**Antibacterial Activity Of The Spice Elettaria cardamomum**

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**Abstract**

*Elettaria cardamomum*, green cardamom, has been long used in south Asia both for medical purposes and as a seasoning. This plant is used in traditional botanic medicine to treat infectious disease such as pulmonary tuberculosis and lung congestion. Additionally, green cardamom is used for its important positive effects on the gastric system, blood pressure, and "fat modulatory". The high rate of natural selection for mutations and genome rearrangement in bacteria resulting in antibiotic resistance, has forced a search for new antibiotics. Thus, after years of extensive research on soil microorganisms-able to produce antibiotics, we need to look for new sources of antibiotics such as plants. Our hypothesis is that *E. cardamomum* can inhibit bacterial growth. We prepared aqueous, methanol, ethanolic, and acetone extracts of *E. cardamomum* seeds and seed shells. The extracts were filtered, dried, and reconstituted to 83 mg/ml in their respective solvent. Each extract was tested against *Escherichia coli* (gram-negative), *Staphylococcus aureus* (gram-positive), *Bacillus subtilis*, *Streptococcus mutans*, and *P. aeruginosa*.  

**Background**

- The availability of antibiotics is crucial. Antibiotics are molecules that are produced by other bacteria, fungi, plants, and other organisms that kill the infectious bacteria.  
- New antibiotics are needed. There has been a rise in antibiotic resistance over the past decades because of the misuse of antibiotics. One case is the emergence of antibiotic-resistant *Staphylococcus aureus* (5, 6).  
- Ancient medicine involved the use of many plants to treat diseases and infections (2). Cinnamon is an effective anti-pseudomonas compound (3). These observations led us to question whether other commonly used spices, such as green cardamom, have antimicrobial activity.  
- *Elettaria cardamomum*, green cardamom (Figure 4), is widely used in Asia to treat gum and tooth infections, tuberculosis, and digestive disorders (4, 7). However, its value has not been tested scientifically.  
- The purpose of our work is to evaluate whether *E. cardamomum* has antibacterial activity.

**Hypothesis**

Green cardamom has medical uses in folk medicine. It is expected that the green cardamom will inhibit growth of bacteria tested in this experiment.

**Methods**

1. Dried *Elettaria cardamomum* seeds were purchased in bulk from Abu Kameel store. The manufacturer was M.R. Corp. and they were grown in Bangladesh.  
2. 10 g dried *E. cardamomum* seeds, was finely ground in an electric mixer and soaked for 48-72 hr in 11 mL of seven different solvents: water, 100% methanol, 100% ethanolic, acetone, 70% methanol, 70% ethanolic, and 70% acetone for 48 to 72 hr.  
3. The mixtures were filtered through Whatman No.1 paper. The supernatant was diluted to final concentrations of 167 and 833 mg/ml.  
4. 20 μL of each extract and its respective solvent was tested in the well diffusion assay against the following gram-negative bacteria: *Escherichia coli* and *Pseudomonas aeruginosa*, and against the gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis*, and *Streptococcus mutans*.  
5. The minimum inhibition concentration (MIC) and minimum bacterial concentration (MBC) of extract was determined by preparing serial dilutions of the cardamom extract reconstituted with their respective solvents in nutrient broth and inoculating each with 100 μL of *E. coli*, *S. aureus*, *B. subtilis*, *S. mutans*, and *P. aeruginosa*.  

**Results**

- The alcoholic and acetone extracts were most effective against gram-positive bacteria. The increasing effectiveness in polar solvents suggests a non-water soluble protein or lipid (Figure 2).  
- The methanolic extracts were most effective against *S. aureus* (Figure 3).  
- The extracts were 50% less effective against gram-negative bacteria. The aqueous extract was only effective against *Pseudomonas*, suggesting there is a different, water-soluble anti-pseudomonas compound (Figure 4).  
- The minimal inhibitory concentration and the minimal bacterial concentration of the both alcoholic and acetone extracts against all five test bacteria was 417 mg/ml and 833 mg/ml respectively.

**Discussion & Conclusion**

- Antibiotics are valuable drugs; however, their overuse has created worrisome antimicrobial resistance. Therefore, new antibiotics are vital.  
- Green cardamom has antimicrobial compounds that inhibit the growth of medically important microorganisms.  
- The use of *E. cardamomum* as a medicine and flavoring in food and drinks for centuries has shown the seeds lack toxicity for humans. Thus, *E. cardamomum* can be a potential source for new antibiotics that are effective against a broad collection of bacteria.  
- Further investigation will consist of isolation of the active compound(s), studying the antimicrobial activity of more concentrated extracts, and testing against other microorganisms.

**Literature Cited**


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