

TITLE: Occurrence of *mcr-1* and *mcr-3* in feces and in the environment from a Zoo

AUTHORS: SANTOS, L.D.R.¹; FURLAN, J.P.R.¹; RAMOS, M.S.¹; GALLO, I.F.L.¹; FREITAS, L.V.P.²; STEHLING, E.G.¹

INSTITUTION: ¹Departamento de Análises Clínicas, Toxicológicas e Bromatológicas, Faculdade de Ciências Farmacêuticas de Ribeirão Preto (FCFRP) - Universidade de São Paulo (USP) - Ribeirão Preto, Brasil. ²Universidade Federal de Minas Gerais (UFMG), Montes Claros, Brasil.

The recent emergence of *mcr-like* encoding genes, which are associated with resistance genes for colistin antibiotic, the last therapy options against infections by multidrug-resistant (MDR) Gram-negative bacteria, has warned the whole world. Antibiotic resistance is a global public health problem and MDR bacteria are responsible by high mortality rates in humans and animals. MDR bacteria carrying acquired antimicrobial resistance genes (ARGs), including *mcr-like* and clinically relevant β -lactamases encoding genes, have been reported in several ecological spheres, such as animal, human and the environment. This study aimed to investigate the presence of ARGs and replicon typing of plasmids in different Zoo samples. Samples of feces, water and soil were collected in a Zoo located in Minas Gerais State, Brazil and genomic DNA of the cultivable aerobic bacteria was extracted. The presence of ARGs and replicon type of plasmids were researched by PCR and the amplicons were sequenced for confirmation. Four samples of three points were analyzed, including feces (Raccoon), soil (Alligator environment), and soil and water (Blue Macaw environment). All samples presented *mcr-like*, being *mcr-1* detected in feces of raccoon and in the alligator environment while *mcr-3* was detected in soil and water from the blue macaw environment. In addition, ARGs that confer resistance to tetracyclines (*tetA*, *tetB*, *tetC*, *tetD*), β -lactams (*bla*_{CTX-M-Gp9}, *bla*_{CTX-M-Gp1}, *bla*_{CTX-M-Gp2}, *bla*_{CMY}, *bla*_{PER}, *bla*_{NDM}), sulfonamides (*sul1*, *sul2*, *sul3*), fluoroquinolones (*qnrB*, *qnrS*, *oqxA*, *oqxB*) and aminoglycosides (*ant(2'')*-*Ia*, *aph(3')*-*Ia*, *aac(6')*-*Ib*, *aadA*) were also detected, besides some replicon type of plasmids, such as IncN, IncFIC, IncFIB, IncHI1, ColE-like, IncFII_s, IncF and IncFIA. This study reports the presence of ARGs, including *mcr-1* and *mcr-3*, which are related to MDR phenotype in Gram-negative bacteria in different types of samples in a Zoo, which is worrying.

Keywords: Antimicrobial resistance; *mcr-1*; *mcr-3*; *bla*_{NDM}; Zoo.

Development Agency: This study was supported by São Paulo Research Foundation - FAPESP grant number 2018/19539-0].