Student-Designed Projects that Ascertain Antibiotic Properties of Natural Substances

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Abstract

For thousands of years, certain foods have been utilized for purposes beyond nutrition. St. Francis College students chose to examine antibiotic properties of natural substances for a General Biology project. Specifically, essential oils, honeys, and vinegars have demonstrated an ability to inhibit the growth of pathogenic bacteria. The students quantified the relative efficacies of tea tree oil, cinnamon oil, garlic extract, apple cider vinegar, and Manuka honey against *Staphylococcus aureus* and *Escherichia coli* by measuring the zones of bacterial growth inhibition after a 24 hour period of incubation. The experimental agent was administered either by drop directly onto the inoculated agar surface or on a saturated piece of filter paper. The conventional antibiotics tetracycline and erythromycin were used as positive controls and as baselines for halo size.

Selection of Natural Antitibiotics

The students found that all natural agents tested were comparably or more effective than conventional antibiotics as measured by the diameter of the zone of growth inhibition. The success of these food remedies was encouraging since they are generally inexpensive and widely available. Food products that have been used historically as remedies are still very relevant and potent sources of antibiotic activity. This student-designed lab activity yielded much data that the students could analyze and relate to existing data on antibiotics.

Null Hypothesis

There is no difference in the efficacy of natural products (Manuka honey, cinnamon oil, garlic extract, apple cider vinegar, tea tree oil) in inhibiting the growth of *Escherichia coli* and *Staphylococcus aureus* compared to bio-pharmacological antibiotics Tetracycline and Erythromycin

Materials and Methods

Fresh garlic juice was extracted by maceration of cloves and filtration of pulp. For apple cider vinegar, cinnamon oil, tea tree oil, and garlic juice: hole-punched pieces of filter paper, matching the size and shape of the antibiotic disks, were saturated. These disks were placed onto the inoculated plates. The Manuka honey was deposited, while on a scale, dropwise to 0.15g per plate. Each natural remedy was used on both S. aureus and E. coli. The plates were then placed in a 37˚C incubator for 24 hours. Two measurements of the zone of inhibition after 24 hours was recorded to measure the effectiveness of the particular pathogenic-killing remedy. There were 5 plates for each combination of antibiotic and pathogen.

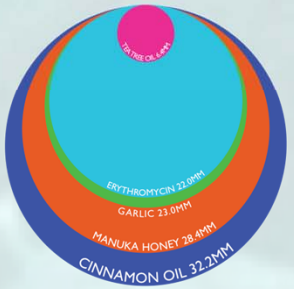
Grinding garlic into pulp

Measuring zone of growth inhibition

Results

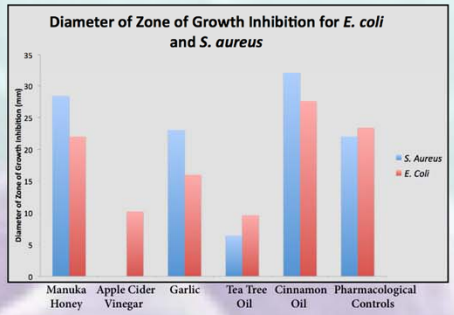
The results from our tests signify that there is measurable evidence that natural remedies are just as, or perhaps more, effective in killing the bacteria *S. aureus* and *E. coli*. The zone of inhibitions differed slightly between each remedy (garlic oil, cinnamon oil, manuka honey, tea tree oil, and apple cider vinegar, Erythromycin, Tetracycline) implying that there are differences in the effectiveness of each remedy for different bacteria.

Staphylococcus aureus
Average Zone of Growth Inhibition



Escherichia coli
Average Zone of Growth Inhibition

*Apple cider vinegar had no measureable effect on the growth of *S. aureus*



Standard Deviation (mm)	*S. aureus*	*E. coli*
Manuka Honey	5.46	9
Apple Cider Vinegar	-	9.42
Garlic	1.87	3.39
Tea Tree Oil	4.12	2.7
Cinnamon Oil	3.03	1.81
Erythromycin	4.47	-
Tetracyclin	-	1.52

Conclusion

Given the data collected from this series of experiments, we conclude that there were differences in the efficacy of inhibiting the growth of *E.coli* and *S. aureus* using natural products compared to the bio-pharmacological antibiotics Tetracycline and Erythromycin.

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