

ASSESSMENT OF HYGIENE AND ANTIMICROBIAL RESISTANCE OF  
*Enterobacteriaceae* IN CRUSTACEAN SEAFOOD, MONGERS, AND  
IN-CONTACT ENVIRONMENT IN LAGOS STATE, NIGERIA

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## ABSTRACT

Despite being an important animal protein source, crustacean seafood constitutes a significant source of foodborne infection. This study investigated crustacean seafood mongers' knowledge, attitudes and practices on hygiene, food safety, and antimicrobial resistance (AMR) in Lagos, Nigeria. It also assessed the presence and AMR profiles of *Enterobacteriaceae* in crustacean seafood, mongers' hands, and in-contact environment. A cross-sectional survey was carried out using a semi-structured questionnaire to collect data on knowledge, attitudes and hygiene practices, as well as antibiotic usage, and AMR knowledge from 121 crustacean seafood mongers. Biological samples including 121 crustacean seafood (comprising of shrimps, prawns, crabs and lobsters), 116 mongers' hand swabs, and 120 swabs of in-contact surfaces (bowls, trays, and tables) were obtained. Bacteria were isolated and identified by standard microbiological culture methods and biochemical characterization. Antimicrobial susceptibility testing was done by the Kirby-Bauer disk diffusion method. Data were analysed using descriptive statistics, bivariate correlation, and binary logistic regression. Over half of the participants demonstrated good knowledge (65, 53.7%) and positive attitude (78, 64.5%). However, only 54 (44.6%) of the participants had good hygiene practices. Many mongers demonstrated good practices such as washing hands with soap after using the restroom (111, 91.7%). However, only 10 (8.3%) always washed their hands after handling money, and 14 (11.6%) after smoking, sneezing, or coughing. Also, only 35 (28.9%) always stopped handling seafood when sick or having diarrhoea. The factors significantly associated with respondents' hygiene practices were tribe ( $p = 0.021$ ), location ( $p = 0.004$ ), and form of seafood sold ( $p = 0.001$ ). There was a significant negative but weak correlation (Pearson correlation = -0.185) between participants' knowledge and practice. Binary logistic regression showed age ( $p = 0.039$ ) as the predictor of attitude level, and the form of seafood sold ( $p = <0.001$ ) as the predictor of the practice level of respondents. Furthermore, 19 (16.8%) of the

respondents obtained their antibiotics by self-prescription, 23 (20.4%) from drug vendors (patent medicine stores) and four (3.5%) relied on advice from friends or family. Also, 53 (46.9%) participants reported that they used antibiotics whenever they felt ill indicating a high prevalence of self-medication and inappropriate antibiotic use. Almost all participants (112, 92.6%) had no prior knowledge of AMR. The microbiological analyses revealed that 113 (97.4%) of the mongers' hand swabs, 116 (96.7%) of in-contact food surfaces' swabs, and 108 (89.3%) of crustacean seafood samples had bacterial contamination. *Escherichia coli* (53, 32.7%), *Enterobacter cloacae* (36, 22.2%), *Enterobacter agglomerans* (23, 14.2%), and *Citrobacter freundii* (23, 14.2%) were the most frequently isolated bacterial species. Overall, the isolates demonstrated resistance to ampicillin (123, 75.9%), amoxicillin (116, 71.6%), cefoxitin (75, 46.3%), trimethoprim/sulfamethoxazole (48, 29.6%), and chloramphenicol (43, 26.5%). There were 75 antibiotic resistance groups, 41 (55.5%) of which were multi-drug resistant. The findings emphasize the direct correlation between hygiene practices, the risk of bacterial contamination, and the significant knowledge gaps on AMR. It underscores the need for improved hygiene practices, awareness of the risks of injudicious use of antibiotics, and better antimicrobial stewardship within the crustacean seafood supply chain.