Prevalence and Minimum Inhibitory Concentration Profiling of Amoxicillin-Resistant Bacteria in Coastal Waters of the Northern and Southern Provinces of Sri Lanka

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Antimicrobial resistance (AMR) represents a severe and escalating threat to global public health, complicating the effective treatment of infectious diseases. Wastewater discharge, agricultural runoff, and aquaculture effluents introduce antibiotic residues and antibiotic-resistant bacteria (ARB), making coastal waters particularly vulnerable to contamination. In Sri Lanka's coastal waters, where such data is scarce, this study evaluated the prevalence and resistance profiles of bacteria resistant to amoxicillin (AMX). Water samples were collected in triplicate from eleven coastal sites: six in the Northern Province (Karaitivu, Anaikodai, Ponnalai, Dambakola Patuna, Point Pedro, and Dutch Fort-Jaffna) and five in the Southern Province (Polhena, Weligama, Koggala, Unawatuna, and Hikkaduwa). AMX-resistant bacteria were isolated using the standard pour plate method on nutrient agar supplemented with 60 µg mL^{-1} AMX. Minimum inhibitory concentrations (MICs) were determined via agar dilution following Clinical and Laboratory Standards Institute (CLSI) guidelines. Total viable counts were higher in the southern sites (5.07×10^4 - 6.75×10^4 CFU mL^{-1}) than in the northern sites (1.21×10^4 - 1.53×10^4 CFU mL^{-1}; $p<0.001$), with the highest count observed at Hikkaduwa. Similarly, AMX-resistant bacteria were more prevalent in the south (2.03×10^4 - 4.94×10^4 CFU mL^{-1}) compared to the north (3.13×10^3–1.11×10^4 CFU mL^{-1}; $p<0.001$). Among 40 distinct isolates, high-level resistance (>360 µg mL^{-1}) was heavily prevalent, particularly in the Northern Province (95.83%) compared to the Southern Province (75.0%). While the remaining northern isolates (4.17%) displayed only low-level resistance at 60 – 120 µg mL^{-1}, southern isolates exhibited a broader spectrum of resistance profiles, showing MIC values of 6.25% at 60–120 µg mL^{-1}, 12.5% at 180 – 240 µg mL^{-1}, and 6.25% at 240–360 µg mL^{-1}. These findings reveal a complex geographic disparity in AMX resistance; while the southern coastal region demonstrates a higher overall prevalence of AMX-resistant bacteria at 60 µg mL^{-1}, the northern coastal region is identified as a significant hotspot for high-level resistance. To mitigate this spread, it is crucial to strengthen local antibiotic stewardship and upgrade wastewater treatment infrastructure across both provinces. Furthermore, it is highly recommended that subsequent research incorporate molecular techniques to map antibiotic resistance genes (ARGs) and expand the geographical scope to understand the ecological impact of AMR.

Keywords: amoxicillin resistance, Antimicrobial Resistance (AMR), environmental surveillance, coastal pollution, northern province