High diversity of genes and plasmids encoding resistance to third-generation cephalosporins and quinolones in clinical Escherichia coli from commercial poultry flocks in Italy

The aim was to investigate occurrence and diversity of plasmid-mediated resistance to third-generation cephalosporins (3GC) and quinolones in clinical Escherichia coli from 200 industrial poultry farms across Italy. E. coli was isolated from colibacillosis lesions in turkeys (n = 109), broilers (n = 98) and layers (n = 22) between 2008 and 2012. 3GC-resistant isolates were screened for extended-spectrum and AmpC β-lactamase (ESBL/AmpC), while all isolates were tested for plasmid-mediated quinolone resistance (PMQR) genes. ESBL/AmpC- and PMQR-positive isolates were typed by pulsed-field gel electrophoresis and antimicrobial susceptibility testing, and their plasmids were characterised by replicon typing, multilocus sequence typing, restriction fragment length polymorphism and conjugation. ESBL/AmpC genes (blaCTX-M-1, blaCTX-M-14, blaCTX-M-2, blaSHV-12 and blacMY-2) were detected in 7%, 9% and 4% of isolates from turkeys, broilers and layers, respectively. We identified seven ESBL/AmpC-encoding plasmid types, usually conjugative (78%), with a marked prevalence of IncI1/pST3 plasmids carrying blaCTX-M-1. PMQR occurred less frequently among isolates from turkeys (0.9%) compared to those from broilers (5%) and layers (4%). The PMQR genes qnrS, qnrB19 and oqxA/B were located on three plasmid types and two non-typeable plasmids, mostly (85%) conjugative. ESBL/AmpC- and PMQR-positive isolates were genetically unrelated and 64% of them were additionally resistant to aminoglycosides, sulfonamides and tetracyclines. Our data show that 3GC- and quinolone-resistant clinical E. coli in Italian poultry production represent a highly diverse population often resistant to most antimicrobials available for poultry. These findings underline the crucial need to develop new strategies for prevention and control of colibacillosis.

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