Evaluation of Three Naturally Occurring Phytochemicals as Alternatives to Aminoglycosides on the Inhibition of Escherichia coli in vitro

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The discovery of new antibiotics to treat life threatening antibiotic-resistant infections has remained stagnant. Naturally occurring phytochemicals like garlic(Allium sativum), ginger(Zingiber officinale), and cinnamon(Cinnamomum verum) may have antibacterial properties. This study evaluated the in vitro antibacterial activity of garlic, ginger, and cinnamon compared to gentamicin on Escherichia coli to develop effective alternatives to antibiotics. Using the Kirby-Bauer disk diffusion assay, the inhibitory activity of garlic, ginger, and cinnamon against E. coli was assessed. Disks impregnated with the test extracts were placed on Mueller-Hinton agar plates inoculated with E. coli. The zone of inhibition around each substance was compared to gentamicin. Garlic and ginger exhibited the largest zones of inhibition against E. coli. The difference between the bactericidal effect of gentamicin compared to garlic, ginger and cinnamon were evaluated using the 2-sample T-test at the 1% significance level. The p-value was 0.019 for garlic and 0.025 for ginger. This means that we failed to reject the null hypothesis indicating no difference in the bactericidal effects of gentamicin, garlic, or ginger. However, there was a statistically significant difference between cinnamon and gentamicin(p-value=0.004) indicating a difference in bactericidal activity. This study demonstrated that garlic, ginger, and cinnamon have inhibitory effects on E. coli and may be potential alternatives for antibiotics. The bactericidal effect of garlic and ginger was similar to gentamicin, thereby supporting the hypothesis. Antibiotic-phytochemical combinations may be synergistic and findings from this study provide an impetus for developing phytochemicals into therapeutic antibacterial agents.