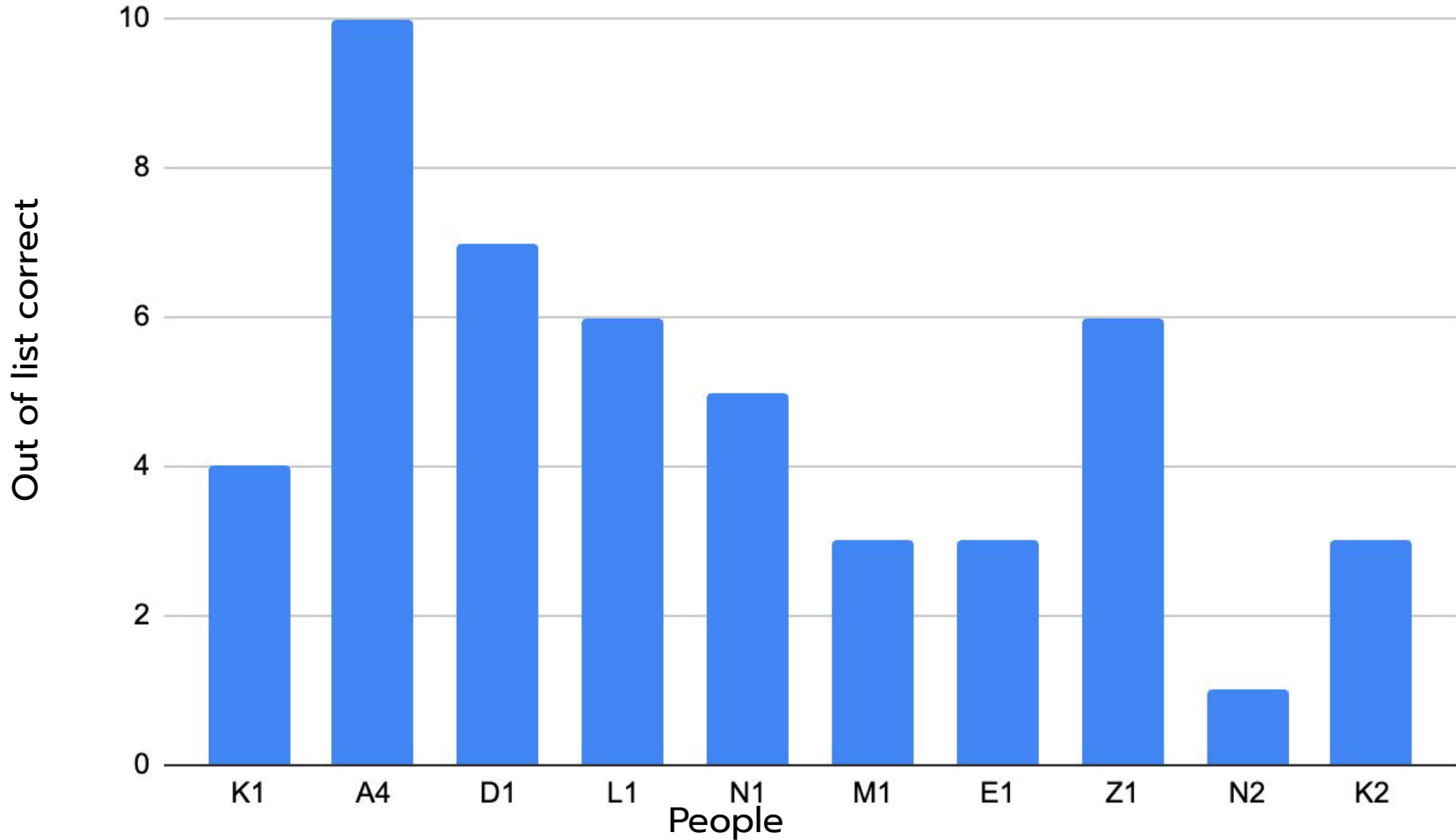


ANALYSIS(FOR RAW RESULTS)

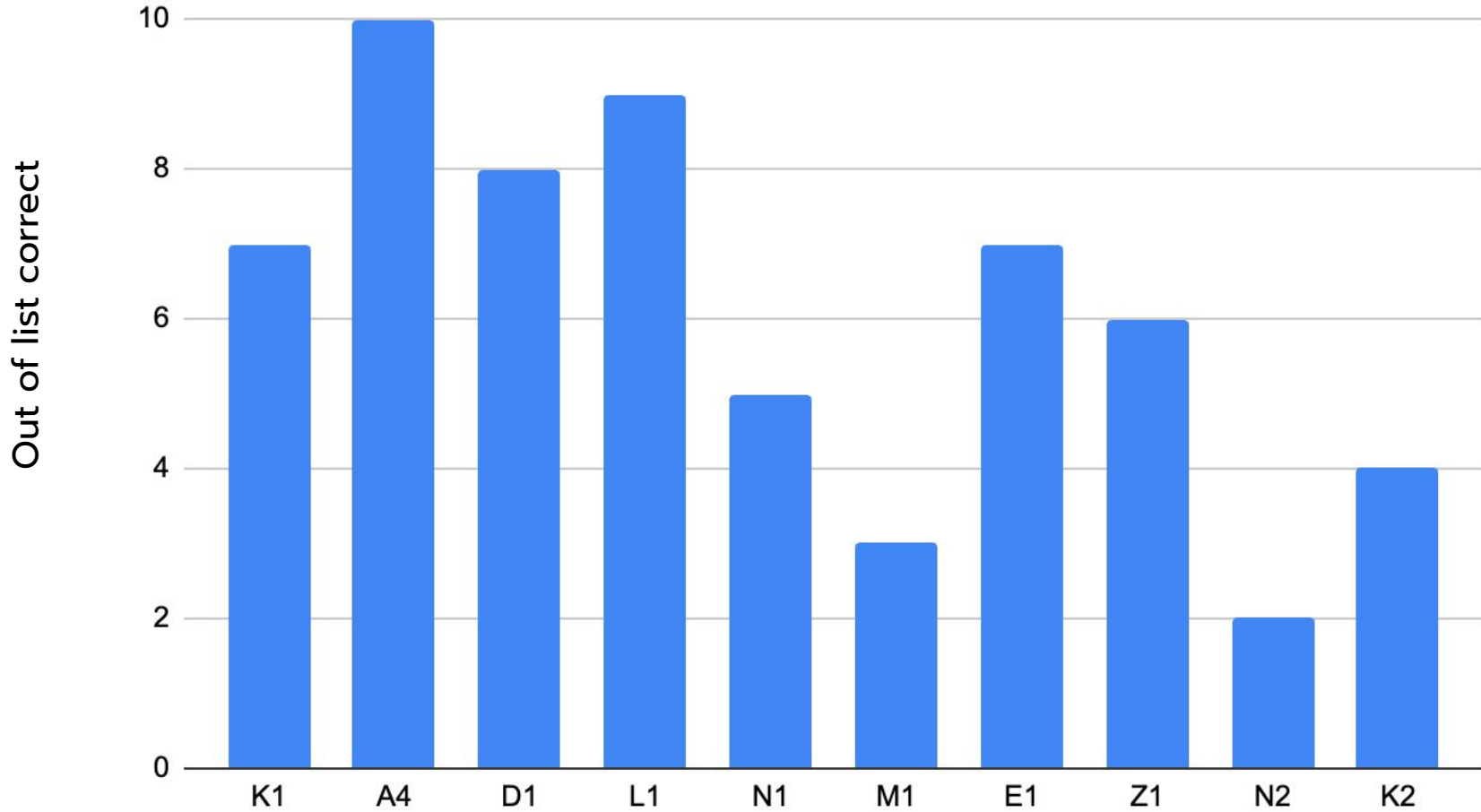
In this graph it shows that most people had scores that went up, and a small amount of people's answers stayed the same and some of their answers decreased. It also shows that our biggest difference within a person was a 20% difference for K1 and the person who decreased the most was E1 10%.



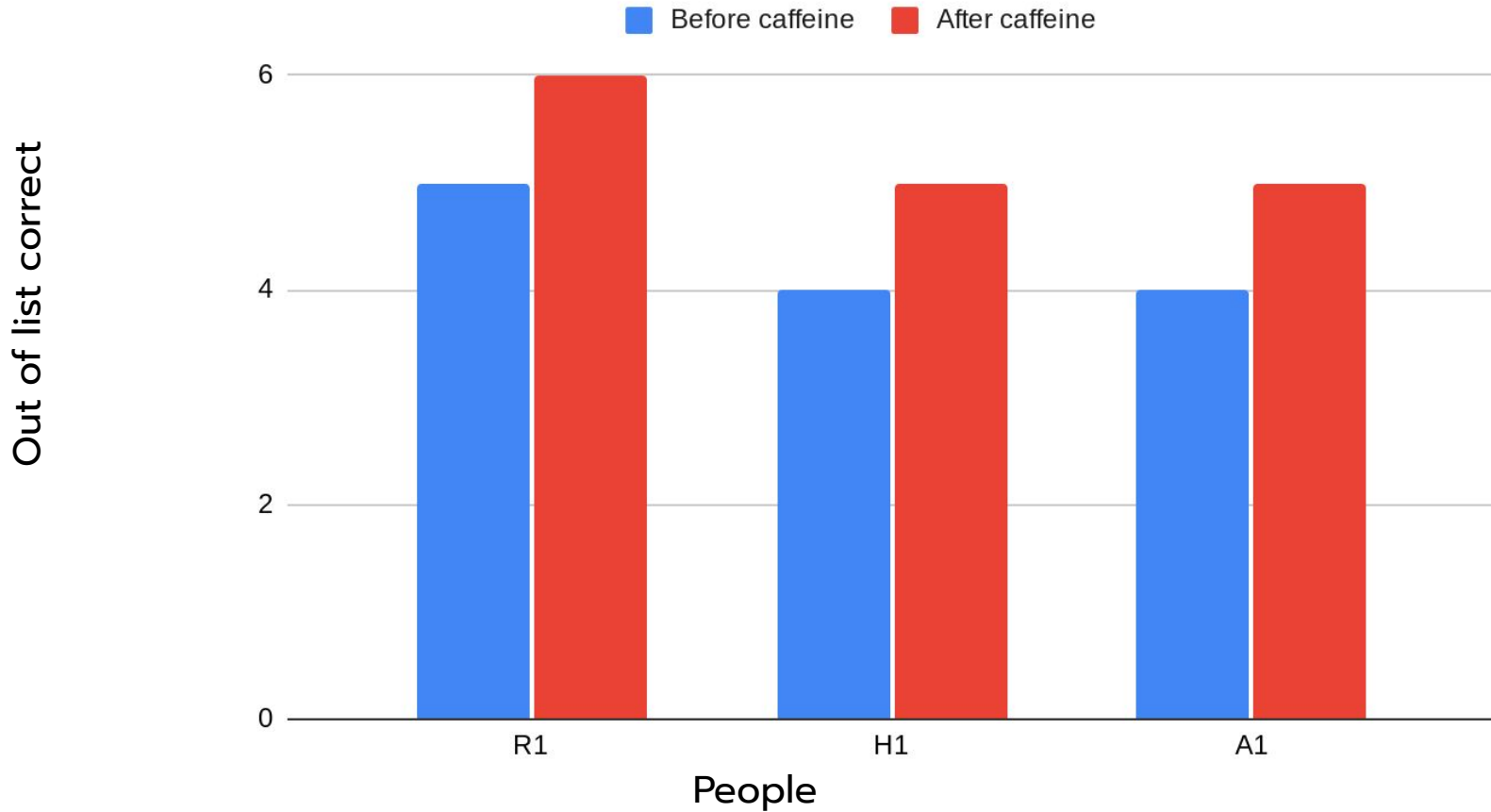
RESULTS - 11 Year Olds - Without Caffeine



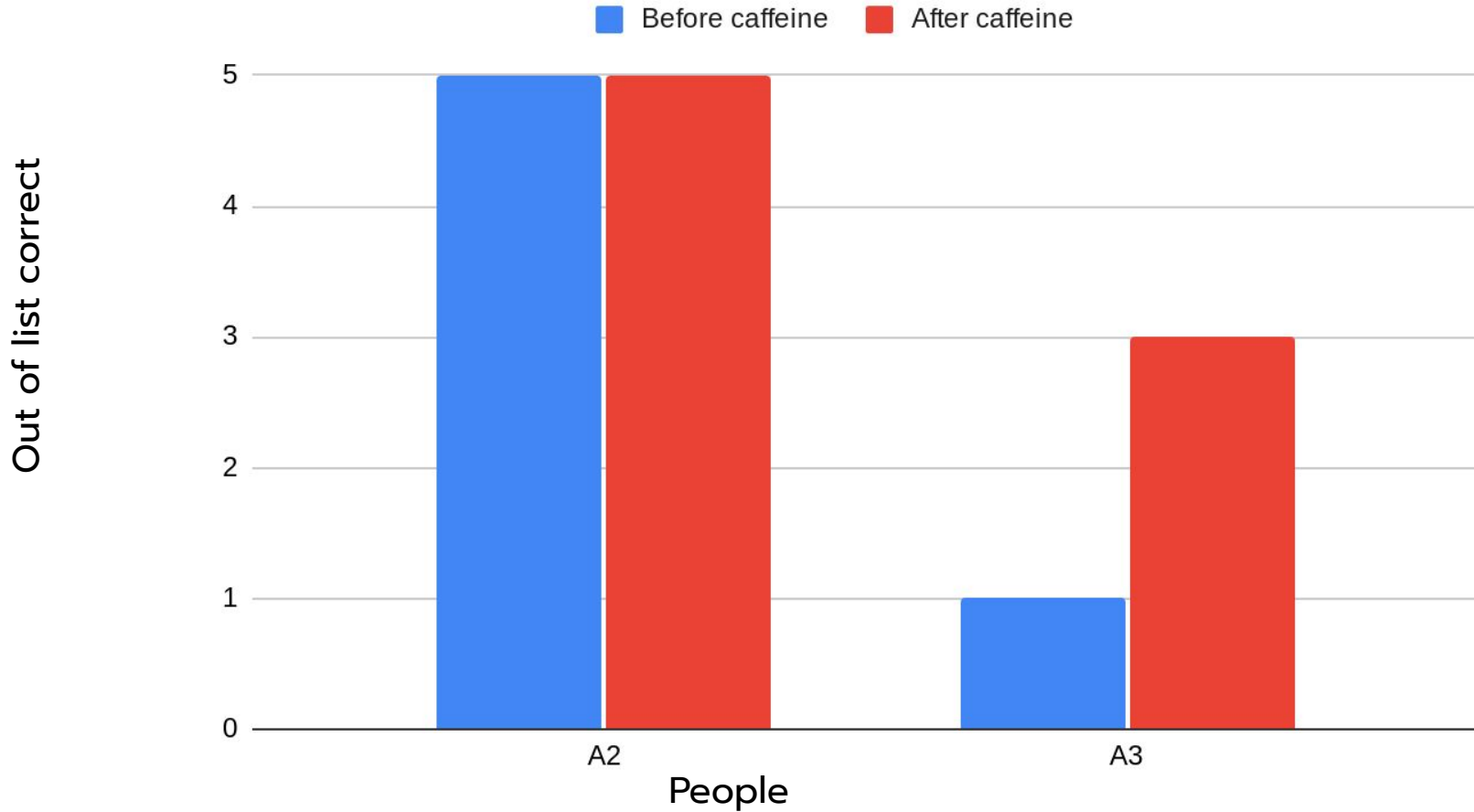
RESULTS - 11 Year Olds - With Caffeine



RESULTS - 10 Year Olds



RESULTS - 9 Year Olds



Averages

OUT OF LIST CORRECT

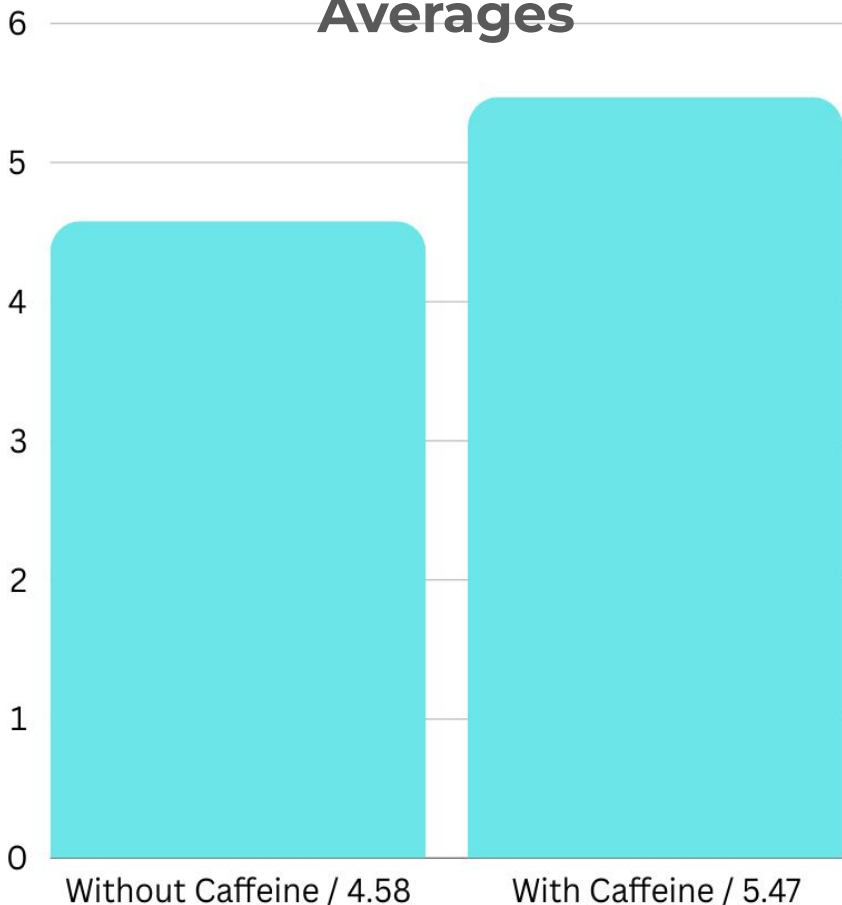


Fig 1 - Out of list correct with and without caffeine

Out of list correct

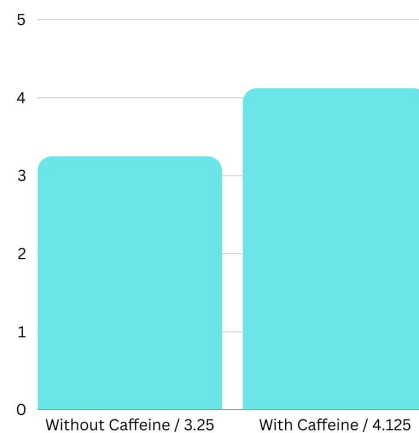


Fig 2 - Out of list correct for females

Out of list correct

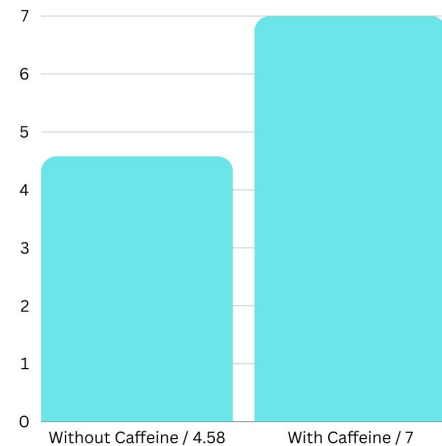
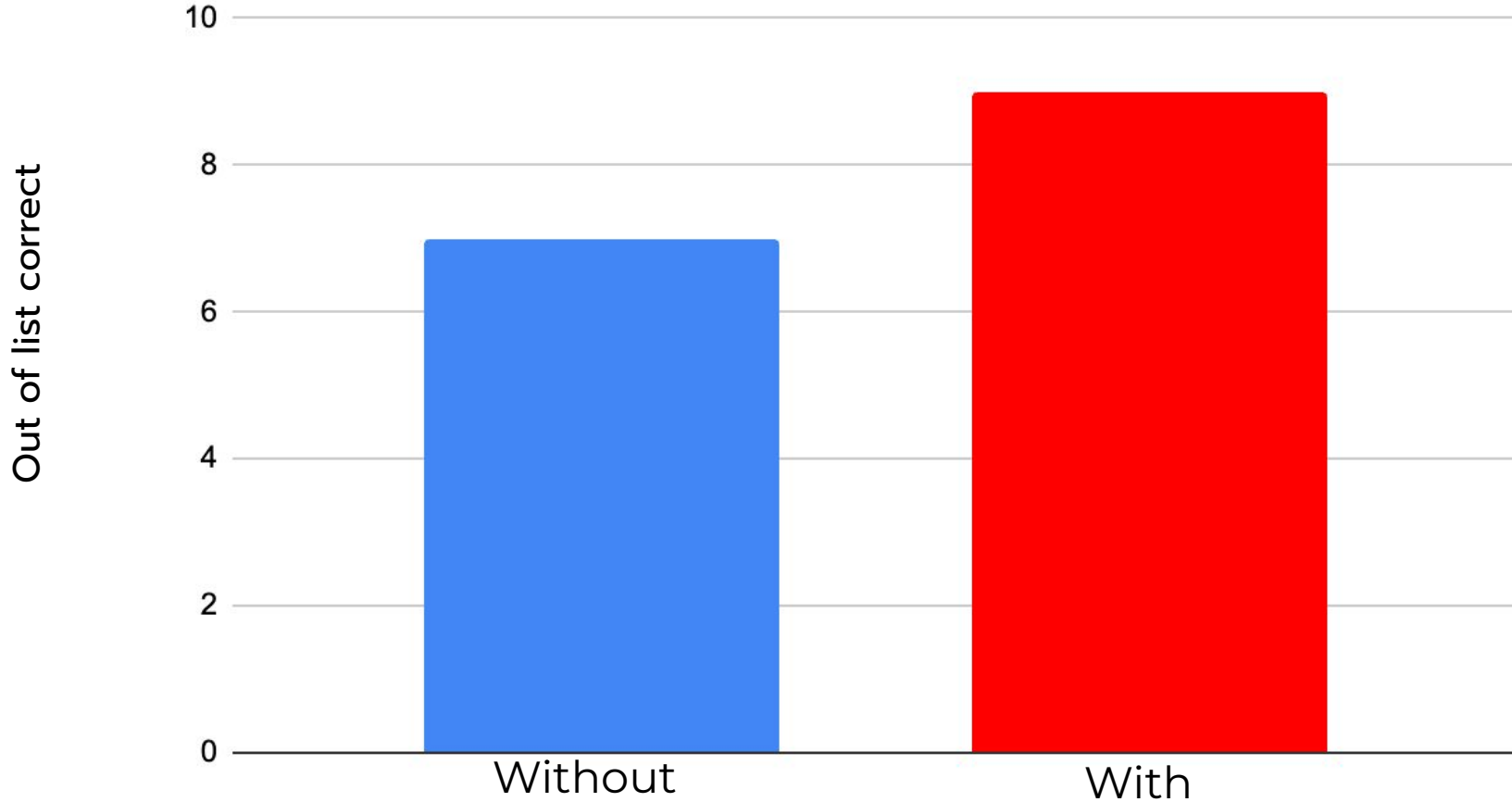
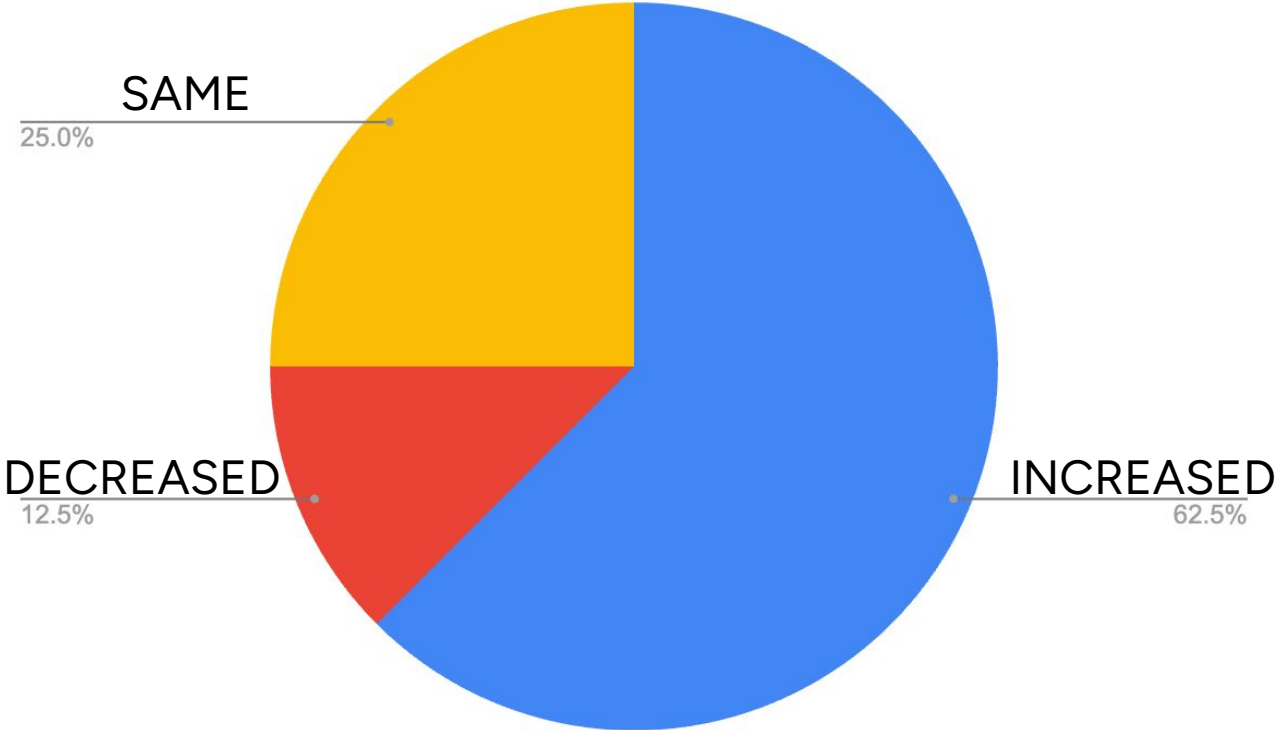


Fig 3 - Out of list for males

RESULTS - The 12 Year Old



PIE CHART - Did people's results increase, decrease, or stay the same?





ANALYSIS

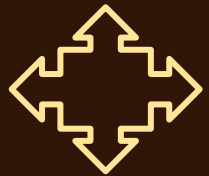
Our analysis is that after drinking a small amount of tea it seems to benefit your memory by helping you remember things, in this case, an assortment of 10 different objects. We think that after drinking an amount of caffeine this stimulates the neurons inside of your brain, we have seen in our experiment that it works for more people better than others. We found evidence of this in our experiment because most people after drinking caffeine had better scores than before. On our pie chart it shows that 62.5 percent of the people's scores were better than before. Some people did worse, we believe that too much caffeine can excite the neurons too much and make it harder to focus and remember objects.

RESULTS

The average for without caffeine was 4.58, while with caffeine, was a staggering 5.47. In our charts, a whopping 25% showed no increase or decrease when they did both the tests. This means that both the results were the same. But, another 12.5% showed a decrease when they took the test with caffeine, which were all 11-12 year olds. Also, another 62.5 (which was the majority) showed an increase when taking the test with caffeine. That's not what we expected, but the results is caffeine DOES in fact improve memory on children in the little way it does. According to John Hopkins Media, as mentioned before, did say that caffeine had a good impact on memory.

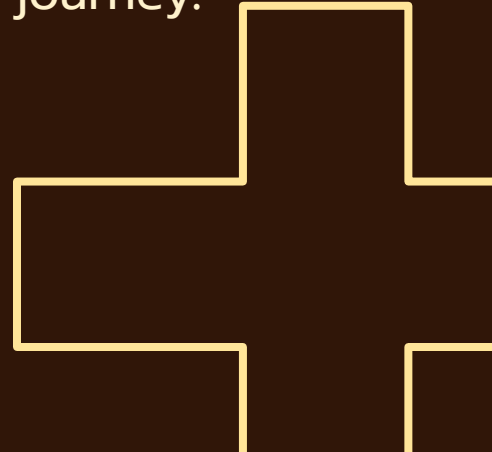
THESIS

Why does caffeine affect memory and how? Our first answer was that caffeine does not help with short-term memory and makes it harder to remember things but we were proven wrong when we finished because our answer was that it actually helps with short-term memory, by helping us remember/memorize things. This means that caffeine does help with short term memory but when drinking too much caffeine it can be harder to remember things. We know this because we tested a few people with 2 servings and with all 3 of them they're scores decreased.



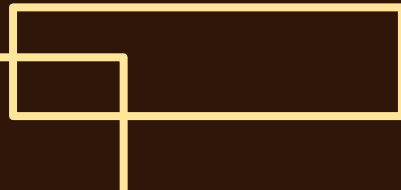
ACKNOWLEDGEMENTS

We'd like to thank Nilufa Yesmin (Aayan's Mother, Brewing Tea, and Support), Mr. Zhang (Guidance and Support), Rupinder Bhuller (Neal's Mother, Support and Brewing Tea), All the people who were willing to experiment, Arham Shaikh (Ideas and Support), Kean Nguyen (Support), Idhant Verma (Support), and ofcourse, us! Big thanks to the various teachers that critiqued and supported us throughout the journey!



SOURCES OF ERROR

We were going to try doing the test except answering it 5-10 minutes later but after that time, we forgot it completely or only remembered 1 word. We failed to keep the distractions to a minimum for a few people so we restarted their tests or didn't write them down. Another thing we didn't do correctly is that we tried doing many things that we couldn't do in our time and ended up failing. We tried getting lots of people to do our tests and tried to trust too many people, but many people didn't bring back their forms. As a result, we wasted lots of forms and even people who brought back forms quit right before we were about to do it.



APPLICATION

Using this information, you could say that this little caffeine tactic works better on males than females. Also, because caffeine does prove to increase the number of things you remember, you could potentially before a test drink small amounts of caffeine to help boost your short-term memory. Another thing you could do using this information as an adult, you could tell your children this. That was ultimately the point of this experiment.

Also, using the data we did about effects on your body when you drink caffeine, you'll have a better understanding of what your putting at risk. You could also know what good things will happen when you drink caffeine.

CITATIONS

[Caffeine Caused a Widespread Increase of Resting Brain Entropy - PMC.](#)

[How Psychologists Test Memory | CogniFit.](#)

[Lateral Prefrontal Cortex - An Overview | ScienceDirect Topics](#)

[Default Mode Network - an overview | ScienceDirect Topics](#)

[Neuroanatomy. Visual Cortex.](#)

[Oxford Languages | The Home of Language Data \(oup.com\)](#)

[Caffeine: Benefits, risks, and effects \(medicalnewstoday.com\)](#)

[Caffeine: MedlinePlus](#)

[Caffeine | The Nutrition Source | Harvard T.H. Chan School of Public Health](#)

[Kidney stones - Symptoms and causes - Mayo Clinic](#)

[Cataracts | National Eye Institute.](#)

[Alzheimer's and Parkinson's Disease: What's the Connection?.](#)

[Skin Cancer - Mayo Clinic](#)

[Caffeine Cheat Sheet: Which Drinks Have the Most?](#)

[How Long Does it Take for Caffeine to Wear Off? | Sleep Foundation](#)

[What Is Memory?](#)

[How Does Caffeine Affect the Brain | Caffeine + Brain Grey Matter \(university health news.com\)](#)

[What Is Caffeine, and Is It Good or Bad for Health?](#)

[Coffee | The Nutrition Source | Harvard T.H. Chan School of Public Health](#)

[9 Reasons Why \(the Right Amount of\) Coffee Is Good for You | Johns Hopkins Medicine](#)

[Kidney stone: Symptoms, causes, diagnosis and treatments \(msn.com\)](#)

[Stroke: Symptoms, causes, diagnosis and treatments \(msn.com\)](#)

[The Effects of Caffeine on Your Body \(healthline.com\)](#)

[Caffeine: Benefits, risks, and effects \(medicalnewstoday.com\)](#)

[Caffeine - StatPearls - NCBI Bookshelf.](#)

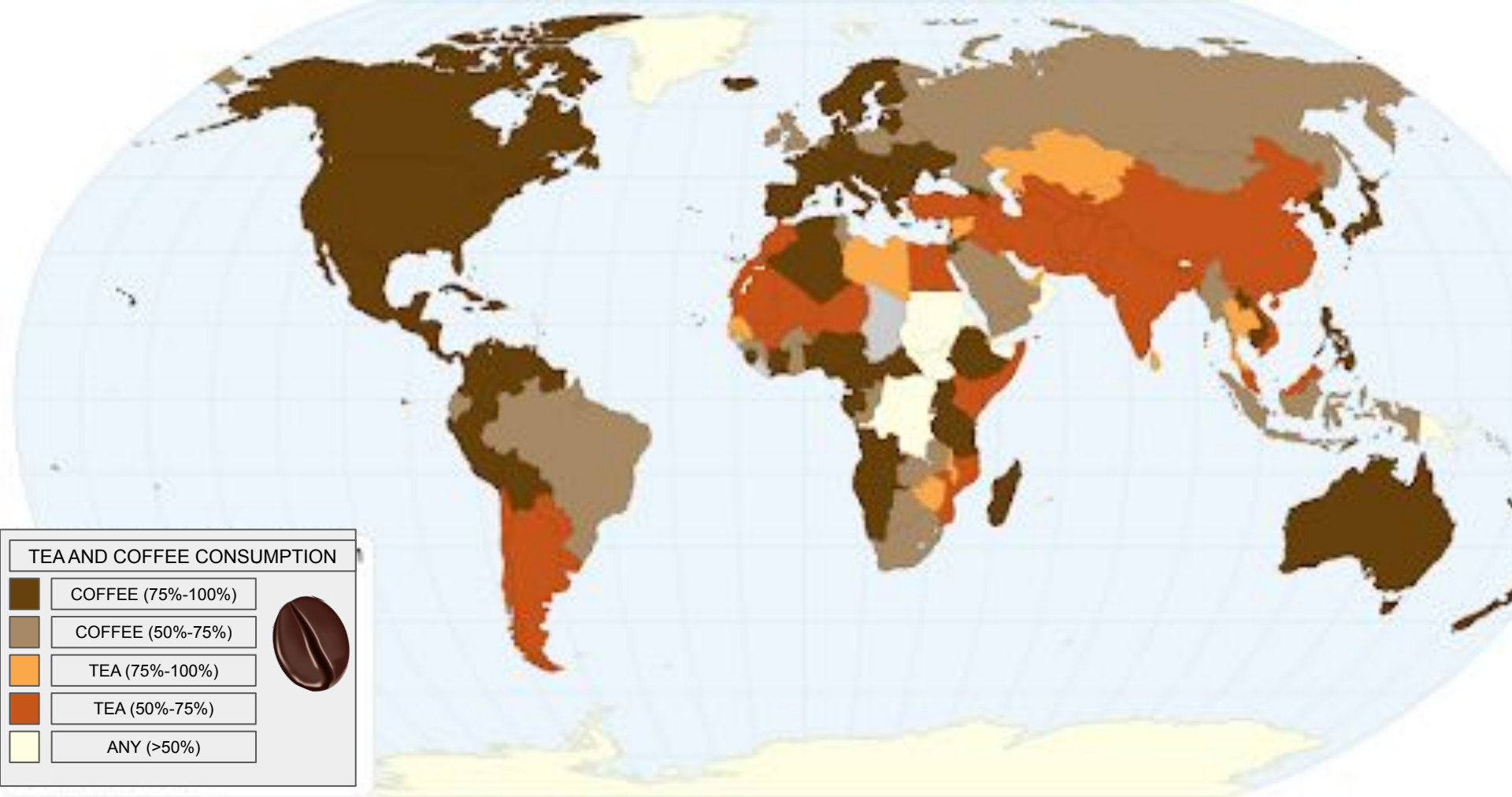
[Long-Term Memory | Merriam-Webster](#)

[Short-term memory Definition & Meaning - Merriam-Webster](#)

[Effect Definition & Meaning - Merriam-Webster](#)

[About Stroke | cdc.gov.](#)













Chemical Structure Of Caffeine

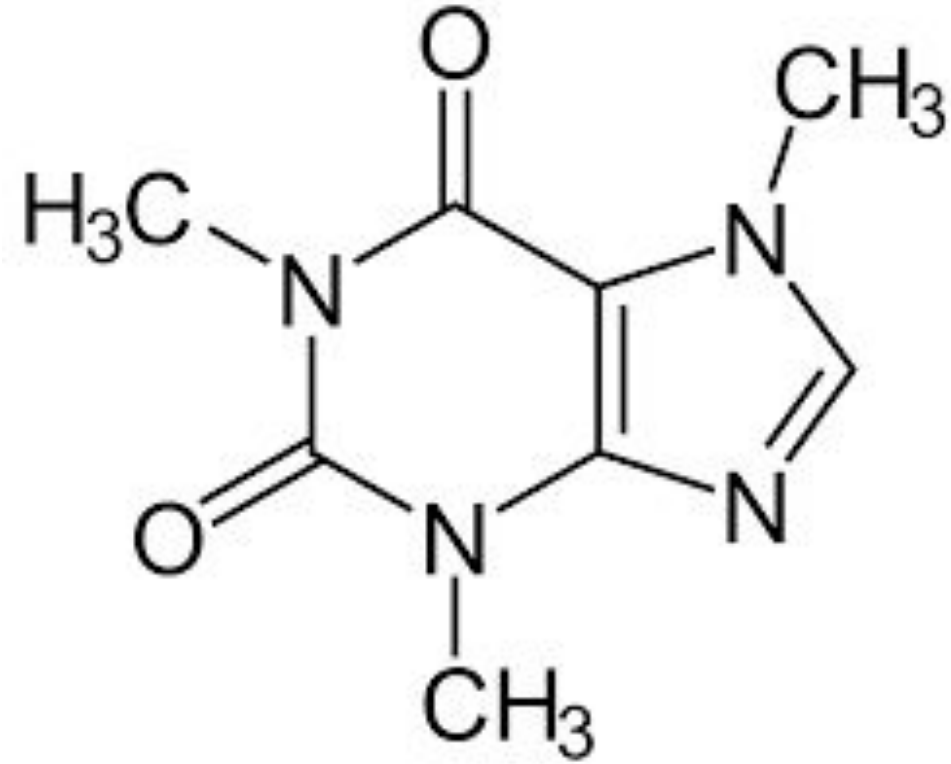
Cup Of Tea Used In Experiment

Chemical Structure Of Caffeine

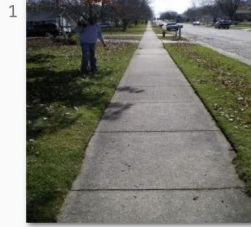
11-year old doing Experiment

Tea Leaves

Kola Nuts



Random things:



sidewalk



bookmark



thermostat



bracelet



book



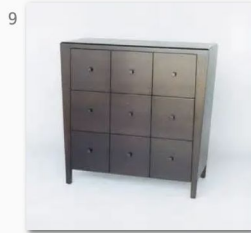
shawl



nail clippers



shoes



drawer



lotion









