CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Luceli Avila-Ayala

Project Number
J1601

Project Title
5 Second Rule! Does It Really Apply and Do Different Ground Surfaces Affect the Myth?

Abstract

Objectives/Goals
The purpose of my experiment is to find out what type of ground has the most bacteria while referring to the five second rule.

Methods/Materials
I am using different grounds as my independent variable. My dependent variable is the amount of bacteria colonies left on the petri dishes. This is a good choice because it is an accurate way to test the amount of bacteria on each type of ground. Once I swab the skittle after it being on the floor for five seconds, I swab the petri dish, and put it in an incubator. After three days, I count the amount of bacteria left on the dishes. The amount of bacteria colonies will determine if the cement, carpet, or tile has the most bacteria.

Results
The cement had the most bacteria colony growth. The average number of bacteria colonies for the cement was 16.07. A low variable was the carpet. The carpet had the least bacteria colonies. The average number of bacteria colonies for the carpet was 3.6.

Conclusions/Discussion
I learned a lot from my experiment. I learned that there are many bacteria on the ground, but there is the most bacteria on cement (out of carpet, cement, and tile). I think that this was important because it can show people how dirty the floor really is. It can teach people to be more cautious, so they could think about how many germs are on an object after it falling on the floor.

Summary Statement
I discovered that the surface a food object lands on does affect bacteria growth. The cement showed the most bacteria growth and the carpet had the least amount of bacteria.

Help Received
Jewely Lickey, Science teacher at Sanger Academy Charter School provided testing area and equipment, Davin Aalto high school teacher prepared agar dishes

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Jenna E. Beausang

Project Number

J1602

Project Title

Spice of Life: Oregano as an Antibacterial Agent: Does State Matter?

Abstract

Objectives/Goals

The purpose of this experiment was to compare the antibacterial effectiveness of different states of oregano (essential oil and liquid herbal decoctions from dry and fresh plants), and to determine which state is most effective in killing or inhibiting the growth of E. coli bacteria.

This is a continuation of a previous experiment, in which I found that oregano oil is an effective antibacterial agent. I take strong prescription medications to control Crohn#s Disease; I worry about long-term effects of these medications and I want to study natural cures.

Methods/Materials

Agar medium in Petri dishes with E.coli bacteria spread in perpendicular #lawn# patterns. Decoctions of both fresh and dried oregano. Oregano oil and liquids were added to the Petri dishes using the Kirby-Bauer method with antibiotic disks. Oregano solution was dropped onto all 4 disks until they were each soaked in solution. Dishes were incubated overnight at slightly warmer than room temperature. After 24, 48 and 72 hours, I measured the #zone of inhibition# around each disk using Vernier calipers.

Results

The decoction from fresh oregano was the most effective antibacterial agent. It had the largest zone of inhibition, which means it was the most powerful state of oregano in stopping the growth of the bacteria.

Conclusions/Discussion

It is interesting that the fresh herb decoction was more effective than the essential oil. Essential oils, which are expensive, are very popular for fighting illness and bacteria. Fresh herbs are a much simpler, cheaper, and more effective alternative. They are available at markets, and can even be grown in your own yard! Decoctions are actually as easy to make as tea, so this is a simple way to take the herbs. It would be best to consult with a licensed herbalist before making or taking any herbal decoction.

Summary Statement

As measured using the Kirby Bauer zone of inhibition method, I found that a decoction of fresh oregano was more a effective antibacterial agent against E. coli than a decoction of dry oregano or oregano essential oil.

Help Received

My teacher, Ms. Nogueira, helped me come up with ideas and learn about decoctions. Dr. Mulhotra at Thousand Oaks High School allowed me to get advice from her students about my experiment. Vincent Lok, a T.O. High School student, suggested the Kirby-Bauer antibiotic testing method.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Aditi Bharti

Project Number
J1603

Project Title
Saliva the Samurai: The Effect of Human Saliva on Bacterial/Fungal Skin Diseases: An Effective/Eco-Friendly Alternative

Abstract

Objectives/Goals

The emergence of antibiotic-resistant bacteria is a global threat. Each year in the US alone, approximately 23,000 people die as a result of antibiotic-resistant bacterial infections. In addition, there are related losses of roughly $55 billion. Antibiotics have serious known side effects and impact the environment as they can enter the human food chain.

The objective of my project is to find out if human saliva can be an effective and eco-friendly alternative to antibiotics and antifungals in the treatment of common skin diseases.

Methods/Materials

The main materials used were 36 agar plates, Staphylococcus Epidermidis (bacteria), Candida Albicans (fungi), morning saliva, Mupirocin Ointment USP 2% (antibiotic), Cipladine Povidone-Iodine IP 5% (antifungal), Lab-Line Barnstead100 Incubator, bleach, ImageJ software (online),and safety apparatus.

First, I prepared sets of 5 Petri dishes for control, antibiotics, and saliva separately for the bacterial experiment group. Next, I left the control plate as is, applied antibiotics to the antibiotics plate, and applied my morning saliva to the saliva plate. After putting the Petri dishes back in the incubator, I observed bacterial growth and took pictures of all the Petri dishes every day for four days. After the 4th day, I disposed of the Petri dishes. I repeated these steps for the fungi group as well. At the end, I analyzed all the colonies using an ImageJ software.

Results

In total, I collected 510 data points and analyzed each one using the ImageJ software. I found that the antibiotic inhibited bacterial growth by 83%, and the saliva inhibited bacterial growth by 77%, showing that the saliva was 71% as effective as the antibiotics. I also found that the antifungal inhibited fungal growth by 79%, and the saliva inhibited fungal growth by 73%, showing that the saliva was 78% as effective as the antifungal.

Conclusions/Discussion

In this experiment, I wanted to see if saliva could effectively treat skin diseases as compared to antibiotics and antifungals. My results show that the saliva was 71% as effective as the antibiotic and 78% as effective as the antifungal in the experimental setup. These results are very promising as they show that saliva can be effective when treating skin diseases, but they need to be further evaluated in a professional setup.

Summary Statement

I found that human saliva can be an effective and eco-friendly alternative to antibiotics and antifungals in the treatment of common skin diseases.

Help Received

I performed the entire experiment in my school's science lab and analyzed the results myself. However, my teacher, Mrs. Mackewicz, arranged the incubator for this experiment, and my parents purchased the necessary materials from Carolina.com. I also consulted with the Carolina.com technical team.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Isaac A. Broudy

Project Number

J1604

Project Title

A Quantitative Assessment of Nutrients and Their Impact on the Microbiome Health

Abstract

Objectives/Goals

The objective of this project was to to quantify how good or bad a nutrient is for microbiome health.

Methods/Materials

Tested how health-promoting nutrients (protein, vitamin C, fiber) and disease-promoting nutrients (glucose, salt, oil) affected the growth of probiotic bacteria (Lactobacillus acidophilus) and pathogenic bacteria (Escherichia coli). Measured the growth of bacteria with a spectrophotometer and recorded the OD650. Developed a quantitative score for each nutrient based on how well it promoted the probiotic or pathogenic bacterial growth.

Results

Vitamin C was found to promote microbiome health because it inhibited E. coli growth, but not L. acidophilus. In contrast, sodium chloride made a negative impact because it slowed L. acidophilus growth, but not E. coli. All the other nutrients did not significantly affect bacterial growth. Percent growth values for each nutrient were used to calculate a Microbiome Health Index (MHI), quantifying the impact of a nutrient on the microbiome. VitaminC has an MHI of 89%, while sodium chloride has an MHI of -35%.

Conclusions/Discussion

This study demonstrated that specific nutrients have health-promoting or disease-promoting effects on the microbiome, and those effects can be quantified in a microbiome health index. The biggest impact observed occurred by slowing the growth of one bacteria over the other. In the human body, both L. acidophilus and E. coli are growing together, competing with each other to colonize the intestinal mucosa. By reducing the growth rate of one species, the other species has an opportunity to flourish, creating health-promoting or disease-promoting conditions.

The finding that Vitamin C promoted microbiome health by reducing E. coli growth, but leaving L. acidophilus unaffected, may be explained by the environment it created. L. acidophilus produces lactic acid, and as a result grows well in acidic environments, similar to the one created by Vitamin C, or ascorbic acid. Salt, on the other hand, does not affect the acidity level, so its impact on inhibiting L. acidophilus growth likely occurs through another means, such as sodium regulation.

Vitamin C and salt are nutrients with large MHIs, but are often ignored in weight loss diets based on calorie counting. These MHI scores could be used as additional information on food labels, to help people make smarter dietary decisions that also consider microbiome health.

Summary Statement

I tested the impact of different nutrients on the microbiome, and developed an index to quantify how good or bad a nutrient may be for microbiome health.

Help Received

I did the testing myself. I got help from my father in getting required materials like my bacteria strains. Also my father watched me do all the testing with bacteria (my father is a scientist).

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Olivia J. Cevasco

Project Number
J1605

Project Title
Healing Tears

Abstract

Objectives/Goals
The objective of this study is to determine if human tears can kill an equivalent amount of Staphylococcus aureus as Bactine, Neosporin, Isopropyl Alcohol, and sterile water.

Methods/Materials
I used the Kirby Bauer antibiotic susceptibility testing method. I built an incubator using a 18 1/4" x 18" x 16" cardboard box, desk lamp, and an insulated styrofoam board. I used 21 tryptic soy agar petri dishes, 100 6mm sensitivity discs, 1.2mL of human tears, Bactine, Neosoprin, Isopropyl Alcohol, and sterile water, 21 sterile cotton swabs, tweezers, 5 sterile pipettes, and a Vernier Caliper. For my scouting experiments, I used 60 petri dishes, 300 sensitivity discs, and 3.6mL of human tears, Bactine, Neosporin, Isopropyl Alcohol, and sterile water.

Results
I used a Vernier Caliper to measure the zone of inhibition per sensitivity disc in millimeters and the results are as follows: human tears and sterile water killed less than 0.1mm of Staph. aureus, Bactine killed an average of 24mm of Staph. aureus, Neosporin killed an average of 18.3mm of Staph. aureus, and Isopropyl Alcohol killed an average of 15.86mm of Staph. aureus.

Conclusions/Discussion
My results indicate that Staph. aureus is resistant to human tears and sterile water, but Staph. aureus is susceptible to Bactine, Neosporin, and Isopropyl Alcohol. I believed that human tears would kill nearly an equivalent amount of Staphylococcus aureus to Bactine, Neosporin, Isopropyl Alcohol, and sterile water because tears contain antimicrobials, such as Lysozyme, that kill bacteria to keep bodies healthy on a daily basis. I disproved my hypothesis because tears and sterile water did not kill any bacteria, but Bactine, Neosporin, and Isopropyl Alcohol killed the bacteria. From my results, you can infer that if you have an open wound, applying Bactine to kill the bacteria would be the best option. For further study, I would use pure Lysozyme as my positive control and water as my negative control. Even though I found that tears cannot kill Staphylococcus aureus, I am determined to find a type of wound bacteria that tears can kill.

Summary Statement
I found that human tears cannot kill as much Staph. Aureus as Bactine, Neosporin, Isopropyl Alcohol, and sterile water.

Help Received
I received no help for this experiment. I researched, preformed this experiment, and constructed an incubator independently.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Camryn Clardy; Dalia Elrih

Project Number
J1606

Project Title
The New and Affordable Alternative! Will Turmeric Treat Powdery Mildew?

Abstract

Objectives/Goals

Powdery Mildew is regarded as a pathogen that attacks plant leaf regions, potentially leading to its mortality. The purpose of this experiment was to test the effect of a turmeric extract solution on plants that are affected by Powdery Mildew. The turmeric solution method would be a #non-chemical# derived treatment that would be a potentially fast, affordable and benign method of Powdery Mildew control.

We conducted a series of five experiments using Turmeric on infected pumpkin leaves. Before we began treatment, we traced the leaves to calculate the surface area and to document the Powdery Mildew evident on the leaf to observe improvement occurring through the various trials.

Methods/Materials

Examine Powdery Mildew on the leaves of the Pumpkin Plant in garden. Trace each leaf on the tracing pad, making sure to get a close to accurate depiction. Using a sheet protector and a white board marker, plot points according to the different places evident of Powdery Mildew. After, carefully paste the tracing paper on the 1 by 1 cm graph notebook to calculate surface area. Take out organic Turmeric powder and pour an amount of 4.5 grams and 20mL of water into the beaker which is placed on top of the electronic scale. Take a picture before and after experimentation. Using a swab, apply Turmeric extract powder directly on infected leaf spores. After, use a paintbrush and apply another coat of the mixture on top of the Pumpkin leaves.

Results

The Turmeric treatment applied to thirteen Pumpkin plant leaves that were infected with Powdery Mildew. The average of the fungal disease suppression was 1.6%. Our hypothesis was partially supported by our collected data.

Conclusions/Discussion

To conduct this experiment, we first calculated the leaf surface area and the number of Powdery Mildew colonies were traced onto graph paper which was used to create a grid system that was observed for 2 weeks.

The average leaf area covered in Powdery Mildew spore colonies that were suppressed was approximately 1.6%, our hypothesis was partially supported.

Summary Statement

Throughout this experiment, we measured the treatment of Powdery Mildew by using Turmeric on the leaf spores of a Pumpkin plant, experiencing partial significant changes to our findings.

Help Received

We independently conducted our experimentation of fungal removal on a plant on our school's garden. Our teacher gave us the notion of experimenting on the Pumpkin plants in our school, instead of experimenting in another environment or field.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Zoe I. Geller

Project Number
J1607

Project Title
The Effects of Ultrasound on Magnetic Bacteria for a Cancer Therapy

Abstract

Objectives/Goals
The objective of this study is to determine if magnetic bacteria are harmed by exposure to ultrasound. I did this to test an original idea, that magnetic bacteria could be used in a cancer treatment that would make use of ultrasound. The reason to consider using bacteria in a cancer therapy is that anaerobic bacteria collect in solid tumors, because most tumors are low in oxygen. The treatment would use a form of "sonogenetics", a technique where ultrasound turns genes on and off. The big picture would entail inserting cancer-killing genes into the magnetic bacteria, and these genes would be turned on by the ultrasound once the bacteria reach the tumor. However, for this idea to work the ultrasound should not negatively affect the bacteria, and this is what I tested. While the cancer treatment could make use of any anaerobic bacteria, I used magnetic bacteria because it#s easier to judge the bacteria#s overall health after exposure to ultrasound. I judge the health of the bacteria by measuring how they respond to an applied magnetic field.

Methods/Materials
I collected magnetic bacteria in mud from a local creek and placed them in several jars. The bacteria were visible under a microscope as they followed a magnet that I moved with my hand. The experimental jars were exposed to ultrasound, but not the control jars. Then I measured the size of a clump, or "spot" of bacteria that gathered towards a magnet. The health of the bacteria was judged by the size of the spot after 15 minutes and 30 minutes. For supplies I needed bacteria, jars, magnets, ruler, an ultrasonic cleaner, camera, and a timer.

Results
This study showed that exposure to ultrasound decreased the ability for these bacteria to move towards a magnet. In the first experiment, the average spot size of the magnetic bacteria for the control jars was 0.7 mm after 15 minutes, and 1.8 mm after 30 minutes. For the experimental jars, the average spot size of the magnetic bacteria was 0.4 mm after 15 minutes, and 1.0 mm after 30 minutes.

Conclusions/Discussion
The bacteria#s health was damaged when exposed to ultrasound. Nevertheless, the cancer treatment might still work. The jars that hold the magnetic bacteria are filled with mud and sand that vibrates and possibly damages the bacteria. I call this the "boulders effect". My next test will avoid the boulder effect by keeping the sand away from the bacteria during exposure to ultrasound.

Summary Statement
I am testing if exposure to ultrasound leaves bacteria unharmed so that they can be used in a cancer therapy.

Help Received
I figured out what tests to do, built the equipment, and did all of the testing myself. I received help on part of the idea from my dad and help understanding the possible uses of sonogenetics from Dr. Sreekanth Chalasani of the Salk Institute.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Melina S. Ghodsi

Project Number
J1608

Project Title
The Secrets to a Cleaner Toothbrush

Abstract

Objectives/Goals
The objective of this study is to determine if toothbrushes have harmful bacteria in their bristles and which one of my cleaning techniques would clean the toothbrush the most effectively. My goal was to be able to decontaminate my toothbrushes from harmful bacteria.

Methods/Materials
After I conducted all my methods to my toothbrushes, I had to cultivate my bacteria. I used a liquid median called Mueller Hinton broth to let the bristles of my toothbrushes fully dissociate into the nutrients. After that, I put the test tubes full with the broth and kept it in my homemade incubator for seven days. Then I took a pipette and drew out one pipette full and smeared the liquid from the pipette onto my homemade agar plates. After another three days on the agar plates you could see colony formation. Then I counted the colonies using a helpful app called iAnnotate.

Results
I assigned every test tube based on clarity from a scale of 0-2, 0 being the clearest. The methods that had the best degree of clarity were the mouthwash, Nano-B, pressure cooker, and the iTouchless U.V. sanitizer methods. Coincidentally, the methods with the least amount of bacteria were the mouthwash, Nano-B, pressure cooker, and the iTouchless U.V. sanitizer with 36, 75, 54, 39 colonies formed.

Conclusions/Discussion
I concluded that the methods that had the best degree of clarity in the test tubes also had the least amount of bacteria. The main problem with my results is that I cannot clearly distinguish which sanitization technique is the most effective, because my results are similar. I was extremely careful on performing this experiment and I tried to minimize the amount of possible sources of errors. However, the margin of errors in this experiment is too large to clearly be able to distinguish which technique works the most effectively. However, I can conclude that there is a lot of bacteria on our toothbrushes and all of my techniques decreased the amount of bacteria on our toothbrushes.

Summary Statement
In my experiment, I concluded that there is a lot of bacteria on our toothbrushes and certain methods decreased more bacteria than others.

Help Received
I would like to thank Mrs. Conklin for providing the nutrient agar premix, Dr. Peters from Western University of Pomona for donating the Mueller Hinton Broth and the test tubes, and finally my parents for purchasing all the other supplies and for supporting me through my journey as a scientist in my

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Joshua J. Hwang

Project Number
J1609

Project Title
The Antibacterial Effects of Onions and Shallots on E. coli DH5 Alpha

Abstract

Objectives/Goals
The objective of this experiment is to study the antibacterial effects of onions and shallots on E.coli DH 5 alpha and to determine which herb has the greatest level of inhibition on the bacteria specimen alone or when mixed with shallots.

Methods/Materials
A freshly grown overnight culture of E.coli DH5 alpha was mixed with red onion, yellow onion, white onion or shallot alone at 10%, 50% and 100% concentration. E.coli DH5 alpha was also mixed with 1:1 mixture of the different types of onion and shallot at 50% concentration. The level of inhibition of the onions or shallot alone and as a mixture on E.coli was compared using a colony counting essay.

Results
The experiments showed that the shallot had the strongest level of inhibition, followed by white onion, yellow onion and red onion. White onion and shallots had strong levels of inhibition at 50% and 100% of concentration. At 10% concentration, the growth was similar to the E.coli control for all treated samples. At 50% concentration, it did show an increased level of inhibition but the exact level of inhibition varies between trials. At 100% concentration of onions alone, 50% or 100% shallot alone and at 1;1 mixture of onion and shallot at 50% concentration, the antibacterial inhibition was 100%.

Conclusions/Discussion
The experiment concludes that onions and shallot have antibacterial effects with shallot being the most effective agent, followed by white onion, yellow onion and red onion. Both onions and shallot are part of the Allium family. They are similar but unique in regards to the varying amount of chemical composition within the herb itself. Therefore, the antibacterial levels are different among the different herbs or a combination of onions and shallots. These data suggested that combination of herbs can be used as a treatment for food-borne diseases caused by E. coli or other bacteria pathogens.

Summary Statement
My project tests the antibacterial activity of onions and shallots on E.coli DH5 Alpha.

Help Received
ProSci Inc. provided access to the facility and the needed supplies. My mentor, Dr. Xin Wang, helped grow the E.coli culture, gave advice on the experimental design. Elaine Gillum, helped in editing and refining the paper, gave advice on the project and Science Fair itself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Ahmad Ismail

Project Number
J1610

Project Title
Yeast Busters: Stopping Fungus in Its Tracks with Antifungal Medicine

Abstract

Objectives/Goals
The objective of this study is to determine the effectiveness of treatments for fungal infections.

Methods/Materials
The method of collecting data for this study is water volume displacement. First, the gas collection apparatus was set up which consisted of an inverted graduated cylinder with plastic tubing connected to a plastic bottle and plastic tub. Then, the different antifungal agents were tested at two different concentrations: 100 and 1000 fold dilution, applied to a solution of yeast and sugar.

Results
The effectiveness of the treatments were compared after conducting multiple trials in the gas collection apparatus. The performance of the azoles were shown to be better than the allylamines. The effectiveness of the third-category of antifungal agents was found to be between the azoles and the allymines. The study also showed that a decrease in dilution of the medicine by 10 decreased the performance by a factor of 2.

Conclusions/Discussion
The performance of azoles for treatment of fungal infections was the most effective. This means that azoles can serve as a more effective medicine in removing fungus as compared to the other medicines tested.

Summary Statement
I tested the effectiveness of different antifungal medicines using a gas collection apparatus and found azoles to be the most effective.

Help Received
I designed and built the gas collection apparatus by myself. I got help in understanding the structure and behavior of the antifungal agents from the website of the National Institutes of Health. My Science teacher guided me through the project and reviewed my results.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Meera Kashyap

Project Number

J1611

Project Title

1000 Year Old Recipe: Can It Kill Today's MRSA?

Abstract

Objectives/Goals

A thousand year old recipe from Bald's Leechbook, which is an English medical text from the Anglo-Saxon period, contains a remedy for treatment of a "wen" or a lump in the eye.This bacterial infection is caused by Staphylococcus aureus. Methicillin resistant staph aureus(MRSA) is now one of the most common cause of wound infections and highly resistant to treatment.I decided to test this thousand year old recipe on today's MRSA and compare it to other home remedies that are believed to kill MRSA. My controls were clindamycin, an antibiotic used against MRSA, and chlorhexidine,a surgical scrub and cleaning agent used in hospitals.

Methods/Materials

The Bald's eyesalve was reconstructed as stated in the Leechbook. Equal amounts of oxgall (bovine bile salts), wine, and crushed yellow onion and garlic. These were placed in a brass vessel and kept refrigerated at 4 degrees Celsius for 9 days. My own recipe of turmeric, wine and crushed yellow onions and garlic were also placed in a brass vessel and kept refrigerated at 4 degrees Celsius for 9 days.These 2 recipes and Manuka honey (known for its antibacterial properties) were taken to a lab. MRSA lawns were made on blood and Mueller-Hinton agar plates.Fifty microliter drops of each of the three home remedies and chlorhexidine were put on sterile disks and these were placed in the center of different plates. A clindamycin antibiotic disk obtained from the lab was also plated. These were incubated for 18 hours and checked for zones of inhibition. The zones of inhibition were measured. The experiment was repeated with all the home remedies, controls and the individual ingredients.

Results

The thousand year old recipe was effective in inhibiting MRSA growth but not as well as the control, chlorhexidine. My own turmeric concoction was even more effective in inhibiting MRSA then the thousand year old recipe. Manuka honey by itself also inhibited MRSA growth but the fresh crushed garlic by itself was the most potent inhibitor of MRSA. This MRSA strain was resistant to clindamycin.

Conclusions/Discussion

Herbal home remedies can in the future provide novel and effective treatments for MRSA without the side effects that are associated with present day antibiotics. My data shows that these can be used topically as safe and cheap alternatives to topical antibiotics for wounds or as washes for decolonizing MRSA from skin and noses and even as antibacterial soaps.

Summary Statement

The thousand year old recipe showed that it can kill today's MRSA as well as my own recipe of turmeric, garlic, onion and wine which proved to be even more effective however, garlic alone was the most potent inhibitor of MRSA.

Help Received

Dr. Freya Harrison from England advised me on my experiment via e-mail. Ms. Nielson the head microbiologist at SVMC lab showed me how to use the equipment. Ms Hembree my science teacher proof read my write up.My mom helped with buying materials and contacting lab.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Laura M. Noronha

Project Number
J1612

Project Title
Which Intravenous Fluid Is Best for Sepsis?

Abstract

Objectives/Goals
To study the effect of normal saline, Ringer's lactate, 5% dextrose in half normal saline (D5 ½ NS) and 3% saline on bacterial solutions (Escherichia Coli and Staphylococcus Aureus) in vitro.

Methods/Materials
Using known controls for Staphylococcus Aureus (S. Aureus) and Escherichia Coli (E. Coli) and the Prompt Inoculation System-D, a standardized bacterial suspension of each bacterium was prepared. 20 µl of S. Aureus bacterial suspension was added to 5 tubes each containing 3 ml of sterile inoculum water, and 20 µl of E. Coli bacterial suspension was added to 5 tubes each containing 3 ml of sterile inoculum water. One tube was used as a control for each bacterium. 3 ml of normal saline, Ringer#s lactate, D5 ½ NS and 3% saline respectively were added, one in each of the 4 remaining tubes. After mixing the solutions well, 100 µl of each solution was plated on to blood agar plates. After incubating overnight at 37º C with 5% CO2, the number of colonies on each plate was counted.

Results
For E. Coli, the average colony counts were least with 3% saline (98.3), followed by D5 ½ NS (112), normal saline (120.3) and Ringer#s lactate (128.6).
For S. Aureus, the average colony counts were least with normal saline (253.7), followed closely by 3% saline (254.3), then Ringer#s lactate (256.3) and D5 ½ NS (269.3).

Conclusions/Discussion
For E. Coli, there was least bacterial growth with 3% saline (most hypertonic fluid) which was statistically significant. This was followed by D5 ½ NS (also hypertonic but less than 3% saline) compared with the isotonic fluids (normal saline and Ringer#s lactate). These findings indicate that the tonicity of the IV fluid made a difference in controlling growth of E. Coli (a prototypic gram negative bacterium). For S. Aureus the results were more variable and no definite conclusion as to whether any of the fluids worked better could be drawn. The tonicity of the fluid used did not seem to have an effect on S. Aureus (a prototypic gram positive bacterium). The difference in the effect of hypertonic solutions on Gram negative versus Gram positive bacteria is likely related to the difference in the structure of their cell walls. My study indicates that use of hypertonic IV fluids (like 3% saline and D5 ½ NS) may be a better choice for patients with sepsis due to gram negative bacteria like E. Coli.

Summary Statement
My study shows that use of hypertonic IV fluids (like 3% saline) may be a better choice for patients with sepsis due to gram negative bacteria like E. Coli.

Help Received
Victoria Go, CLS gave me advice and taught me the proper procedures for conducting my experiments. My sister Andrea helped me to conduct the statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Jian Park

Project Number
J1613

Project Title
Amoxicillin and Vitamin C: A More Powerful Combination

Abstract

Objectives/Goals
The purpose of this experiment is to test which ratio of amoxicillin and vitamin C is most effective in combating Staphylococcus epidermidis bacteria.

Methods/Materials
During my experiment, I used the standard Kirby-Bauer disk sensitivity testing method. I mixed Amoxicillin powder in distilled water, and did the same procedure to the vitamin C powder. Next, I created different ratios of the Vitamin C and Amoxicillin solutions (0:100,20:80,40:60,ect.). Then, I dipped filter paper hole punches into the solutions, and placed them on petri dishes inoculated with Staphylococcus epidermidis bacteria. I incubated the dishes for four days, and measured the zones of inhibition with a clear ruler.

Results
After measuring the sizes of the zones of inhibition, I saw that while amoxicillin alone had an average zone of inhibition of 3.1 cm, but a combination of 40 Amoxicillin to 60 Vitamin C showed a larger zone of inhibition with 3.158 cm on average. All other combinations of Amoxicillin and vitamin C had moderate zone of inhibition size between 2 and 3 centimeters. My results also showed that Vitamin C had an average zone of inhibition size below one centimeter.

Conclusions/Discussion
In this experiment, I have concluded that a combination of 40 amoxicillin and 60 vitamin C is more effective at combating Staphylococcus epidermidis instead of amoxicillin alone. All other combinations of amoxicillin and Vitamin C showed to be less effective than Amoxicillin alone.

Summary Statement
This experiment tested whether a combination of Vitamin C and Amoxicillin (An antibiotic) was better at combating bacteria than Vitamin C or Amoxicillin alone.

Help Received
During my experiment, my parents purchased the supplies and my teacher, Mr. Briner, gave me advise during my experimenting.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Savera Sheikh; Emmaan Sipra

Project Number

J1614

Project Title

How to Kill Bacteria: Natural Herbs vs. Antibiotics

Abstract

Objectives/Goals

Antibiotics are commonly used to treat common human bacterial infections. Overuse of antibiotics disturbs human bacterial flora and causes emergence of bacterial resistance. Our goal was to find out a safer and cheaper alternative to kill bacteria found in and around our kitchen area. Therefore, we hypothesized whether natural herbs- turmeric, ginger, or cinnamon inhibit bacteria as effectively as antibiotics (abx), such as trimethoprim/sulfamethoxazole(TMP) or ampicillin (AMP).

Methods/Materials

This study was performed in a major pathology laboratory under supervision of an MD pathologist. Bacterial samples were collected in blood agar plates (total #30) from kitchen disposal can. Five petri dishes were used to evaluate antibacterial activity of each agent; two antibiotics (TMP & AMP) and three natural herbs (turmeric, ginger & cinnamon). Five petri dishes were used as control (no abx or herb). Freshly prepared and carefully weighed amounts of each herbs mixed in sterilized water were placed in the center of bacteria laden plates. The petri dishes were finally incubated at 37 degrees Celsius for 24 hours in the laboratory refrigerator. The antibacterial activities were calculated in each plate by measuring inhibition zone (IZ) in millimeters at 3 points around each agent. The mean IZ of each agent was finally calculated across all 5 samples.

Results

The mean, Inhibition Zone, calculated from five samples of each agent were as follow: AMP 3.7 mm, TMP 2.7 mm, turmeric 1.3 mm, ginger 2.6 mm and cinnamon 5.5 mm respectively.

Conclusions/Discussion

Among three herbs we used, cinnamon demonstrated the best bacterial killing activity as compared to common antibiotics, TMP and AMP. Antimicrobial properties of cinnamon perhaps come from its three basic ingredients- cinnamaldehyde, cinnamyl acetate, and cinnamyl alcohol.

Our results are consistent with and support many prior studies that used herbs. However, the amount of each herbs used and the nature/type of bacterial growth are important variables that can influence our results.

In summary, the common natural herbs have incredible prospective be used to treat common bacterial infections. Given several challenges with the use of commercial antibiotics (adverse effects, emergence of resistance and cost), we must utilize anti-bacterial potential of our natural herbs as safer and cheaper alternatives.

Summary Statement

We hypothesized and proved through our experiment that natural herbs have potential to kill bacteria as compared to commonly used antibiotics.

Help Received

We came up with the hypothesis/question and details of procedures. Our mentor, Dr. David Slater (at UCSF Fresno MEP) provided laboratory space; material used in the project and assisted us in fine-tuning the methodology. We personally performed data analysis, conclusions and wrote the abstract.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Juan A. Velasquez

Project Number
J1615

Project Title
The Effects of Ultraviolet Radiation on the Growth of Bacteria

Abstract

Objectives/Goals
This investigation tests if ultraviolet (UV) radiation decreases the bacterial load on the surface of produce such as tomatoes and broccoli as compared to regular washing of produce.

Methods/Materials
Tomatoes and broccoli were divided into six test groups: washed produce, unwashed produce, UV exposed groups for 5, 10, 20 and 30 minutes. An ultraviolet light bulb with wavelength of 254 nm was used for the UV exposed groups. Four petri-dishes were inoculated per test group for both tomatoes and broccoli. All petri-dishes were incubated for total of 72 hours in homemade incubator maintaining a constant temperature of 85 degrees that was measured with a digital thermometer. An electric space heater was used to control for temperature.

Results
The number of bacterial colonies per square centimeter were recorded at 24, 48, and 72 hours for all test groups for both tomatoes and broccoli. Unwashed broccoli grew the most bacteria per square centimeter and washed broccoli grew the second highest number of bacteria. UV exposed groups grew the fewest number of colonies per square centimeter. Broccoli exposed to 30 minutes of UV radiation grew no bacterial colonies. Unwashed tomatoes grew many colonies but not as many as the unwashed and washed broccoli groups. There was no significant difference in number of colonies between the washed and UV exposed groups of tomatoes.

Conclusions/Discussion
Ultraviolet radiation significantly decreased the bacterial load on the surface of tomatoes and broccoli. This effect was most significant in the broccoli groups which demonstrated that washing was not as effective in decreasing the bacterial load on the surface of the produce. Also, UV radiation exposure duration had a significant effect in decreasing bacterial load: the longer the exposure time, the lower the number of bacterial colonies. This effect was not as pronounced in the tomato group and it is believed that produce surface impacts the surface bacterial load. I accomplished demonstrating that UV radiation can significantly decrease the bacterial load on the surface of vegetables, specifically produce that do not have smooth surfaces and this can be more effective that washing produce.

Summary Statement
I showed that UV radiation is more effective in decreasing the bacterial load on the surface of produce than washing the produce.

Help Received
I designed the study but my mother helped me build the homemade incubation chambers.