CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Amethyst B. Audon

Project Number

J1701

Project Title

Antibiotic Resistance: Synthetic vs. Natural

Abstract

Objectives/Goals

I am testing which type of antibiotic, natural or synthetic, leaves a larger zone of inhibition against bacteria.

Methods/Materials

I used LB agar plates, and s. epidermidis bacteria. the antibiotics that I used were (natural) ACV (raw apple cider vinegar), honey, garlic, (synthetic) tetracycline, penicillin, and ampicillin. I inoculated six antibiotics into each agar plate and let it grow for two days in and incubator at 38 degrees Celsius. After two days, I measured the zones of inhibition in millimeters.

Results

Natural antibiotics showed more consistency, while the synthetic ones only worked well in the beginning, but had little to no zone of inhibition in trials 2 and 3. The mean for pharmaceutical was 9.19 mm. The mean for natural was 10.62 mm. Garlic had the largest (average) zone for natural, and ampicillin had the largest (average) zone for synthetic.

Conclusions/Discussion

Synthetic antibiotics were not as consistant as the natural. Natural antibiotics, on average, left a larger zone of inhibition than synthetic antibiotics.

Summary Statement

My project is about antibiotic resistance, testing which antibiotic, synthetic or natural, will leave a larger zone of inhibition against bacteria

Help Received

My science teacher allowed me to use his lab, my sister gave me the idea of this project, and my mother gave me tips on what to do in my procedure.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Fatimah S. Bari

Project Number

J1702

Project Title

An In vitro Approach to Finding a Treatment for Developed Antibiotic Resistance in Escherichia coli with Coliphage T4

Abstract

Objectives/Goals

At which concentrations is antibiotic resistance developed in Escherichia Coli and is Coliphage T4 a viable treatment for the developed resistance?

Methods/Materials

Coliphage T4, e. Coli, nutrient agar plates, Amoxicillin, saline, microscope.
Inoculate the agar plates with the e. Coli. Allow bacteria to culture for 3 days. Dilute the amoxicillin and create a 100%, 75%, 50%, and 25% concentration. Add solution to the plates once every day and count the bacterial colonies for 5 days. Observe the bacterial colonies. Dilute the Coliphage T4 and administer solution to the agar plates for 3 days. Observe the bacterial colonies.

Results

After 5 days of testing with the antibiotic solution the 25% solution had 42% more bacteria than originally starting. The 50% concentration had grown 7% more bacteria. The 75% concentration had killed 11% of the bacteria. The 100% concentration had decreased 32% than originally starting. After 3 days of testing with the Coliphage solution the 25% concentration had killed 45% of the bacteria, the 50% killed 53% of the bacteria, the 75% killed 44% of the bacteria, and 58% of the bacterial colonies were killed in the 100% concentration plate.

Conclusions/Discussion

After a 8 day testing period antibiotic resistance developed at the lowest concentrations and had gained more than 42% more bacterial colonies than originally starting. The Coliphage T4 had killed 58% of the bacteria in just two days. The Coliphage T4 not only worked in the plates that had developed antibiotic resistance but also in the ones that hadn't. Countries in the east, such as Georgia, have adopted bacteriophages to treat antibiotic resistance.

Summary Statement

I found that antibiotic resistance is developed at a low concentration of antibiotics in Escherichia Coli and Coliphage T4 proved as an effective treatment to treat developed antibiotic resistance.

Help Received

Mr. Sean Gillette provided guidance throughout the experiment. Dr. Akhil Sharma provided antibiotic samples for the purpose of the experiment and the medical advice.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Haley L. Brooks

Project Number

J1703

Project Title

The Effect of Heteractis magnifica on the Cell Viability of Multicentric Canine Lymphoma

Abstract

Objectives/Goals

In this study, cytotoxicity induced by Heteractis magnifica venom was investigated using a hemocytometer and a trypan blue solution to determine malignant canine lymphoid CLL-1390 cell viability.

Methods/Materials

Heteractis magnifica
8 mL of Canine Lymphoma cells
Hemocytometer
0.4% solution of trypan blue in buffered isotonic salt solution
Suspended 6 mL of CLL-1390 cells on 12 mL of Heteractis magnifica venom to understand its effect on the cell viability.

Results

The results of the petri-dishes with the addition of Heteractis magnifica venom ranged from 10.16% to 15.5%, a significant decrease from the 79.9% viability rate of the dish in which the venom was not introduced. The first dish (#1) had a 15.5% viability. The second dish (#2) had a 12.8% viability. The third dish (#3) had a 10.16% viability. The average was calculated to be 12.82%.

Conclusions/Discussion

The overall aim of this study was to determine if Heteractis magnifica venom affects the cell viability of multicentric canine lymphoma. According to the data collected, the hypothesis, if the Heteractis Magnifica venom is introduced to the multicentric canine lymphoma cells, then multicentric canine lymphoma cell viability will be significantly reduced, appears to be supported. As suggested by the evidence, the venom showed a significant reduction of cell viability.

Additional studies may confront complications with the expression of Bcl-2 proteins, anti-apoptotic proteins, that challenge therapeutic capabilities and inhibit apoptosis. Fortunately, in this study the cytolytic compounds surpassed the inhibitory protein. Other studies may also confront the dilemma, that the venom is saturated in water.

To yield more accurate and error free results in the future an automated cell counter would be used. If the experiment were to be repeated, WST-1 assays would be utilized to determine exact cytotoxicity levels. The next step would likely be to identify the bioactive traits in which the actinoporins possess, and formulate an appropriate therapeutic. Future studies should include the investigation of the venom#s safety, efficiency, and tolerance doses. Future studies should also utilize human cells in replace of canine

Summary Statement

I proposed and tested an effective method of treating multicentric canine lymphoma.

Help Received

I acquired the lymphoma cells from Peter F. Moore, Professor of Pathology at UC Davis. Also consulted with Dr. Kent, Dr. Aboulafia, Dr. Kelber, Dr. Feldman, Dr. Stan Kunin, Dr. Sue Downing, and Kristy Harmon via email regarding particular questions I had.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Aria Delgado

Project Number
J1704

Project Title
Using Ultraviolet Light to Sanitize Music Instruments

Abstract

Objectives/Goals
My objective is to determine if ultraviolet light can effectively eradicate bacteria from student music instruments.

Methods/Materials
I used sterile nutrient agar plates, sterile swabs, clarinet reeds, saxophone reeds, and a ultraviolet light. The agar is used as a food source for the bacteria. The ultraviolet light was used at various time lengths (30, 90, and 120 seconds).

Results
The largest amount of bacteria on a reed from the 120 seconds of UV light group was 7 units of bacteria remaining, and a low for this variable was 0 units, which was the least amount of bacteria possible on the surface of the reed. The low shows that UV light, in certain situations, is capable of completely eliminating bacteria from a reed. From my results, the average was 0.69 units, the lowest average among the variable UV exposure times. I believe the reason why 120 seconds under the UV light was the most effective at decreasing bacteria was because the more time the surface is under a UV light, the more it kills bacteria on that surface.

Conclusions/Discussion
I learned that an instrument reed exposed to UV light for 120 seconds can reduce bacteria on that surface the most. Because of all the bacteria on the reed, this can be important for one#s health. In conclusion, wind players should be more careful with cleaning their own instruments to prevent fungi and bacteria growth in the instrument. Exposing the reeds to ultraviolet light for 120 seconds was effective at eradicating most bacteria found on the reeds.

Summary Statement
I showed that exposing music reeds to ultraviolet light for 120 seconds was an effective bacteria sanitizer.

Help Received
Mr. Davin Aalto, Sanger High School AP Biology Teacher

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Alexander N. Fan

Project Number

J1705

Project Title

Essential Oils vs. Medications: A Quest to Find the Most Effective Antifungal Agent

Abstract

Objectives/Goals

Since the 1940s antimicrobial medications have been widely used. They have benefited our society in many ways, but over the last decade there has been a growing problem called antibiotic resistance. Each year around 23,000 people die in the United States due to the uprising issue of medication resistance. When this happens medications no longer serve their purpose. One potential way to fight this issue is through the use of essential oils. The objective of my project is to find out if essential oils are more effective antifungal agents than medications.

Methods/Materials

Candida Albicans was obtained from Bakersfield Dermatology, various Essential Oils from Doterra, Nystatin solution and Clotrimazole cream from a Kaiser Pharmacy, agar plates, swabs, tweezers, disks, incubator, gloves, and a sharpie. I used the Kirby Bauer Disk Diffusion Test for my experiment. I plated agar plates with Candida Albicans. Then I placed a disk, soaked in either a medication or Essential Oil, into the middle of each agar plate. Over a period of 72 hours, I recorded the "Zone of Inhibition" on each agar plate which shows us the area that each substance inhibited at the specific time intervals.

Results

The Essential Oils inhibited the growth of the Candida better than the medications. I measured my results by measuring the "Zone of Inhibition" of each agar plate. After two days the difference between the averages of the essential oils and medications was about 7.23 cm, and after three days the difference was about 5.73 cm. My data suggests that Essential Oils are better antifungal agents than medications.

Conclusions/Discussion

The results from my experiment suggest that Essential Oils are more effective antifungal agents than medications. I am hoping my experiment will stimulate further research about Essentials Oils and ultimately provide another form of treatment for infections. I am also hoping that essential oils can be one solution to overcoming the issue of antimicrobial resistance. My project definitely has opened the door for further medcial providers to consider other treatment forms for cutaneous fungal infections.

Summary Statement

I tested essential oils and medications to find out if essential oils are more effective antifungal agents than medications.

Help Received

My mother helped transport me to and from the lab where I conducted my experiment. Dr. Treanor helped me perfect my experimental methods and provided me the lab space and Candida albicans.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Lizzie Garcia; Grace Jeter

Project Number

J1706

Project Title

Backyard Antibiotics: Differential Antibiotic Potential of Sierra Nevada Plants against Gram Pos. and Gram Neg. Bacteria

Abstract

Objectives/Goals

The objective of this study is to determine if antibiotics found in Sierra Nevada foothill plants are broad spectrum acting agents. In other words, are Sierra Nevada foothill plants effective in killing or stopping the growth of many different bacteria?

Methods/Materials

Agar plates, mortar and pestle, syringes, paper discs, antibacterial solution, buffer, bacteria (Bacillus megaterium, Staphylococcus epidermidis, Aquaspirillum itersonii, and Escherichia coli), and native plants. The materials were purchased through Odin as a part of a kit to isolate antibiotics. Bacteria was put on the plates. Plant samples were made into an extract. Paper discs were dipped into the extract and placed as 5 replications on the plate along with 3 controls (paper disc, antibacterial, and buffer). Pictures were taken at the beginning, at 12, 24, 36, 48, 60, and 72 hours. At each time period measurements were taken in mm of the area cleared by the antibacterial control and/or the plant extracts.

Results

All the plants we tested had some antibiotic qualities against Gram-positive bacteria, Staphylococcus epidermidis and Bacillus megaterium. Bush Lupine and Theodore Payne Buckwheat had some effectiveness against Bacillus megaterium, clearing an area of 24mm squared-96mm squared, but compared to the antibacterial control, clearing an area of 103.62mm squared-1551.95mm squared, there was little effectiveness. All plant specimens had some effectiveness against Staphylococcus epidermidis. White Sage and St. Catherine#s Lace were most effective, clearing an area of 12mm squared-288.64mm squared, but compared to the antibacterial control, clearing an area of 923.63mm squared-1551.95mm squared, there was little effectiveness. Both Gram negative bacteria were not affected by the plants and would not be considered effective antibiotic agents.

Conclusions/Discussion

We found that the antibiotics in Sierra Nevada foothill plants were not broad spectrum acting agents. Some plants have the potential to be narrow spectrum acting agents. This is important because many bacteria today are antibiotic resistant, and to discover an alternative type of antibiotic could be a medical breakthrough. The study also interests us to find other plant specimens, and use fungi and other bacteria as antibiotics. We could use bacteria that causes bacterial infections in humans because we would know how these plants would help cure the infection.

Summary Statement

We showed that antibiotics found in Sierra Nevada foothill plants can be narrow spectrum acting agents and can be used to kill gram positive bacteria.

Help Received

We conducted all the steps of our experiment on our own under adult supervision. Our teacher, Mrs. Garcia, helped us determine how to measure our findings so we could properly record our data. We also received help from a college student, Andy Garcia, to input the data into a statistical program.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Presley W. Golling

Project Number

J1707

Project Title

Methods to Inhibit the Growth of the Acne Causing Bacteria Propionibacterium acnes

Abstract

Objectives/Goals

The objective of this project was to determine the most effective method of inhibiting the growth of the acne causing bacteria Propionibacterium acnes.

Methods/Materials

Propionibacterium acnes was spread as a uniform film onto blood agar plates. Five sterilized filter paper disks (6 mm in diameter) were saturated with 30 ul of select treatment and placed upon each plate. Plates were incubated for two days, after which the diameter of the zone of inhibition (where there was no bacterial growth) was measured for each disk. The five measures were averaged and compared amongst each different treatment. Treatments used in the experiment included commercial, home, and other miscellaneous acne remedies.

Results

Of all the treatments, tea tree oil was the most effective at killing P. acnes, as determined by the size of the zone of inhibition. One surprising result was the discovery of a bacterium that inhibited the growth of P. acnes.

Conclusions/Discussion

Repeated testing has led to several interesting findings, including the best way to treat acne (tea tree oil), and the effect of several common acne treatments on P. acnes. A bacterium was also discovered to inhibit the growth of P. acnes. Further research into this bacterium could yield evidence of the processes going into this result, as well as other bacterium capable of the same thing.

Summary Statement

By measuring the zones of inhibition produced by several different treatments I was able to determine the most effective method of treating acne.

Help Received

I used lab equipment provided by Taft College, under the supervision of Dr. Greg Golling, and received advice and mentoring from school teachers. Project setup and testing was done by myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Saira S. Gupta

Project Number
J1708

Project Title
Smartphone Heal Thyself: An Inexpensive Bacteria Blasting Attachment

Abstract

Objectives/Goals
The goal of this project is to test the bacteria eliminating ability of a novel smartphone based ultraviolet (UV) sterilizer. Ultraviolet radiation is known to inhibit cell growth and be bactericidal. For these reasons, UV radiation is used as a method to sterilize surgical instruments. The bacteria-killing effects of UV are often dampened by the presence of visible light so isolating the UV segment is an important part of this method. Modern smartphones use an LED-based light for the camera flash that emit both visible and UV light.

Methods/Materials
A filter that blocks visible light and allows UV light to pass was added to a smartphone. The presence of UV rays was confirmed with a UV detector. This experiment was then designed with ten experimental groups. Five control groups of six Petri dishes each were not exposed to any bacteria, and five additional groups consisting of six Petri dishes each were exposed to bacteria. The source of bacteria was oral flora harvested with a cotton-tipped applicator. Within each group of five, one group received no additional intervention, one group was exposed for 10 minutes to a commercial ultraviolet sanitizer expected to eliminate 99.9% of bacteria, one group was exposed to the LED light of a smartphone for 10 minutes, the fourth group exposed to the LED light filtered to allow only the UV light through for 10 minutes, and the final group similarly exposed for 20 minutes. The Petri dishes were then allowed to grow in identical conditions, and underwent a colony count after one week of growth. Following this, a second, identical treatment was performed. A second week was allowed to pass, and the final colony count was performed. The data was recorded, analyzed, and summarized.

Results
The UV detector detected UV radiation for each of the sanitizer, LED alone, and LED with filter. The results from the ten experimental groups showing contrasting outcomes. The control groups with no bacteria applied showed little difference. The treatment groups with UV allowing filter applied for 20 minutes showed comparable results to the commercial UV sterilizer.

Conclusions/Discussion
Smartphone LED lights emit UV radiation capable of bactericidal activity when filtered to eliminate visible light. When used for 20 minutes, there was superior bacterial reduction then even from a commercial UV sanitizer.

Summary Statement
The Ultraviolet portion of smartphone LED lights may be used to sterilize the surface of objects exposed to it providing a simple, inexpensive solution to sterilizing surfaces.

Help Received
My parents helped with the photography and layout of this board. My father also helped with the spreadsheet data. I would like to acknowledge Mrs Eleanor Ludwigsen for loaning me the UV Sterilizer.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Rumaysa H. Haris

Project Number

J1709

Project Title

Fighting ABPA: Oregano Oil and Anti-fungal Medicine

Abstract

Objectives/Goals

The objective of my experiment is to find out if we can fight fungus faster if we use an anti-fungal medicine with a natural remedy or the medications or remedies alone.

Methods/Materials

An Empty water bottle, Oregano oil, Yeast, A small bucket, Water, Sugar, Goggles, Gloves, Mask, Falcon tube, Drill, Silicon sealant, Voriconazole, and a Flex Tube.

Results

After repeated trails, results showed that least CO2 was produced when we used Voriconazole with oregano oil. Voriconazole produced more than the two combined. Oregano oil used alone produced less CO2 than the Voriconazole but still more than the two of them combined. The highest amount of CO2 was produced when we did the control experiment without using any medication or remedies

Conclusions/Discussion

On the basis of my results, I concluded that my hypothesis was correct. As I assumed, anti-fungal medicine works better when used with natural remedies like oregano oil. If I were to add on to my project, I would test its antibacterial and antiviral properties as well. As Oregano Oil is known for its antibiotic and antiviral properties, so that my project can be useful for others out there.

Summary Statement

Serious fungal infection can be tackled much faster with the help of medication and natural remedies rather than the medication alone

Help Received

My mother, sister, science teacher, and my father all helped and guided me in various ways for my experiment.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ahmad Ismail

Project Number
J1710

Project Title
Effect of Structure and Behavior of Antifungal Agents on the Treatment of Candidiasis

Abstract

Objectives/Goals
The objective of this study is to determine the effect of different natural antifungal agents, the level of concentration, structure, and behavior on the treatment of candidiasis.

Methods/Materials
For this study, a gas collection apparatus was set up, that was used to determine the effectiveness of the agent. The apparatus comprised of an inverted graduated cylinder, placed in a tub filled with water. The cylinder and a plastic bottle were connected to plastic tubing. Agents were tested at two concentrations (1% and 0.1% medicine) by applying to a yeast solution in the bottle. The CO2 produced from the yeast traveled through the tubing and displaced water in the graduated cylinder.
Additionally, agar was prepared and put on petri dishes to culture candida. Yeast solution was pipetted onto the dishes, which were then incubated for 6 days. An incubator was made out of a cardboard box, styrofoam sheets, and a light bulb. Yeast growth was measured by the area of the cultures.

Results
The effectiveness of the treatments of the antifungal agents were compared after conducting multiple trials in the above-mentioned experiments. It was shown that Allium cepa was the most effective in treating candidiasis, followed by Allicin, Oleuropein, Curcumin, Terpinen-4-ol, and Cinnamaldehyde, in that order. The azoles have the lowest amount of water displaced while the allylamines have the highest. For the yeast cultures, the order of most effective to least effective remained the same. The azoles had the lowest measurement of the area which means that they are the most effective in the treatment of candidiasis.

Conclusions/Discussion
After analyzing the data, it was shown that by type, azoles were the most effective, followed by cell wall inhibitors, and then allylamines. Increasing dilution by a factor of 10 caused the effectiveness of the agents to decrease by a factor of 2. The lines of best fit (derived using exponential regression) for the growth of cultures were drawn. Agents of the same type have similar lines of best fit. Certain elements present in the agents increase effectiveness, including sulfur, chlorine, zinc, and nitrogen. It was concluded that if a new antifungal agent was to be synthesized, the agent's effectiveness will depend on the right amount of these elements, as these elements have antifungal properties.

Summary Statement
I tested different antifungal agents to understand the effect of their structure and behavior in the treatment of candidiasis; and I found out that azoles are the most effective as they inhibit multiple enzymes in the fungus.

Help Received
I designed and set up the gas collection apparatus on my own, and also set up the incubator to culture yeast. My Science teacher guided me through this project and reviewed my results.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Kirsten A. Jilot

Project Number

J1711

Project Title

EDTA and Lysozymes: Weakening the Cell Walls of Gram Positive and Negative Bacteria

Abstract

Objectives/Goals

The purpose of my experiment was to determine the effectiveness of antibiotics, lysozymes and EDTA (Ethylenediaminetetraacetic Acid) on weakening the antibiotic resistance of the cell wall in gram positive and negative bacteria.

Methods/Materials

Tested gram positive bacteria (Bacillus Cereus) and gram negative bacteria (Escherichia Coli) on various combinations of lysozymes, EDTA (Ethylenediaminetetraacetic Acid) and antibiotics (Streptomycin and Ampicillin) using the kirby bauer disk diffusion method.

Results

The combination of lysozymes, EDTA and antibiotics was the most effective at killing bacteria on both gram positive and negative bacteria. The combination of lysozymes and antibiotics came second, then just antibiotics. EDTA and lysozymes, just lysozymes and control tests did not kill any bacteria.

Conclusions/Discussion

Without antibiotics, the lysozymes alone and the combination of lysozymes and EDTA did not kill any bacteria. The results for those tests were 0 mm showing no clearing of bacteria around the filter paper containing lysozymes and/or EDTA. However, the results indicated that lysozymes and EDTA did help eliminate bacteria with a larger diameter of clearing around the substance discs when EDTA and lysozymes were combined with antibiotics than antibiotics alone.

Summary Statement

The purpose of my experiment was to determine the effectiveness of antibiotics, lysozymes and EDTA (Ethylenediaminetetraacetic Acid) on weakening the antibiotic resistance of the cell wall in gram positive and negative bacteria.

Help Received

None. I designed and conducted the experiment by myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Michael J. Kendall

Project Number
J1712

Project Title
Allicin vs. Escherichia coli: The Antimicrobial Properties of Garlic

Abstract

Objectives/Goals
The objective of this experiment is to determine if garlic is effective as an antimicrobial against E. coli bacteria.

Methods/Materials
The antimicrobial properties of garlic was compared to other agents after 20 petri dishes of E. coli culture obtained from a biological supply company were treated with garlic, mouthwash, bleach, hand sanitizer, and/or milk. The petri dishes were observed for five days for changes in culture. 60-day post hoc observations included.

Results
The microbial concentrations of 16 petri dishes treated with other agents were compared to the microbial concentration of 4 petri dishes treated with garlic. The antimicrobial performance of garlic was shown to be more effective in deterring or inhibiting microbial growth.

Conclusions/Discussion
The performance of garlic as an antimicrobial was more effective than that of other agents. This means garlic can provide a reasonable alternative to commercial antimicrobial agents.

Summary Statement
I showed that garlic is effective as an antimicrobial agent against E. coli.

Help Received
My father helped set up and maintain controls on the cultured samples.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Kylie M. Konyn

Project Number
J1713

Project Title
The Battle Continues

Abstract

Objectives/Goals
Mastitis is the most common disease among dairy cattle, as well as being the most costly. The purpose of this project was to examine the cost and time effectiveness of treating gram negative Escherichia coliform (E. Coli) mastitis in the bovine species.

Methods/Materials
90 lactating Holstein cows that tested positive for E. Coli mastitis using bovine blood agar culture plates were placed in two groups based upon whether their identification number was odd or even. Then, they were further categorized as having either grade one (fever or swelling of the mammary system) or grade two (fever and swelling of the mammary system) E. Coli mastitis. Cows with odd identification numbers received the antibiotic Spectramast LC, while those with even identification numbers received no antibiotics. The number of visits to the hospital parlor, cost of medication, and the amount of lost milk revenue was monitored and recorded.

Results
Grade one mastitis cows who received medication had had more visits (M=16.1) compared to grade one mastitis cows who received no medication (M=10.7). Grade two mastitis cows who received medication had more visits (M=16.9) to the hospital parlor compared to grade two mastitis cows who received no medication (M=15.7). The cost to treat grade one mastitis cows on medication was higher (M=$118.47) compared to grade one mastitis cows not on medication (M=67.92). The cost to treat grade two mastitis cows on medication was higher (M=$125.02) compared to grade two mastitis cows not on medication (M=$98.97).

Conclusions/Discussion
The use of antibiotics to treat cows infected with gram negative Escherichia coliform mastitis is more costly and time consuming, especially in those with grade one E. Coli mastitis, suggesting that it may be more economical to allow the infected cows to self cure on their own without the use of antibiotics.

Summary Statement
In my project, I proved that it is neither cost nor time effective to treat gram negative E. Coliform mastitis with intramammary treatment.

Help Received
My father and I were the only two people to give the antibiotics during the study. Cornell University and University of Wisconsin-Madison provided me with background research for my project. My mother helped me to fill out all the necessary forms and applications. My instructor helped me to submit my

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Suhanee S. Mitragotri

Project Number
J1714

Project Title
Improving Selectivity of Antibiotics towards Pathogenic Bacteria

Abstract

Objectives/Goals
Antibiotics have revolutionized medicine by providing an effective treatment against bacterial infections. While pathogenic bacteria cause serious health issues, our bodies also contain trillions of healthy bacteria that help our metabolism. Current antibiotics kill healthy and pathogenic bacteria alike, thus compromising our natural metabolism. The goal of this project was to test whether the selectivity of antibiotics towards pathogenic bacteria can be improved by using a combination rather than a single antibiotic.

Methods/Materials
The main materials I used for this experiment include: petri dishes, Luria Broth agar, Escherichia Coli (pathogenic bacteria), Staphylococcus Epidermidis (non-pathogenic bacteria), ampicillin and kanamycin (antibiotics), and kitchen oven (Thermador, used as incubator). All bacteria were obtained from Home Science Tools and culture materials were obtained from Carolina Science Supplies. I prepared agar plates with ampicillin alone, kanamycin alone, 50:50 ampicillin: kanamycin, and no antibiotic in them (control). After the agar settled, I streaked E.Coli and Staphylococcus Epidermidis onto separate plates for 48 hours at 38 degrees C.

Results
My hypothesis was largely supported by my experimental data. The combination of antibiotics eliminated pathogenic bacteria better than either antibiotic alone. Further, the combination spared non-pathogenic bacteria better than one of the antibiotics. A combination of ampicillin and kanamycin reduced the growth of E.Coli to only 6% coverage of the plate compared to 27.5% for untreated controls. This bactericidal effect was significantly higher compared to that observed for ampicillin alone (14.5%) or kanamycin alone (19%). The same combination of antibiotics enabled Staphylococcus Epidermidis to grow to cover 9% of the plate, which was greater than what kanamycin alone allowed (0%), but not as high as that allowed by ampicillin alone (20.5%).

Conclusions/Discussion
My results show that the combination of antibiotics is effective in eliminating pathogenic bacteria, and has the potential to spare non-pathogenic bacteria. In future, this experiment could be conducted in a professional laboratory, which has greater access to a broader variety of antibiotics and bacterial species. Combining antibiotics is a frugal way to create more selective therapies for treating bacterial infections and diseases.

Summary Statement
Combinations of antibiotics offer a safer and more effective method of treating pathogenic bacteria while sparing non-pathogenic native bacteria in the body.

Help Received
I conducted this experiment at home on my own, with occasional advice from Dr. Samir Mitragotri.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Adhithi Narayana Murthy

Project Number

J1715

Project Title

Ayurvedic Plant Extracts: An Alternative to Antibiotics

Abstract

Objectives/Goals

The objective of this project is to determine whether four Ayurvedic plants (Aloe Vera, Brahmi, Neem, and Turmeric) can prevent E. coli bacterial growth. The objective is also to determine whether Ayurvedic plants could be a potential alternative to antibiotics.

Methods/Materials

The four Ayurvedic plants Aloe Vera, Brahmi, Neem, and Turmeric were made into a plant extract with 50% of Ethanol concentration. The plants were individually tested. Various amounts of each plant extract (100µL, 200µL, 500µL, 1mL, 2mL, and 3mL) were added to flasks containing Lauria Birth Nutrient Media, Agar, and E. coli bacteria. One flasks was left for the control, which had no plant extracts. The flasks were put into a shaker for 24 hours. 1mL was taken from each flask as a sample to calculate optical density and estimated amount of bacteria of each flask.

Results

The Aloe Vera extract wasn't successful in preventing the E. coli bacterial growth. 3mL of the Aloe Vera plant extract increased the amount of E. coli bacteria by 150%. The Brahmi plant extract was more successful than the Aloe Vera plant extract. 3mL of the Brahmi plant extract was able to prevent 60% of the E. coli bacterial growth. The most successful Ayurvedic plant extract in the project was the Neem plant extract. 3mL of the Neem plant extract was able to prevent the growth of 98% of the E. coli bacteria. The Turmeric plant extract was successful, however it didn't perform as well as the Neem plant extract. 3mL of the Turmeric plant extract was able to prevent the growth of 80% of the E. coli bacteria.

Conclusions/Discussion

It is concluded that the Neem plant extract was the most effective plant extract of the four plant extracts. 3mL of the Neem plant extract prevented 98% of the E. coli bacterial growth. The Turmeric plant extract was also deduced to be effective, however not as much as the Neem plant extract. 3mL of the Turmeric plant extract was effective in preventing 80% of the E. coli bacterial growth. It is concluded that the Brahmi plant extract was somewhat effective, as the plant extract prevented about 60% of the bacterial growth. It is also concluded that the Aloe Vera plant extract is not effective in preventing bacterial growth, as it increased the bacterial growth by 150%. Ultimately, it can be concluded that the Neem, Turmeric, and Brahmi plant extracts are Ayurvedic plant extracts which could be successful alternatives to antibiotics.

Summary Statement

In this project, four Ayurvedic plant extract were tested on E. coli bacteria to see fi they could prevent plant growth, and serve as potential alternatives to antibiotics.

Help Received

I conducted the experiment in my dad's lab, where I was provided some of the materials to conduct the experiment.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Jade Robinson; Oliver Russell

Project Number

J1716

Project Title

Honey vs. Bactine: Bonny Doon Honey Proves Most Effective against E. coli

Abstract

Objectives/Goals

The purpose of this project is to see which variable--Manuka honey, Bonny Doon honey or antibiotic spray (Bactine)--will work the best at inhibiting the growth of E.coli bacteria.
Compared with a chemical antibiotic, how effective are Bonny Doon honey and Manuka honey in inhibiting the growth of E.coli?
Our hypothesis was that the order of effectiveness, from most to least effective would be: Bactine spray, Manuka honey, and Bonny Doon honey.

Methods/Materials

1. Following BSL-1 safety protocols, we marked and swabbed three sectioned treatment plates and three control plates, using live E.coli bacteria.
2. We soaked 3 sterile disks in each of the treatments, placed them in the corresponding marked sections of the treatment plates, and put the covered plates in the incubator set to 98.6°F.
3. For six days, we recorded the date, time, incubator temperature, and diameter of the zones of inhibition developing around the treatment disks.

Manuka honey, Bonny Doon honey, Bactine Antibiotic First Aid Liquid, Sterile Disks, Nutrient Agar Plates, Live E. coli bacteria strain K-12, Incubator, Safety equipment per BSL-1 requirements.

Results

Our results indicate that, during the 6-day experiment, E. coli had intermediate resistance to Bonny Doon honey, while E. coli was resistant to both Bactine and Manuka honey. Therefore, Bonny Doon honey was most effective at inhibiting the growth of E. coli.

Conclusions/Discussion

In our study we found that Bonny Doon honey proved more effective than Manuka honey and Bactine at inhibiting the growth of E. coli. E. coli is a common source of infections, and there is growing concern about the overuse of antibiotics. Our results support local honey as an accessible and effective alternative treatment.

Summary Statement

We found that E. coli had intermediate resistance to Bonny Doon honey, while E. coli was resistant to both Bactine and Manuka honey.

Help Received

Scott Russell (Parent and Designated Supervisor/Qualified Scientist) ordered the bacteria and project equipment, trained us on lab safety, and supervised our experiment in keeping with the procedure and BSL-1 requirements for working with microorganisms.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
LeAnn Tai

Project Number
J1717

Project Title
Natural Alternatives for Preservation without Refrigeration

Abstract

Objectives/Goals
795 million people, or one out of nine people suffer from chronic undernourishment. Food, such as meat can spoil as quickly as a couple hours at room temperature. The objective of this research is to determine what the best natural preservative that is both commonly available and cheap against bacteria for meat is without refrigeration, and how effective the preservatives are.

Methods/Materials
The primary materials for the project used were beef, table salt, table sugar, distilled white vinegar, lemon juice, hydrogen peroxide, honey, mustard oil, trypticase soy agar plates, and laboratory and personal protective equipment. This experiment was done in three parts. In the first part, beef was cut into cubes and preserved in each preservative, which was then kept in the incubator at 98°F for 24 hours. Then, in the second part, the bacteria grown in the meat was washed out with 0.9% saline, and diluted with saline to a ratio of 1:10000. 20µL of the solution was applied to the plates that were preserved in the incubator at 98°F for 24 hours. Lastly, in the third part, the number of bacterial colonies was counted and recorded. The experiment was repeated 4 times for consistency and calculating the standard error.

Results
Ultimately, the overall ranking of the preservatives was found to be: lemon juice, vinegar, cooked (no preservative), salt water 20%, mustard oil, sugar water 1%, honey, sugar water 20%, hydrogen peroxide 1.5%, salt water 10%, sugar water 10%, sugar water 5%, salt water 1%, and salt water 5%.

Lemon juice resulted to be the best natural preservative, with 100% reduction against meat without preservation. On the other hand, the least effective preservative turned out to be 5% salt water, only reducing the number of bacteria by 58%.

Conclusions/Discussion
The results reveal that the most effective preservative is lemon juice. The data proved my hypothesis that low pH is effective. Although my hypothesis stated that vinegar would be the best preservative, it came in as a close second. Through this project, we learned a lot about how meat can be kept for long periods of time, and suggests that some of these preservatives can be considered in the future as common preservatives.

Summary Statement
This experiment showed that lemon juice is the best natural, commonly available, and cheapest preservative for meat against bacteria without refrigeration.

Help Received
My science teacher, Mrs. Okenwa, helped and guided me to finalize the project. Kenlor Industries Inc. allowed me to perform part of my experiment in their laboratory, with Dr. Saurabh Ghosh Roy supervising throughout the process. My parents helped me with buying the materials and transportation.