Meat and Muscle Biology™

Antibiotic Resistance of Salmonella Enterica Isolated from Whole-Muscle Beef Cuts and Beef Carcasses in Mexico

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Objectives

A substantial number of cattle are raised in Mexico and imported into the U.S., however due to lax regulations, protocols for use of antibiotics in animals are not always properly followed. The objective of this study was to determine and compare the antibiotic susceptibility profiles of S*almonella enterica* recovered along the beef production chain in Southeastern Mexico.

Materials and Methods

A total of 120 *Salmonella enterica* isolates were recovered from whole-muscle beef cuts samples ($n = 60$) and beef cattle carcasses at harvest ($n = 60$) in 2 cities in the Yucatan Peninsula of Mexico (Cancun and Merida). All *Salmonella* isolates were recovered using standard microbiological methods in a previous study. A frozen stock cultures of each isolate was streaked onto blood agar plates and incubated at 37°C for 18 h. Susceptibility profiles were determined using the Sensititre (Trek Diagnostic Systems, Westlake, OH) automated antimicrobial susceptibility system with the National Antimicrobial Resistance Monitoring System (NARMS) Gram Negative plate format CMV3AGNF. The minimum inhibitory concentration (MIC) for each of the 14 antimicrobials tested was interpreted using the Clinical and Laboratory Standards Institute (CLSI) standards for microdilution broth methods and NARMS breakpoints. Fourteen antimicrobials were tested: amoxicillin/clavulanic acid 2:1 ratio (AUG2), ampicillin (AMP), azithromycin (AZI), cefoxitin (FOX), ceftiofur (TIF), ceftriaxone (AXO), ciprofloxacin (CIP), chloramphenicol (CHL), gentamycin (GEN), nalidixic acid (NAL), streptomycin (STR), sul-fisoxazole (FIS), tetracycline (TET), trimethoprim/sulfamethohazole (SXT). Statistical analyses were performed using the GraphPad Prism software to determine statistical differences among the antibiotics tested.

Results

Overall, 68 (56.7%) *S. enterica* isolates exhibited resistance to at least one or more antibiotic. Furthermore, the isolates displayed 19 different resistance phenotypes. Among the whole-muscle beef cuts isolates, 61.7% (37/60) were considered resistant, most commonly to TET (21.6%), followed by multidrug-resistance (MDR) phenotypes to AMP-CHL-STR-TET-SXT (10.8%) and AMP-CHL-TET-SXT (8.1%). Among carcass isolates, 51.7% (31/60) were deemed resistant, most frequently to NAL (18.4) and TET (15.8%). Additionally, the most common MDR phenotypes among carcass isolates were the phenotype CHL-STR-TET-SXT (10.5%) and the phenotype CHL-NAL-STR-TET-SXT (7.9%). No significant differences were found between the resistance patterns across multiple antibiotics (p-value > 0.05).

Conclusion

In Mexico, antimicrobial resistance, and in particular, multidrug-resistance may be of concern due to the high prevalence of *Salmonella* along the beef production chain. An initial investigation like the one presented here contributes to a broader global understanding of the potential exposure to drug-resistant *Salmonella* through food, thus providing insight into the need for control strategies to avoid the spreading of antibiotic resistant *Salmonella* in Mexico.