Antibacterial benefits of spices

It is becoming more and more common to find many bacteria developing resistance to most common antibiotics. As the resistant strains develop ways around our traditional methods, it may be important to look into alternative methods to fight back. The alternatives may be as simple as looking in your spice cabinet.

There has been research conducted observing the use of spices as antibiotics. The effectiveness is still not as beneficial as manufactured drugs, but there is definitely potential to expand on these ideas. The mass production of penicillin to fight many infections was introduced in 1940, though Sir Alexander Flemming discovered it in 1928. Four years after penicillin began to be mass-produced, bacteria was already adapting and becoming resistant to its effects. (Bellis) So, even from the early stages of synthetic antibiotic use, bacteria were already evading our efforts. Bacteria become resistant by actually destroying the drug, some staphylococci create penicillinase, which destroys penicillin. Some bacteria sites where the antibiotic attaches are altered making them less susceptible to the drug. (Hughes) The overuse of antibiotics and the rate that bacteria replicate make the antibiotics less effective, which in turn creates more resistant strains.

Because of this bacterial behavior, it has been important for scientists to conduct research that will aid them in changing antibiotics to increase their effectiveness. The most promising spices that displayed antibacterial properties are garlic, turmeric and cinnamon. Each play a better role in some bacteria than others, it also appears that the concentration and form of the spice makes a difference.

An experiment presented by James M. analyzed the different oils in spices at different temperatures and concentration. Escherichia coli, Enterococcus faecalis, and Staphylococcus aureus were tested. The spices used were garlic, oregano, turmeric and cinnamon.

For comparison, the antibiotics that were used were amoxicillin and tetracycline. Amoxicillin is in the same family of antibiotics as penicillin and it is generally used to stop the growth of bacteria. Tetracycline is used to prevent the growth and spread of infection.

Garlic has been used for its numerous health benefits; it displays abilities as an anti-viral, anti-bacterial and anti-fungal. This is due to its high sulfur containing compounds, high trace mineral content and enzymes. (Bongiorno, Fratellone, & LoGiudice, 2008) Oregano has more than 20, 000 different species. Among these species, the Labiatae family is the one that exhibits anti-microbial benefits. It is also used as an antiseptic and anti-parasitic. (Koksal, Gunes, Ozer, & Ozden, 2010) The active ingredient in turmeric is curcumin and has been used for many medicinal purposes. It has been beneficial in the prevention and inhibition of cancer and it poses cardiovascular and anti-inflammatory properties. (Chandra) Curcumin is what provides turmeric its antibacterial property, especially against the bacteria Staphylococcus aureus. (Bhowmik, Chiranjib, Kumar, Chandira, & Jayakar, 2009) Cinnamon has long been used as a food preservative. It is able to inhibit the growth of bacteria like Salmonella and E. coli. (Craig, 2003) Cinnamon is attributed to anti-microbial activity, anti-clotting actions and blood sugar control. (The World’s Healthiest Foods)It is also known to improve the quality of taste in foods.

The study was conducted using the three spices at different dilutions of 5% and 10% while also comparing the results to the synthetic antibiotics. It also compared the effects of using dried spices and spice oils, while also testing spice combinations as opposed to single spices and if the spices work better at different temperatures.

He hypothesized that the spices would have antibacterial potential, but the synthetic antibiotics would work faster. He believed that the higher the concentration of the spice the better the results and that the spice oils would be more effective. He also thought that gram-negative bacteria would be more sensitive. Finally he thought that spice mixtures and the heated spices would perform best.

The independent variable was spice concentration, spice oils, spice mixtures and dissolved antibiotics. The dependent variable was the inhibition zones on the agar. The control was the media. Tryptic Soy Agar plates were used.

First, each agar plate was swabbed with different bacteria and incubated for 48 hours at 37ï‚° C. The 250 mg synthetic oral antibiotics were dissolved in 24ml of distilled water. The spice powders and oils were prepared by using 5 kg of powder/oil and 45 ml of water for the 5% concentration, and 10 kg in 45 ml of water in the 10% concentration. A hole punch was used to punch paper discs out of filter paper that were 6 mm in diameter. A sterile disc was then dipped in each solution as follows: distilled water (control), liquid garlic solution, garlic oil, cinnamon, cinnamon oil, oregano, oregano oil, garlic oil/turmeric oil mixture and dissolved antibiotic solutions. The discs were incubated for thirty minutes and then placed on the bacteria cultures. All of

the plates were then incubated for 24 hours at 37ï‚° C. The same procedure was replicated for the heated spices. There were three different trials run on both the cooled spices and the heated spices each.

If the bacteria were inhibited by the spice or antibiotic, a clear area would surround the disc, this is referred to as the inhibition zone. The larger the inhibition zone is the more antibacterial effectiveness. The inhibition zones were measured by placing a ruler over the TSA plates and then recorded in millimeters.

The experiment concluded that the synthetic antibiotics had the greatest effect on inhibiting bacterial growth. E. coli was the gram-negative bacterium and it showed that tetracycline worked best followed by amoxicillin. The garlic oil/turmeric oil mixture was the most successful of the spices followed by all of the single spice oils. S. aureus, gram-positive bacteria, was inhibited best with amoxicillin followed by tetracycline. Again the garlic oil/turmeric oil mixture was the most efficient in regards to bacterial inhibition. However E. faecalis, gram-positive bacteria, was affected best by amoxicillin and then garlic oil/turmeric oil mixture with tetracycline in third place. Overall, the heated garlic oil/turmeric oil mixture proved to be the most efficient and the gram-negative bacteria was most sensitive to the spices.

Another study by Venugopal Amrita, observed the effects that spices had on Escherichia coli. While the presence of E. coli in the human intestines is normal, it can cause problems when there is too much or if it becomes virulent. Many spices are used in food preparation, but the scientist

conducting this study did not believe that the effects of spices in food should be part of their research.(Amrita, Sonal, & Shalini, 2009)

The spices used in this study were: thyme, oregano, tulsi, ginger, turmeric, cinnamon, clove and asafoetida. The E. coli culture was inoculated to N-broth and then incubated for 24 hours at 37ï,° C. The innoculum was then spread in N-agar plates with a glass spreader and kept for five minutes. The spices were soaked in water for 24 hours and then ground up with 5 ml of distilled water by using a mortar and pestle. Sterile paper discs were then soaked in the spice concoction and placed in the inoculated plates. The plates were incubated for 24 hours at 37ï,° C and then the clear area around the disc was measured. This procedure helped to analyze the effects the spices had on inhibiting growth of the bacteria.

Another method they used was the agar ditch method. Four ditches were bored in each inoculated N-agar plate. Different spices were added to these ditches. The plates were then incubated at 37ï,° C for 24 hours and the clear areas around the ditches were measured.

The results were obtained by turbidometric method and mean % inhibition of growth compared to the concentration. The study concluded that the higher the concentration of the spice, the better inhibition. Turmeric showed the best results even at the lowest concentration. The second best results came from thyme. All of the spices with the exceptions of oregano, ginger and cinnamon, showed 100% inhibition at the highest concentration.

As with synthetic antibiotics, certain spices work better on different bacteria. For instance, horseradish works against both gram-negative and gram-

positive, while garlic is more active against gram-positive organisms. (Skrinjar & Nemet, 2009)

The research being done on spices is promising, but it is clear that the synthetic antibiotics work more efficiently. Now that we have seen the effects of spices and antibiotics separately, why not try them together? If the bacteria are becoming resistant to traditional antibiotics, and the spices don’t work as quick by themselves, maybe the combination of the two would be a force to be reckoned with. The mixture of synthetic antibiotics and spices may be the formula needed to battle the antibiotic resistant strains of bacteria.

For hundreds of years people have turned to natural remedies to treat their ailments. When traditional treatments don’t seem to be working, people turn to homeopathic alternatives for some comfort. By taking a bit of the past and combining it with the present, we may come up with something even better.

The problem with antibiotic resistance research is there is not enough of it. It is not cost effective to pharmaceutical companies to develop new antibiotics because they are generally short-term drugs. Also, to avoid further resistance, doctors try not to write as many prescriptions for antibiotics. This also means less money to drug companies. Because of this, the bacteria are becoming resistant, but we are not doing enough to try fighting them. Incentives to the drug companies could offer them extensions on their patents, which would allow them exclusive rights to any major discoveries for a longer period of time. Another incentive could be to offer accelerated regulatory approval of new antibiotics so they could get their drugs pushed

through quicker.(Herrell, 2009) The problem will not fix itself, and it is only through more research and trials that we will get ahead of the bacteria and their ever-changing ways.