A novel alanine to serine substitution mutation in SoxS induces overexpression of efflux pumps and contributes to multidrug resistance in clinical Escherichia coli isolates

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Abstract:

Objectives The purpose of this study was to describe a putative role for a novel soxS mutation in contributing to multiple-antibiotic resistance in canine fluoroquinolone-associated MDR (FQ-MDR) Escherichia coli. This soxS mutation was discovered in canine faecal E. coli isolates during a study investigating the effect of oral fluoroquinolone administration on faecal E. coli in healthy dogs. Methods We determined via quantitative real-time RT-PCR that both soxS and acrB were overexpressed in the clinical soxS Ala-12→Ser (soxSA12S) mutants and this may account for their FQ-MDR phenotype. We validated the FQ-MDR phenotype of the clinical isolates by reconstructing the WT and the soxSA12S mutation in the E. coli soxS null mutant JW4023 (soxS::kn) via allelic exchange. Results The JW4023 soxSA12S derivative showed an increase in MICs of ciprofloxacin, enrofloxacin and chloramphenicol compared with the JW4023 derivative in which the WT soxS had been restored. The soxS and acrB genes were overexpressed in the JW4023 soxSA12S mutant compared with JW4023 with WT soxS. A similar overexpression of efflux pump genes and an increase in antibiotic resistance were observed upon stimulation with paraquat to resemble the phenotype of the clinical soxSA12S isolates. Conclusions Our data suggest that the soxSA12S substitution mutation is selected in clinical isolates when dogs are exposed to a fluoroquinolone and that this mutation contributes to the FQ-MDR phenotype of E. coli isolates.

Keywords:
fluoroquinolones acrB soxS soxR

Published In:
Journal of Antimicrobial Chemotherapy, NULL, PP. 2228-2233