

Antibacterial Properties of some Spices and Herbs against Food borne Pathogens, Spoilage Bacteria, and their Application in Food Preservation

Md. Mahfuzul Hoque
UNU-Kirin Fellow from Bangladesh
Food Hygiene Laboratory

Chloroform, ethanol, and aqueous extracts of some spices (Cloves, Cinnamon and Thyme) and herbs (Guava, Neem, Tulsi, Edible Mushroom, Nira, Shungiku, Shiso, Igusa and Cherry) were analyzed for antibacterial activity against 21 food borne pathogens: *Listeria monocytogenes* (5), *Staphylococcus aureus* (4), *Escherichia coli* O157: H7 (6), *Salmonella* Enteritidis (4), *Vibrio parahaemolyticus* and *Bacillus cereus*, and 6 food spoilage bacteria: *Pseudomonas* spp. (2), *Alcaligenes faecalis*, *Aeromonas hydrophila* (2) and *B. subtilis*. Of 12 plants studied, cloves, cinnamon, guava and neem showed antibacterial activity against the test organisms. The ethanol extract, aqueous extract, and essential oil of cloves showed zones of inhibition from 13.4 (*P. putida* KT 2440) to 26.3 (*L. monocytogenes* JCM 7671), 9.7 (*A. hydrophila* NFRI 8283) to 22.5 (*A. faecalis* IFO 12669), and 11.0 (*L. monocytogenes* JCM 7676) to 32.0 mm (*A. hydrophila* 8282), respectively. The ethanol extract and essential oil (EO) of cinnamon showed zones of inhibition from 10.0 (*S. aureus* JCM 2151) to 11.4 (*V. parahaemolyticus* IFO 12711), and 11.0 (*P. putida* KT 2440) to 46.5 mm (*B. cereus* IFO 3457), respectively. The ethanol and aqueous extracts of guava showed zones of inhibition from 10.7 (*S. aureus* JCM 2894) to 21.9 (*L. monocytogenes* 49594), 10.0 (*A. hydrophila* NFRI 8282) to 18.0 mm (*L. monocytogenes* JCM 7671), respectively. The chloroform and ethanol extracts of neem extracts showed zones of inhibition from 14.2 (*L. monocytogenes* ATCC 49594) to 16.0 (*L. monocytogenes* ATCC 43256) and 9.0 (*S. aureus* JCM 2894) to 20.0 mm (*L. monocytogenes* ATCC 49594), respectively. The MIC values of cloves, cinnamon, guava and neem extracts were determined for sensitive test organisms. The plant extracts studied and EOs of clove and cinnamon showed the MIC values ranged from 0.1 to 7.0 mg/ml and 1.25 to 5.0 %, respectively. The EOs of clove and cinnamon at different concentrations were applied against vegetative cells and spores of *B. subtilis*. The findings suggested that both EOs at 2.5 % concentration showed minimum inhibitory activity for vegetative cells and 2.5 % and 5 % for spores of *B. subtilis*, respectively. The ethanol and aqueous extracts, and EO of cloves and cinnamon and ethanol extract of neem were treated against cocktails of *L. monocytogenes* (5 strains), *S. aureus* (4 strains), *E. coli* O157: H7 (6 strains), *S. Enteritidis* (4 strains) and *A. hydrophila* (2 strains) with various temperatures and pH. The findings suggested that all plant antibacterials were stable at high temperature and showed higher activity at pH 5.0 with a few exceptions. The EOs of cloves and cinnamon were employed in ground chicken meat inoculated with cocktail of 5 strains of *Listeria monocytogenes*. The result showed that EO of clove reduced all *Listeria monocytogenes* cells to undetectable level in ground chicken meat within 3 h of exposure at which EO of cinnamon reduced *Listeria monocytogenes* to two logs CFU/ g and then slightly reduced the number of cells within 15 days of incubation.