

**Antimicrobial Effects of Selected Herbal Extracts on Clinical Multi-
Drug Resistant Gram-Negative Bacteria**

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ABSTRACT

The rise in antibiotic resistance has resulted in decreasing numbers of effective antimicrobial agents available to treat infections caused by multi-drug resistant (MDR) bacteria. This has necessitated a search for new antimicrobial agents. Herbal remedies may offer alternative treatment options especially because they elicit little or no transferable resistance if used in optimal concentrations. This study evaluated antimicrobial properties of 10 plants traditionally used as herbal remedies against a total of 27 MDR Gram-negative bacterial isolates. The extracts were obtained through organic (methanol) and inorganic (water) solvents extraction. Susceptibility of the test strains to conventional antibiotics was determined by the disc diffusion technique while molecular characterization of resistance was done through plasmid profiling and PCR screening for the presence of Class 1 integrons and genes encoding β -lactamases such as *bla-SHV* and *bla-TEM*. Determination of the Minimum Inhibitory Concentrations (MICs) and the sub-lethal concentrations of the effective extracts was done by broth cultures followed by colony counts. The test isolates were habituated in sub-lethal extract concentrations for 72 h to investigate effect on their sensitivity to conventional antibiotics. Mating experiments were employed in order to determine if the extracts facilitate or inhibit conjugative transfer of resistance markers. Out of the 27 MDR strains, 74% contained class 1 integrons while 80% were positive for the *bla-SHV* and *bla-TEM* genes. Out of the 10 plants, only *Warbugia ugandensis* root and stem-bark extracts were active against the MDR strains and their inhibitory effect was significantly higher than that of other plant extracts (t-test, $p < 0.001$). Methanol extracts from the root and stem-bark of this plant were inhibitory but not lytic against test strains with an MIC of 42 $\mu\text{g/ml}$. The inhibitory effects of the root or stem-bark

extracts was significantly reduced when mixed with the leaf extracts (t-test, $p < 0.02$). Susceptibility of test strains to conventional antibiotics was not significantly affected before and after exposure to sub-lethal extract concentration (t-test, $p > 0.005$). The extracts did not stimulate or inhibit conjugal transfer of resistance determinants. Methanol extracts from the root and stem-bark of *W. ugandensis* may provide potential sources for further development of alternative antimicrobial agents that may find use in the treatment of MDR infections.