NATURAL BACTERIA BUSTERS

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Grade 7
Research and Experimental Project

Problem/Question

How can we avoid topical mild antibiotics and what are some natural substitutes?

Our Hypothesis

We predict that the creams will have an effect on killing the bacteria and preventing the bacteria from growing or reproducing. We also predict that the size of the dead zone will be similar between the natural antibiotics and the Polysporin.

Research

What are antibiotics?

Antibiotics are medicines that help stop/prevent infections by killing bacteria. There are 2 different ways antibiotics can help the body fight illnesses, and these are

1. They kill the bacteria
2. They prevent bacteria from reproducing at all.

The definition of the word antibiotic is ‘against life’, and any drug that kills germs and bacteria in your body, although most people only use the term antibiotic for describing a medicine meant to kill bacteria. Antibiotics can help many different infections of viruses. Some of these include strep throat, ear infections, coughs, skin infections or even dental infections.

Antibiotics are drugs used to fight and treat bacterial infections, or illnesses, although they have no effect on viral infections. When they were first created, antibiotics were substances produced by a single microorganism that encourages the growth of another, so they just keep multiplying.

Why substitute antibiotics?

Antibiotics have done lots of good, and have even saved many lives, so why should we substitute them for other things? Well, although antibiotics do many great things, they also do things that aren't so great. For one, they can weaken one's immune system by making it rely on antibiotics, which is not good, as then that individual would have to take antibiotics very often. This is not a very good thing due to the fact that, surprisingly, some antibiotics even have side effects, including stomach pains, nausea, loss of appetite, diarrhea, and many other unhealthy side effects. One severe side effect of antibiotics is anaphylaxis, which is a serious allergic reaction, and may occur if an individual is allergic to any ingredients in antibiotics. Antibiotics destroy bad bacteria, but they also destroy the good bacteria, and this is how they weaken one's immune system

What is in antibiotics?

To make antibiotics, the compounds that ferment the broth are needed. This broth is an aqueous solution consisting of all the ingredients needed for the microorganisms to reproduce. This typically contains a source of carbon such as molasses or soy meal, which both consist of sugars for lactose and glucose. Such materials are required for the organisms as a food source. Nitrogen is another compound required in the organism's metabolic cycles. A salt of ammonia is usually used for this purpose. In addition, trace elements are included that are essential for the proper growth of antibiotic-producing species. These elements can include arsenic, mercury, magnesium, zinc, iron and copper, which have been added into water-soluble salts. Anti-foaming agents such as lard oil, octadecanol, and silicones are used to avoid foaming during fermentation.

What is a natural antibiotic?

A natural antibiotic to us is an ingredient that boosts the immune system and fights bacteria, similar to a regular antibiotic, except they do not kill the good bacteria, and they have no chemicals. Natural antibiotics boost the immune system if had when not needed, as opposed to making it weaker and making the immune system rely on it. This is good because if someone gets sick, their immune system is strong and can fight it better than if they had a regular antibiotic, which just makes their immune system weaker.

What can we substitute antibiotics with?

Honey

Topical and oral

One great natural antibiotic is honey, which has lots of antibacterial properties, due to the high content of hydrogen peroxide, and it can help fight illnesses or infections. Hydrogen peroxide is used to cleanse cuts and scrapes and can be used as an antiseptic. Due to honey's high content of hydrogen peroxide, it can be used as an antiseptic. Honey also has a high content of natural sugars. This may sound like a bad thing, but it is actually beneficial to the body as it can help prevent certain bacterias from growing. Honey also has a low pH level, and this allows the honey to extract the moisture from bacteria, making it very dry and causing it to die. It can be applied directly to a wound, or ingested for internal infections, such as an illness. One can just eat some honey (about 1 tablespoon) or mix it in herbal tea, or blend it in a smoothie. The best type of honey is Manuka Honey, due to its antiviral, anti-inflammatory and antioxidant benefits, although types are very good.

What can we substitute antibiotics with?

Garlic

Topical and oral

Another great, healthy substitute is garlic. This is not very tasty, but there are ways to incorporate it so that one can't even taste it. Ways to do this can be adding small amounts into foods, or even putting some in a smoothie, and adding other things to it in a way so the garlic is very hard to taste. Garlic extract or concentrated Garlic can also be used. It is a good natural antibiotic substitute as it has allicin in it, which can boost immunity, prevent cancer, and an anti-inflammatory effect. No one should have too much garlic, as for some people it may cause indigestion. This can be slightly prevented by soaking some garlic cloves in olive oil or using garlic extract. Garlic can be eaten, and it can also be put directly on the skin for cuts. Garlic contains sulphur compounds called cysteine sulfoxides, which help battle bacteria that are both uncommon, and common. To get as much out of the garlic as possible, chop it and let it sit for about 10 minutes. This will help the enzymes convert to allicin, which helps one's body fight bacteria.

What can we substitute antibiotics with?

Ginger

Topical and oral

Another natural antibiotic is ginger. Ginger is used very commonly to treat cases of flu and other colds. It is also very helpful when dealing with stomach pains, or even nausea. Ginger has the fantastic power to be able to lower blood sugar levels. As to the reason for ginger's amazing powers, the root has phenols and gingerols, and these are both very important when treating inflammation. Ginger also has a great anti-inflammatory property in it that helps greatly with inflammation. Ginger acts as a great spasmolytic, which is something that helps get rid of spasms in a smooth muscle. This is great for soothing and relieving an upset stomach, flatulence, and other gastrointestinal or digestive issues. This amazing herb also relieves nausea from motion sickness and pregnancy, as well as helping heal muscular sprains and joint pains. Someone can incorporate ginger in their diet by putting it in smoothies or juices, eating natural dried ginger, sucking on it raw, putting it in soups or other dishes, or even drinks, hot or cold.

What can we substitute antibiotics with?

Turmeric

Topical and oral

In turmeric, there is something called Curcumin. This is what gives turmeric its vibrant bright yellow colour. This spice is known for the antimicrobial properties in it as well as its anti-inflammatory properties. Turmeric also has the power to reduce pain and stiffness related to rheumatoid arthritis and osteoarthritis. Scientists have recently discovered that Curcumin kills bacteria on contact and this could lead to cutting boards, etc. that will be anti-bacterial.

Variables

Our manipulated variable is applying the natural antibiotic, and the responding variable is the bacterial growth. The control variables are the amount of agar in the Petri dish, the number of antibiotics applied onto the agar, as well as how much ‘broth’ is applied onto the agar.

*the broth is a mixture of dirt from under the bathroom sink mixed with water used to inoculate the agar.

Procedures

Formulating antibiotic cream

1. Sterilize all containers within the experiment, using hot water.
2. Combine olive oil, coconut oil, and beeswax in a double boiler or a glass bowl on top of a pot.
3. Heat pot to 90.5 degrees Celsius (low on a gas stove), in order to properly melt ingredients. We measured this by using a thermometer to measure the temperature of the water once it began to boil.
4. Stir the mixture occasionally in the bowl until combined. When combined, the mixture will appear to only be one colour and look as though it is only one item.
5. Once melted, separate the natural antibiotic base into the 5 individual jars and mix with the appropriate ingredients.
6. Add in the natural antibiotic
7. Wait for the creams to harden, seal and store in a cool dry place away from direct sunlight.

*Best if the ingredients are all organic as this makes a more controlled environment.

Preparing the Petri dishes

1. Sterilize all materials to be used using boiling water and pouring it over the items/materials.
2. Pour the contents of nutrient agar vial into a 250 ml (1 cup) of water. Use a large container, to ensure the solution does not spill as it will bubble. A four-cup or larger Pyrex measuring cup is best for this process.
3. Mix thoroughly
4. Heat the mixture to boiling and completely dissolve the medium in the microwave or using hot water. This will take approximately 2 minutes.
5. Lay the empty Petri dishes on your work surface but do not remove the covers until the last possible second before pouring the hot solution.
6. Have a partner remove one lid at a time while you pour and then replace the lids immediately. This will prevent additional bacteria from going into the Petri dishes. When pouring the agar solution, it is only necessary to cover the bottom of the dish, not to create a swimming pool for bacteria to grow. If it helps, you may gently tilt the dish to spread the agar to ensure there is not too much used.
7. Cool the Petri dishes by setting them on a counter and allowing them to harden.
8. Once they are set, place them upside down in the refrigerator. It is best to seal the Petri dishes with a piece of tape to prevent them from opening.

*powdered nutrient agar is used for this process

Testing the growing conditions

1. Remove two Petri dishes from the refrigerator keeping them upside down, remove from any packaging etc and label it.
2. Carefully lift the half of the plate that contains the nutrient agar with one hand, tilt if necessary, but be sure not to turn it over completely.
3. Inoculate the agar with a mixture of dirt from under the bathroom sink mixed with water by smearing it over the surface.
4. Place the inoculated agar back on the lid immediately. This Petri dish is called positive control.
5. Place both Petri dishes upside down in an incubator for 48 hours or more with a warm temperature to mimic body heat, about 37 degrees Celcius (98 degrees Fahrenheit). Avoid sunlight.
6. Check daily. If there are bacteria growing in the negative control dish, it may be best to start again and sterilize everything again in an oven. Repeat until there is no bacteria growth in the negative control dish.

Building the incubator

Materials

- Rubbermaid container with lid
- Large glass jar to hold the Petri dishes
- Heating pad
- Folded towel (optional)
- Thermometer

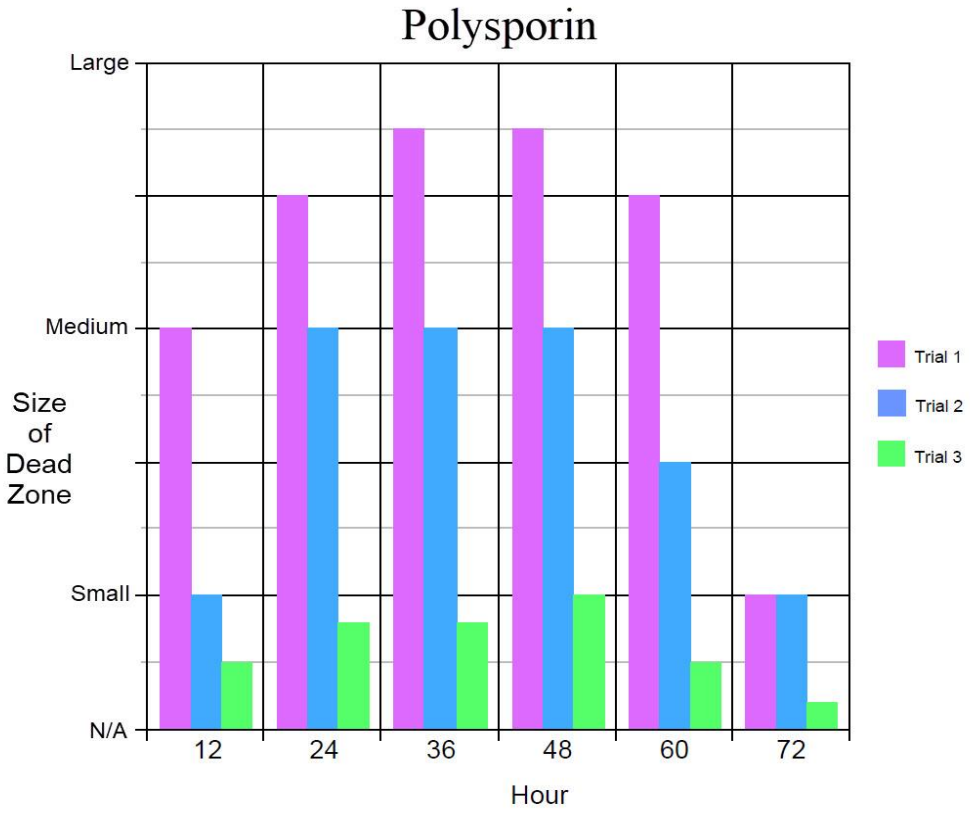
1. Turn the heating pad on the low setting and place underneath the Rubbermaid container.
2. Place the Petri dishes inside the glass jar and place the glass jar inside the container.
3. Use the thermometer to monitor the temperature to ensure it is consistent, and if it is too hot at any time, place the folding towel on top of the heating pad.

Testing natural antibiotics

1. Remove two Petri dishes from the refrigerator keeping them upside down, remove from any packaging etc and label it.
2. Carefully lift the half of the plate that contains the nutrient agar with one hand, tilt if necessary, but be sure not to turn it over completely.
3. Inoculate the agar with a mixture of dirt from under the bathroom sink mixed with water by smearing it over the surface (the 'broth') using a Q-tip.
4. Place the inoculated agar back on the lid immediately.
5. Repeat this process with all the Petri dishes.
6. Wearing gloves, punch 36 holes in the filter paper and dip 6 in each cream using sterilized tweezers.
7. Place the holes of filter paper with the same cream on them in one Petri dish, spread out, and label the dish with the antibiotic on it.
8. Do this for all the natural creams.
9. Place all labelled Petri dishes in the incubator and check them every 12 hours.
10. There should be a ring around each filter paper hole with no bacteria growth. This ring is called the dead zone. The larger the dead zone is, the stronger and more powerful the antibiotic cream is.

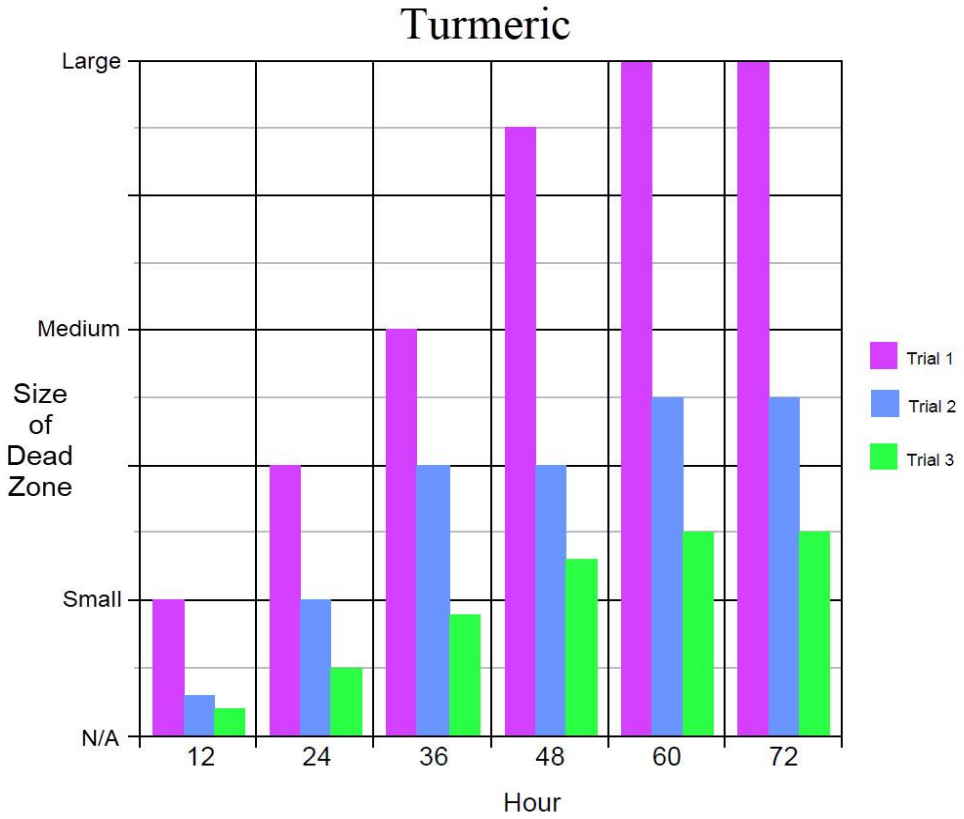
Observations

Polysporin



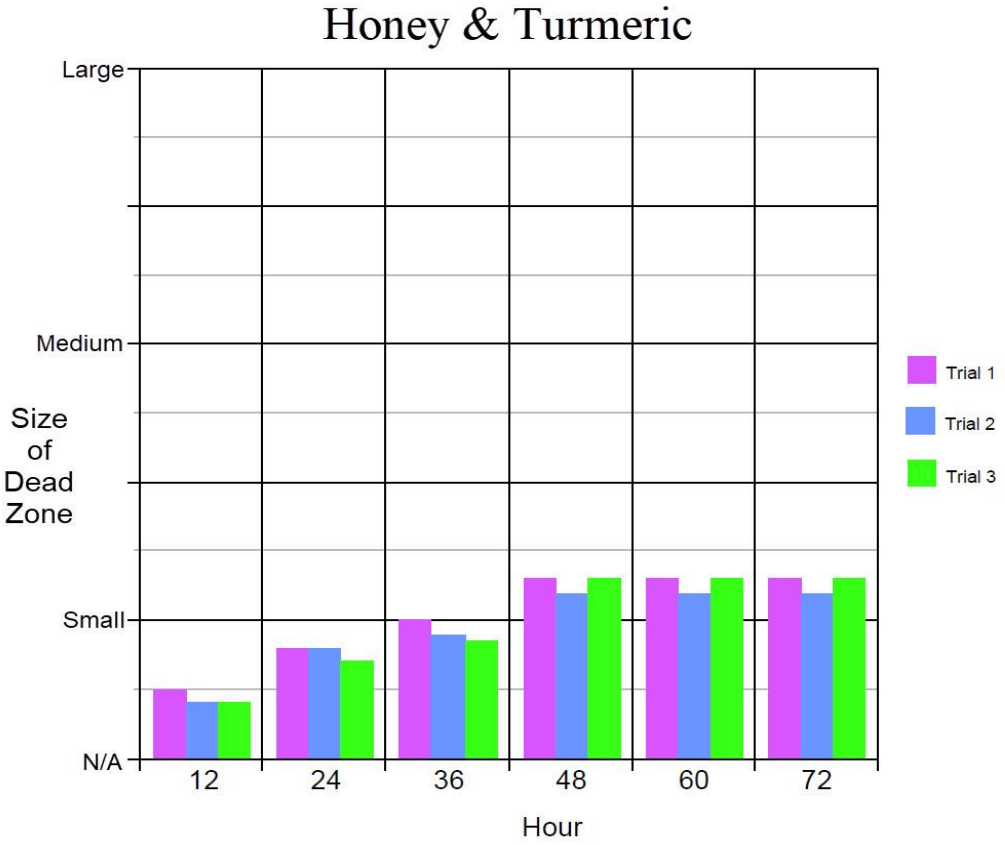
The dead zone was very big at the beginning of the experiment and then grew a little bit throughout the experiment. But a little after the halfway mark the dead zone began to shrink.

Turmeric



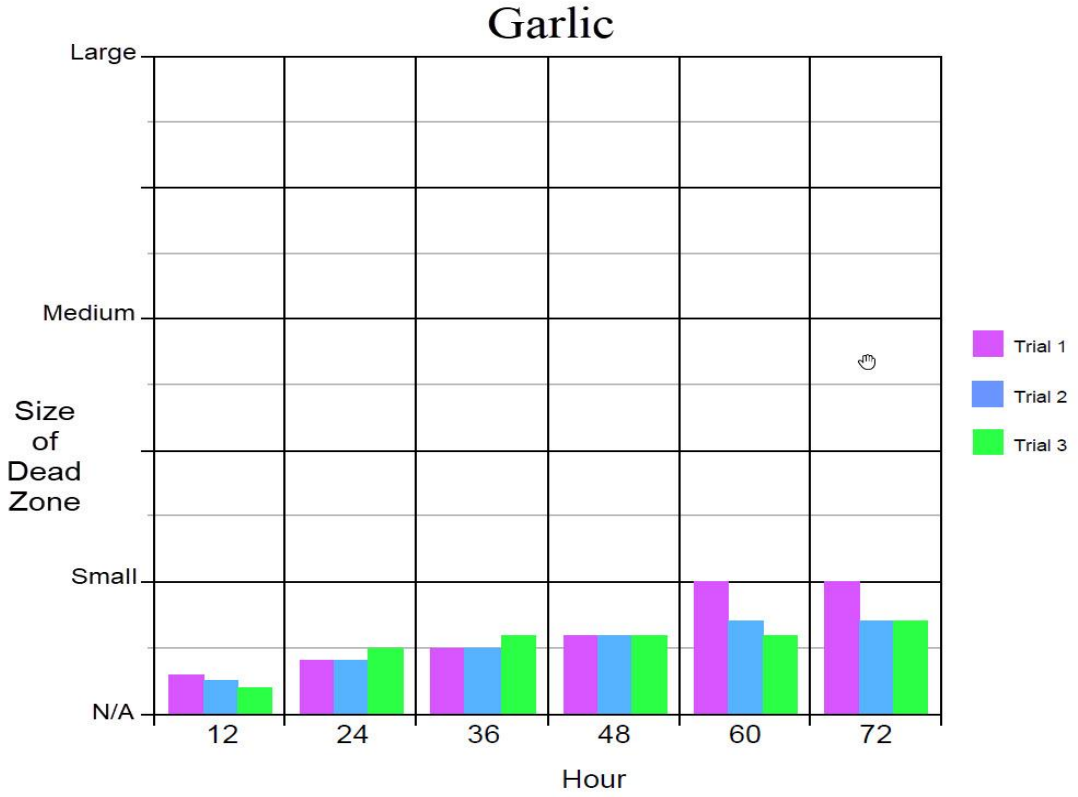
The dead zone grew larger throughout the experiment. By the end of the experiment turmeric had the largest dead compared to all the others.

Honey & Turmeric



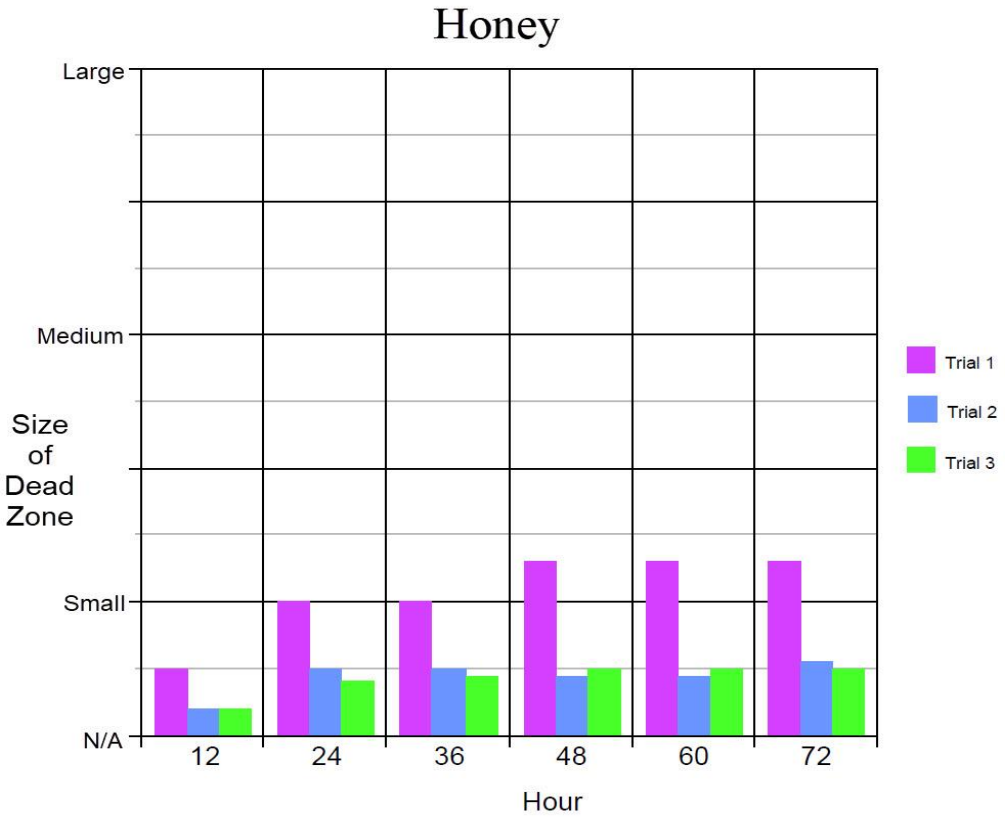
The dead zone grew larger throughout the entire experiment. This was probably the third best after turmeric and polysporin.

Garlic



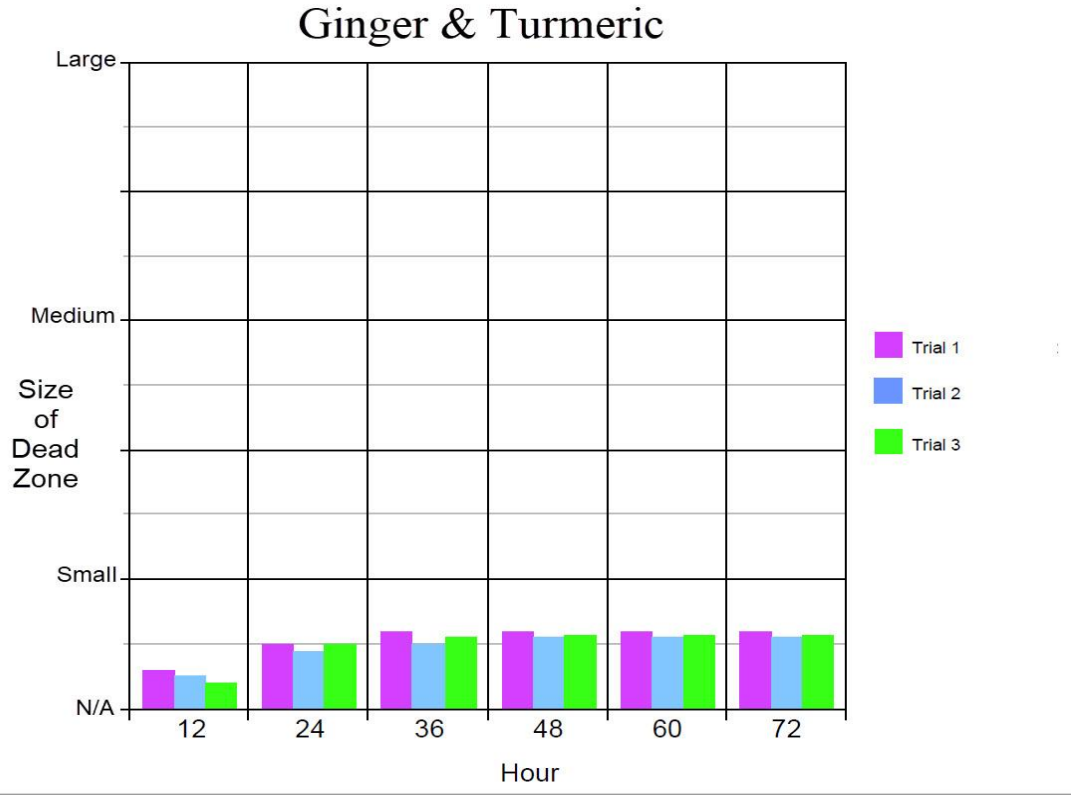
The dead zone grew larger throughout the entire experiment. This may be that garlic needs time for it to actually work.

Honey



The size of the dead zone for honey was about the same throughout the entire experiment.

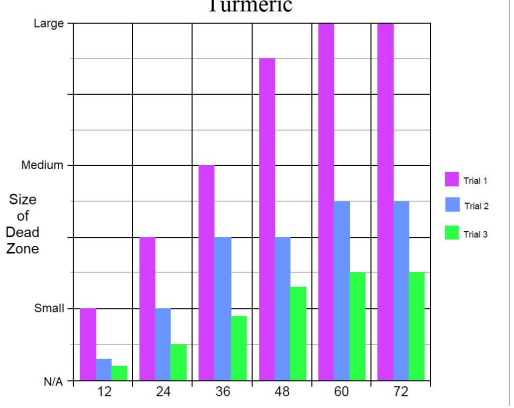
Ginger & Turmeric

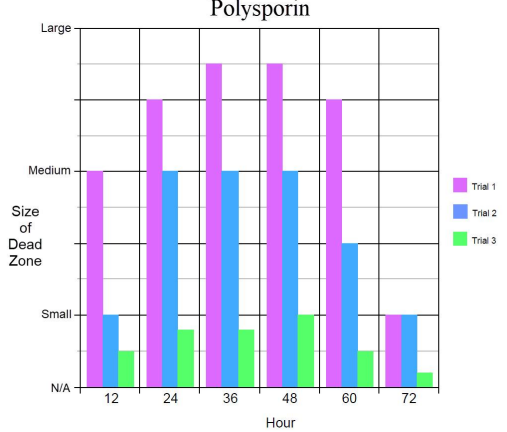


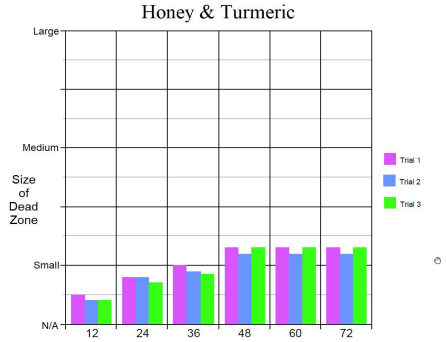
The size of the dead zone for ginger and turmeric was about the same throughout the entire experiment.

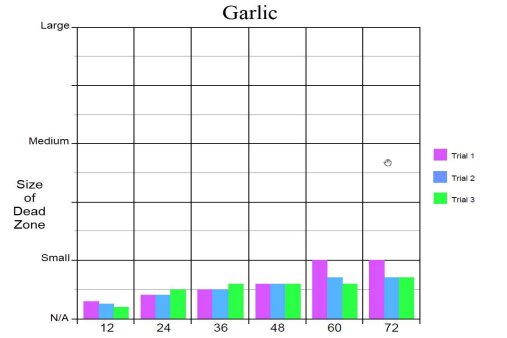
Experiment data

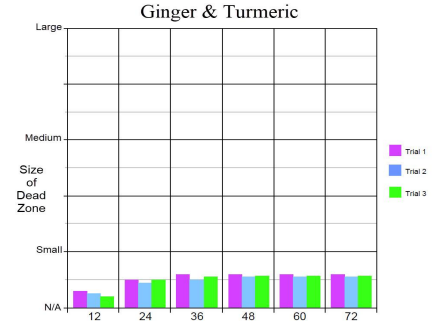
After trial one, it appears that the qualities turmeric displays are those similar to antibiotics. A big difference between turmeric and Polysporin includes the fact that the Polysporin works quickly but slowly begins to weaken after about 48 hours, whereas the turmeric works slower (by approximately 24 hours). It appeared that the Polysporin stopped working (dead zone shrinking) and let bacteria overpower it after 24 hours, though the turmeric continued its growth until 36 hours, and even then did not let the bacteria overpower it, unlike the Polysporin. Similarly, it is safe to say that honey, garlic, and ginger also have characteristics that are comparable to antibiotics including that they both prevent bacteria from growing altogether. After trial 2, there was not as large of a dead zone in all of them, aside from Polysporin. Polysporin seemed to have about the same size dead zone. The reason for this could be because the natural creams are stronger at first, but as they get older, their effect will be less. After trial 3, it is the same data as after trials 1 and 2.

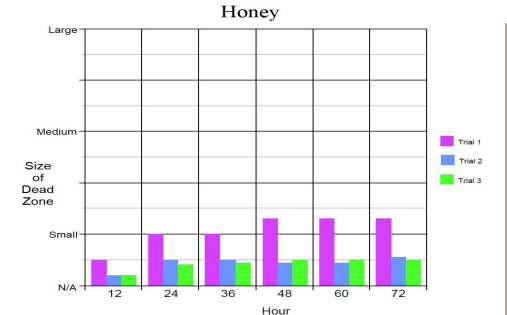












The most important takeaway of our project.

Conclusion

Using the data from all of our experiments, it is safe to conclude that antibiotics can be avoided and substituted with natural ingredients such as turmeric, garlic, ginger and honey. The strongest of these natural antibiotics is turmeric, most likely due to its curcumin. Natural antibiotics, although they work slower, still work just as well as regular topical antibiotics, and turmeric may even work a bit better. Thus, it is safe to call these natural substitutes natural antibiotics.

Polysporin had a much faster effect on preventing bacteria growth but did not have a long-lasting effect and let the bacteria overpower it after 36 - 48, whereas the natural creams stayed strong.

Application

There are many ways discoveries made in this project can be applied to real-world situations. Some of these situations include being able to substitute regular antibiotics with natural ones, as regular antibiotics are not always available. This is also a solution to people who cannot afford regular antibiotics as the natural antibiotics that we tested are quite common in most households, and are also somewhat easy to gain access to. One more way this project can be applied to the real world is if someone has some sort of a reaction to regular antibiotics that prevents them from using them when they may need to, they can substitute them with these natural antibiotics.

Errors

- We thought mould and bacteria were related and mould growth represented bacterial growth.
- At first, we used oranges, not agar as our bacteria growing medium.
- We stored our first experiment in the cold, whereas bacteria grows better in warmth, close to body heat.
- We used turmeric powder, whereas a lot of the nutrients in turmeric is in the root.
- We should’ve combined all of the natural topical creams to make one strong one and to see how strong all the natural creams are together.
- We should’ve measured the diameter of the dead zone, rather than just using sizes, as that would have been more accurate.
- When doing our experiment, we should have had a controlled variable which could have been an ingredient that we know does not have antibacterial properties to ensure that not all ingredients have dead zones, and that only antibiotics do.

Citations

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George Pastirik - Science is (www.science-is.com)

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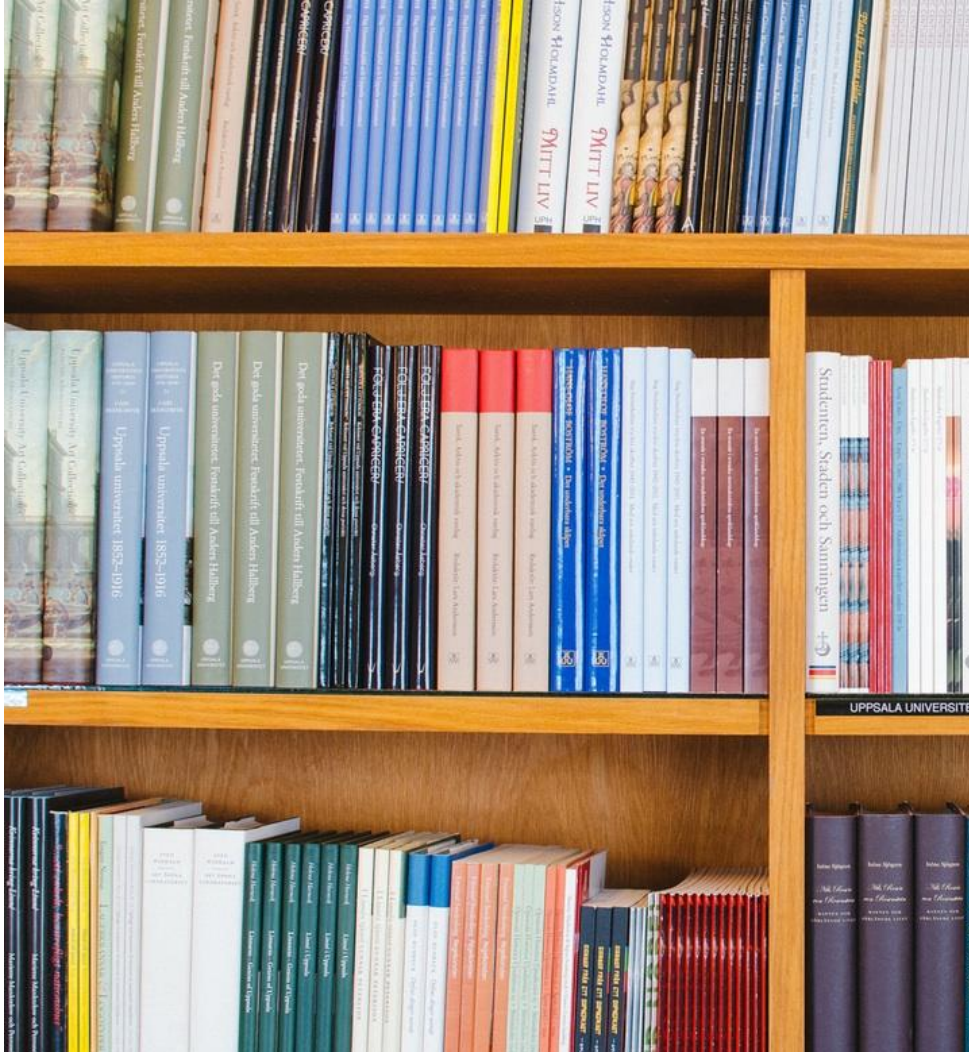
What will I do next?

In the future, we could elaborate on this experiment a little bit more by trying to test oral antibiotics as well, or maybe even by testing some other common household ingredients, or one perhaps ones that aren’t so common.



Pictures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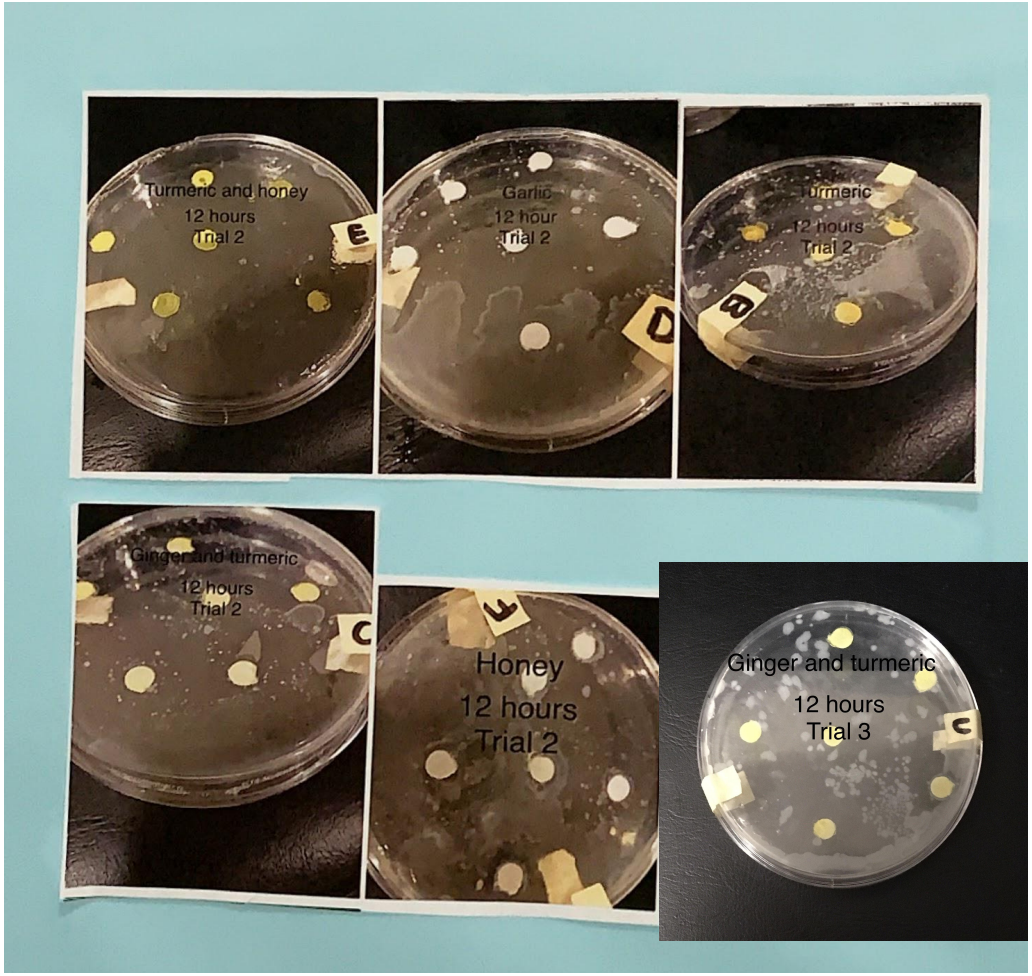
Turmeric and honey
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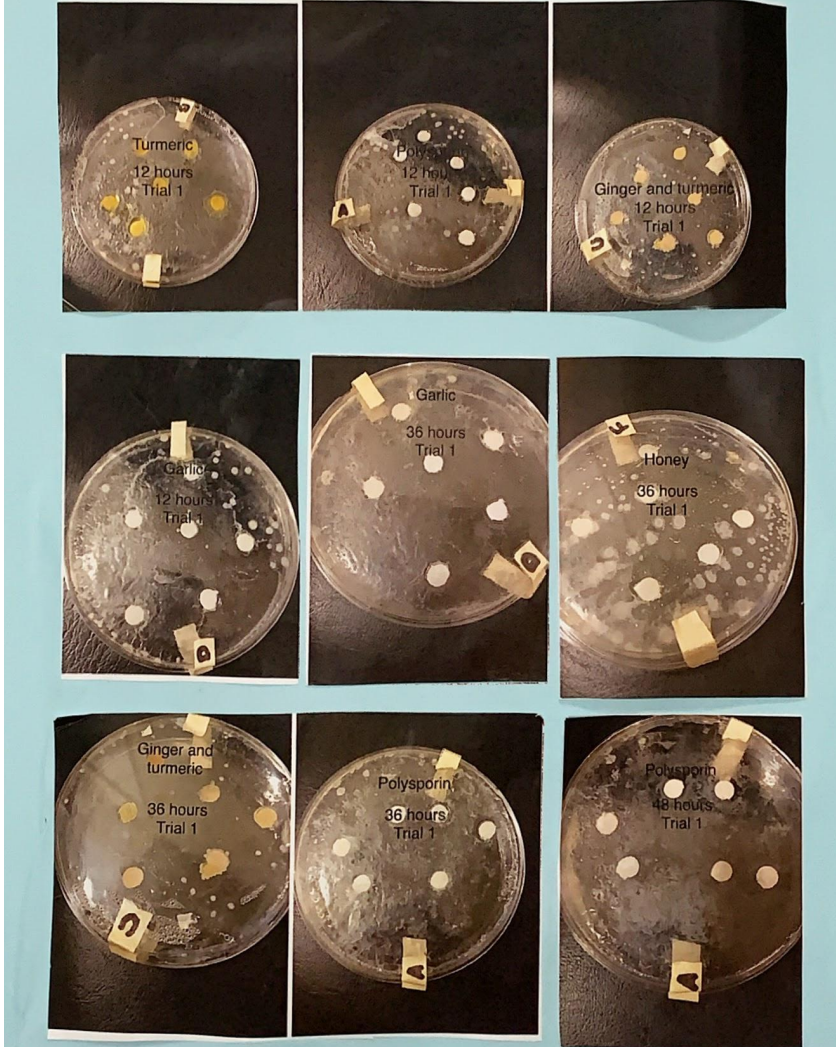
Turmeric
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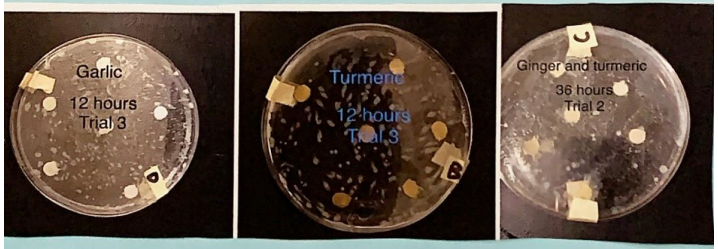
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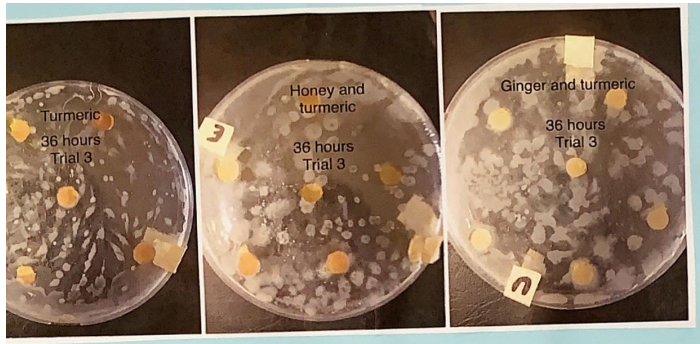
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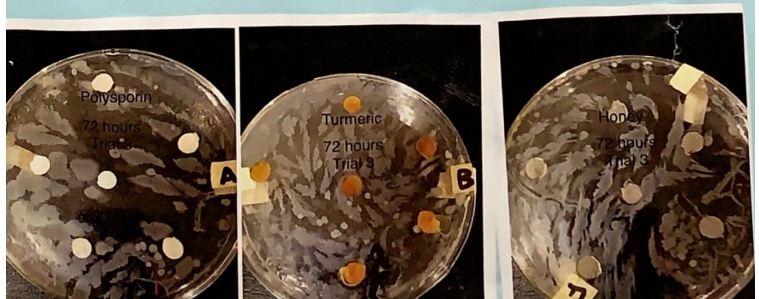
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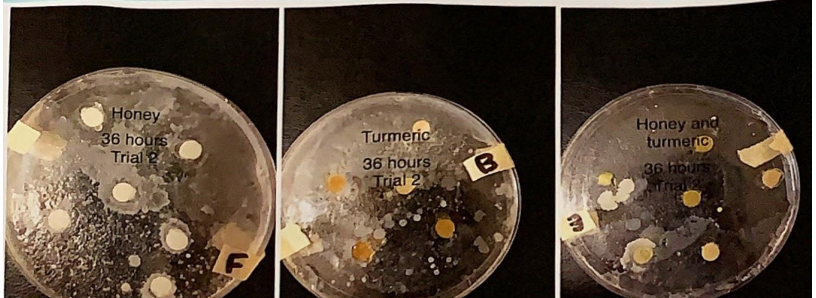
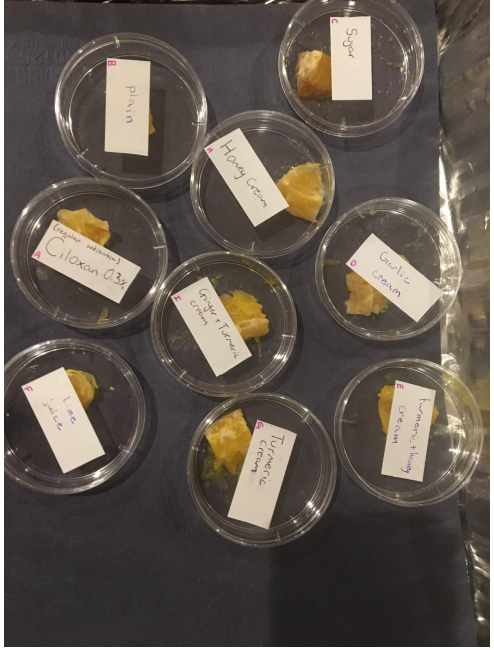
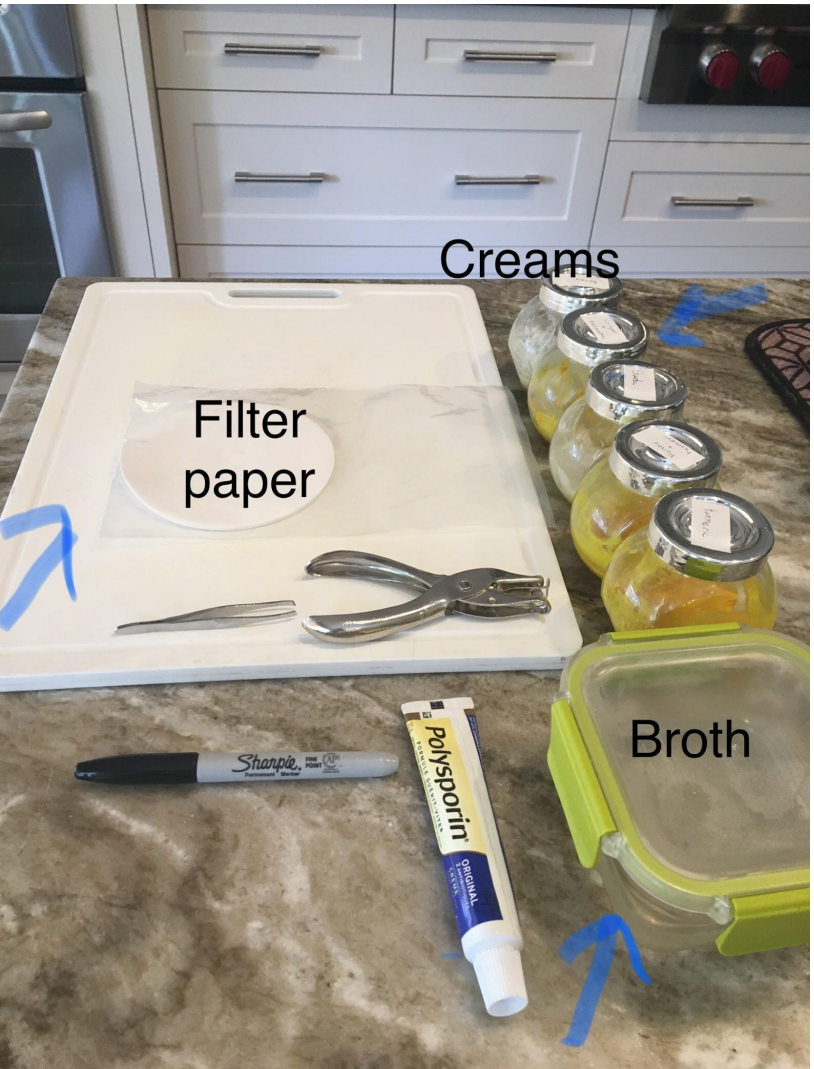
Trial 2
A

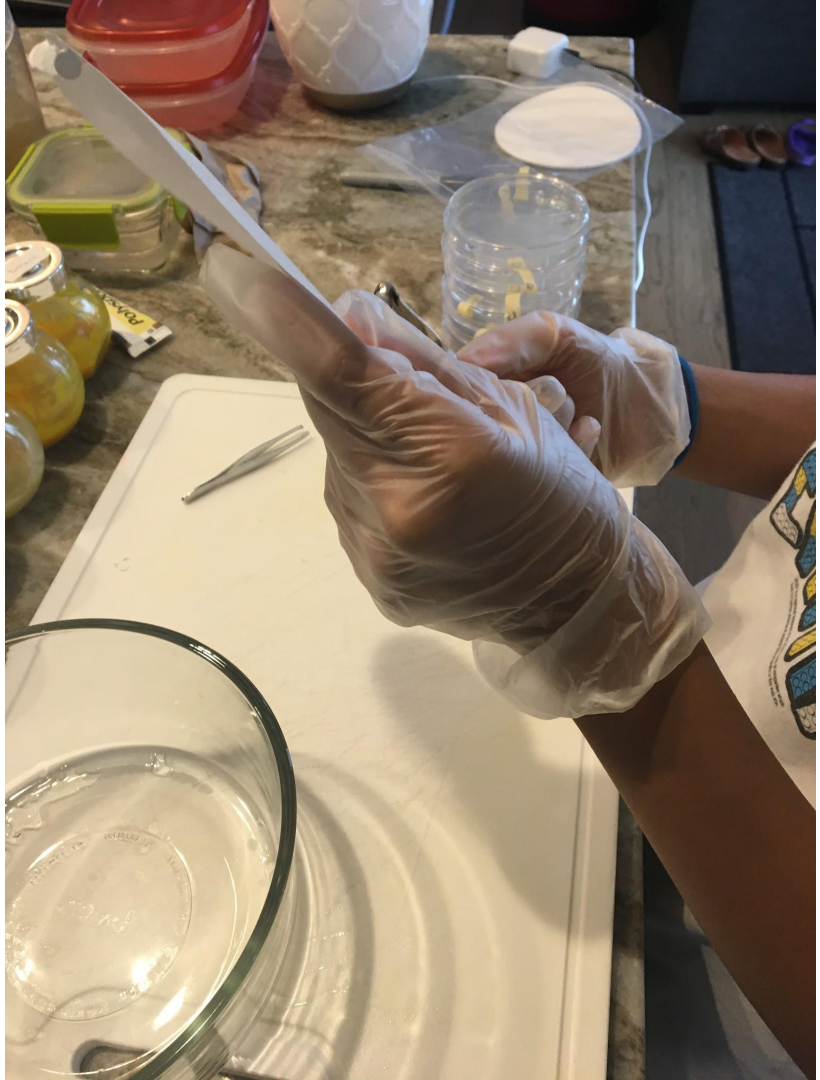

Honey
36 hours
Trial 2
F
Turmeric
36 hours
Trial 2
B
Honey and
turmeric
36 hours
Trial 2
E

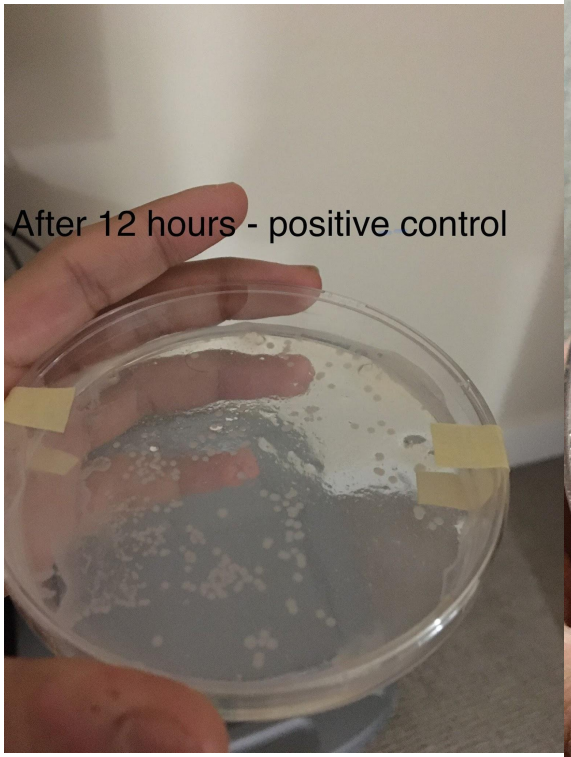

Honey


Turmeric+honey cream
Ciloxan 03%
Garlic cream
Ginger+Turmeric cream
Turmeric cream
Honey Cream
Lime juice
Plain
Sugar


Sugar
Plain
Honey Cream
Ciloxan 03%
Garlic cream
Ginger+Turmeric cream
Lime juice
Turmeric Cream
Turmeric+honey cream

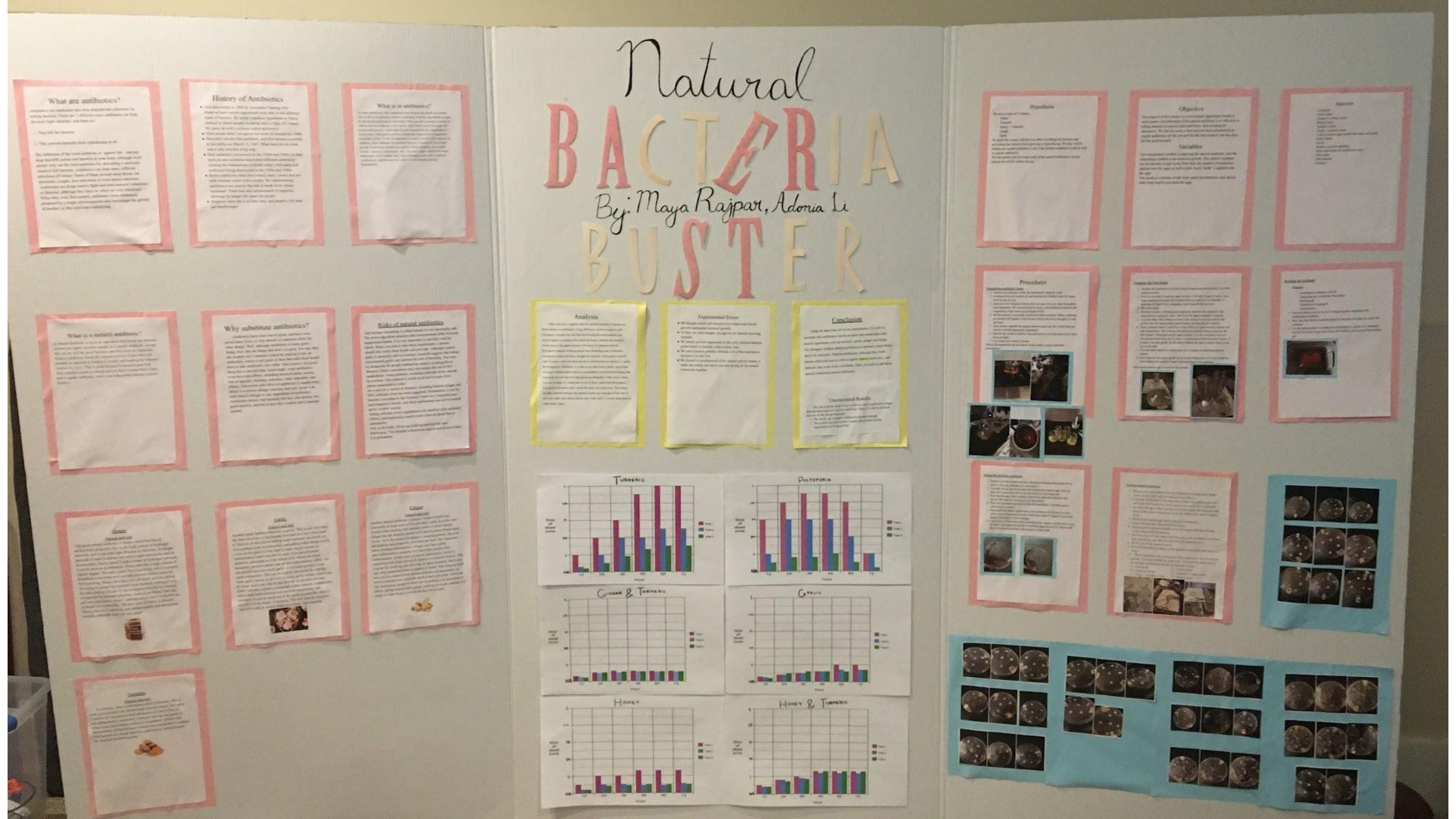

Creams
Filter paper
Broth
Sharpie
Polysporin
ORIGINAL




After 12 hours - positive control


After 19 hours - negative control


After 19 hours - positive control


Natural
BACTERIA
By: Maya Rajpar, Adonia Li
BUSTER
What are antibiotics?
History of Antibiotics
What is in antibiotics?
What is a natural antibiotic?
Why substitute antibiotics?
Risks of natural antibiotics
Analysis
Experimental Errors
Conclusion
Hypothesis
Objective
Variables
Materials
Procedures
Tumeric
Polysporin
Ginger & Tumeric
Garlic
Honey
Honey & Tumeric

Presentation

Here is a link to our virtual presentation.

https://drive.google.com/file/d/1aU2WCD9MR9NKPxAlWkykC3kmwMMu4lXn/view?usp=sharing