

Occurrence and Genetic Characteristics of Third-Generation Cephalosporin-Resistant *Escherichia coli* in Swiss Retail Meat

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Key words

ESBL, AmpC, poultry, CTX-M, CMY, food, animals, antibiotic resistance, virulence, plasmid, replicon, MLST

Aim of the study

To determine the prevalence and genetic relatedness for third-generation cephalosporin-resistant *Escherichia coli* (3GC-R-*Ec*) detected in Swiss beef, veal, pork, and poultry retail meat.

Material and methods

Meat (n=225) [i.e., veal (n=50), beef (n=50), pork (n=50), chicken (n=75)] was purchased at different intervals between April and June 2013 from different retail stores. Samples came from 7 geographically distant Swiss meat-packing plants processing 70% of the slaughtered animals in Switzerland. 3GC-R-*Ec* isolates were obtained by an enrichment method and characterized by MIC measurement, microarray, PCR/DNA sequencing, MLST, plasmid replicon typing. Plasmids of selected strains were transformed by electroporation into *E. coli* TOP10 cells and analyzed by plasmid MLST.

Results and significance

The prevalence of 3GC-R-*Ec* was 73.3% in chicken and 2% in beef meat. No 3GC-R-*Ec* were found in pork and veal. Overall, the CTX-M-1 (79.4%), CMY-2 (17.6%), CMY-4 (1.5%) and SHV-12 (1.5%) β -lactamase genes were detected, as well as other genes conferring resistance to chloramphenicol (*cmlA1-like*), sulfonamides (*sul*), tetracycline (*tet*) and trimethoprim (*dfrA*). The 3GC-R-*Ec* from chicken meat often harbored virulence genes associated with avian pathogens. Plasmid incompatibility groups IncI1, IncFIB, IncFII, IncB/O were the most frequent. A high rate of clonality (e.g. ST1304, ST38, ST93) among isolates from the same meat-packing plants suggests that strains persist at the plant and spread to meat at the carcass-processing stage. Additionally, the presence of CTX-M-1 gene on an IncI1 plasmid sequence type 3 (IncI1/pST3) in genetically diverse strains indicates inter-strain spread of an epidemic plasmid. The CMY-2 and CMY-4 genes were located on IncB/O plasmids. This study represents the first comprehensive assessment of 3GC-R-*Ec* in meat in Switzerland. It demonstrates the need for monitoring contaminants and for the adaptation of the HACCP concept to avoid the spread of multidrug-resistant bacteria through the food chain.

Publications, posters and presentations

Vogt, D.; Overesch, G.; Endimiani, A.; Collaud, A.; Thomann, A.; Perreten, V. 2014. Occurrence and genetic characteristics of third-generation cephalosporin-resistant *Escherichia coli* in Swiss retail meat. *Microb. Drug Resist.* 2014 Apr 28 [Epub ahead of print] doi:10.1089/mdr.2013.0210.

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