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Antibacterial Efficacy of *Syzygium aromaticum* Essential Oil Against Extended Spectrum Beta-Lactamase-Producing *Escherichia coli* in Urinary Tract Infections

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Abstract

This study accessed the antibacterial efficacy of *Syzygium aromaticum* (clove) essential oil against extended spectrum beta-lactamase (ESBL)-producing *Escherichia coli* isolated from urinary tract infections (UTIs) at the State Hospital Ijaiye and Federal Medical Center Idi-aba, both in Abeokuta, Ogun State. A total of 229 urine isolates were collected, cultured on eosin methylene blue agar (EMB), and identified biochemically following standard procedures. Ten antibiotics belonging to five different classes of antimicrobial agents including four fluoroquinolones, three beta-lactam, sulfonamide, chloramphenicol, and aminoglycoside were tested on the isolates. ESBLs were determined using double disc synergy method. Essential oil from the *S. aromaticum* was obtained by hydrodistillation using Clevenger apparatus and dehydrated with anhydrous sodium sulfate salt. Antibacterial effect of the oil was determined using agar well diffusion. Minimum inhibitory concentration (MIC) and minimum bactericidal concentrations (MBC) were also determined following the double fold dilution method. The rate of kill by the oil on isolates was also determined. The physicochemical property of the oil was evaluated using gas chromatography-mass spectrometry (GC-MS), while molecular docking was carried out on the components of the oil. High resistance was recorded against ceftazidime (92.4%), Septrin (87%), amoxicillin (84.9%), ampicillin (76.7%), and gentamycin (74.2%); while least resistance was recorded against chloramphenicol (16.4%). Out of 109 isolates, 30 were

identified as ESBL producers. The zones of inhibition of the essential oil of *S. aromaticum* were 8.0 ± 0.0 mm to 14.0 ± 0.0 mm. The MIC and MBC values ranged from 0.75–6.25 mg/ml to 0.75–12.5 mg/ml. GC-MS analysis of the oil showed the presence of several components including eugenol (80.98%) and caryophyllene (6.00%). Molecular docking suggested that caryophyllene and humulene are durable. The study suggests that the oil of the natural product used may be useful in combating the extended spectrum beta-lactamase-producing *E. coli* in UTI.

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