ANTIBIOTIC RESISTANCE IN SWISS VEAL CALVES AT SLAUGHTER

Di Labio, E.[1], Regula, G.[1], Miserez, R.[2] and Ledergerber, U.[1]

[1] Federal Veterinary Office, Schwarzenburgstr. 155, CH-3003 Bern, Switzerland;
[2] National Centre for Zoonoses, Bacterial Animal Diseases and Antimicrobial Resistance, Institute of Veterinary Bacteriology, Vetsuisse Faculty, Laenggass str. 122, CH-3012 Bern, Switzerland.

SUMMARY

Resistant bacteria can be transferred from animals to humans and may compromise antimicrobial treatment in case of infection. Among bacteria isolated from veal calves resistance was mainly observed to antibiotics with high use in food animals. However, a rather high number of synercid-resistant *E. faecium* and ciprofloxacin-resistant *Campylobacter* were detected. Four *Campylobacter* strains exhibited resistance to ciprofloxacin, erythromycin and tetracycline. Calf purchase, large finishing groups, outdoor access, feeding of milk by-products and administration of antibiotics through feed upon arrival of the animals on the farm significantly increased the risk of antibiotic resistance at farm level.

Keywords: calves, *E. coli*, *Enterococcus* spp., *Campylobacter* spp., antibiotic resistance, risk factors

INTRODUCTION

The use of antimicrobial agents in food animals can select for resistant pathogenic and commensal bacteria in these animals. Through direct contact or the consumption of contaminated food resistant bacteria or resistance genes can be transmitted to humans and may hinder a successful treatment in case of infection. Due to the frequent use of antibiotics in the raising and finishing of calves and due to the possible feeding of milk which contains antimicrobial residues, veal calves have to be considered as a high-risk population for resistant bacteria. In order to ensure food safety, it is important to monitor the resistance situation in zoonotic agents and indicator bacteria in calves at slaughter. By identifying possible risk factors for antibiotic resistance at farm level specific measures can be taken to improve the management and reduce the usage of antibiotics and thereby the risk of resistance. The objectives of this project were i) to determine the prevalence of antibiotic resistance in *E. coli*, *Enterococcus* spp. and *Campylobacter* spp. in calves at slaughter, and ii) to identify possible risk factors at farm level associated with the occurrence of resistance.

MATERIAL AND METHODS

Faecal samples from 500 randomly selected calves originating from 129 farms were collected at slaughter. The samples were cultured for *E. coli*, *Enterococcus* spp., and *Campylobacter* spp. For antimicrobial susceptibility testing, the MIC (minimal inhibitory concentration) technique by the

broth microdilution method was performed as recommended by the Clinical and Laboratory Standards Institute (CLSI). Resistance was defined following the breakpoints published in approved literature (ARBAO-II 2005, CLSI M7-A6 and M100-S15, DANMAP 2004 and FDA 2002). From 100 farms, data on farm management, animal husbandry and antibiotic treatments of the calves were collected by questionnaire. Risk factors at farm level associated with resistance against selected antibiotics were identified by logistic regression.

RESULTS

E. coli were isolated from 467 out of the 500 faecal samples (93.4%). Of those, 321 strains (68.7%) were resistant to at least one of the tested antibiotics. Resistance was most frequently observed to sulfamethoxazole (64% of the isolates), tetracycline (56.5%), streptomycin (53.1%) and ampicillin (47.5%). All isolates were susceptible to ceftiofur and colistin. Prevalence of resistance in *E. coli* is shown in Figure 1. About 60% of the *E. coli* isolates were resistant to two or more antibiotics, most frequently to ampicillin/ neomycin/ streptomycin/ sulfamethoxazole and tetracycline.

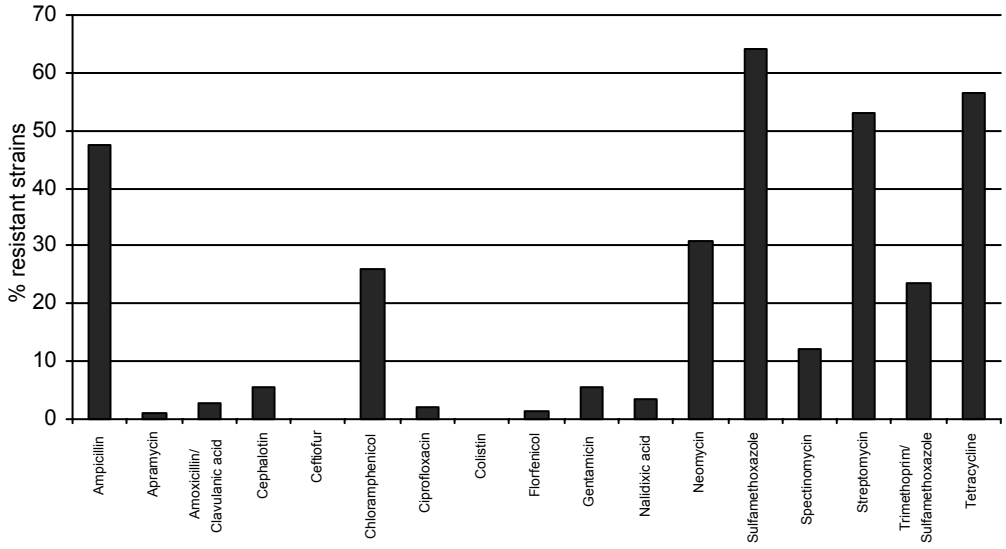

Figure 1. Prevalence of resistance in *E. coli* (n=467) from veal calves

In total, 413 *Enterococcus* strains were isolated from 359 (71.8%) out of the 500 faecal samples. Of those, 195 strains were typed as *E. faecalis* and 160 as *E. faecium*. All *E. faecium* and 99.5% of the *E. faecalis* isolates were resistant. The resistance pattern differed between the two species (Figure 2).

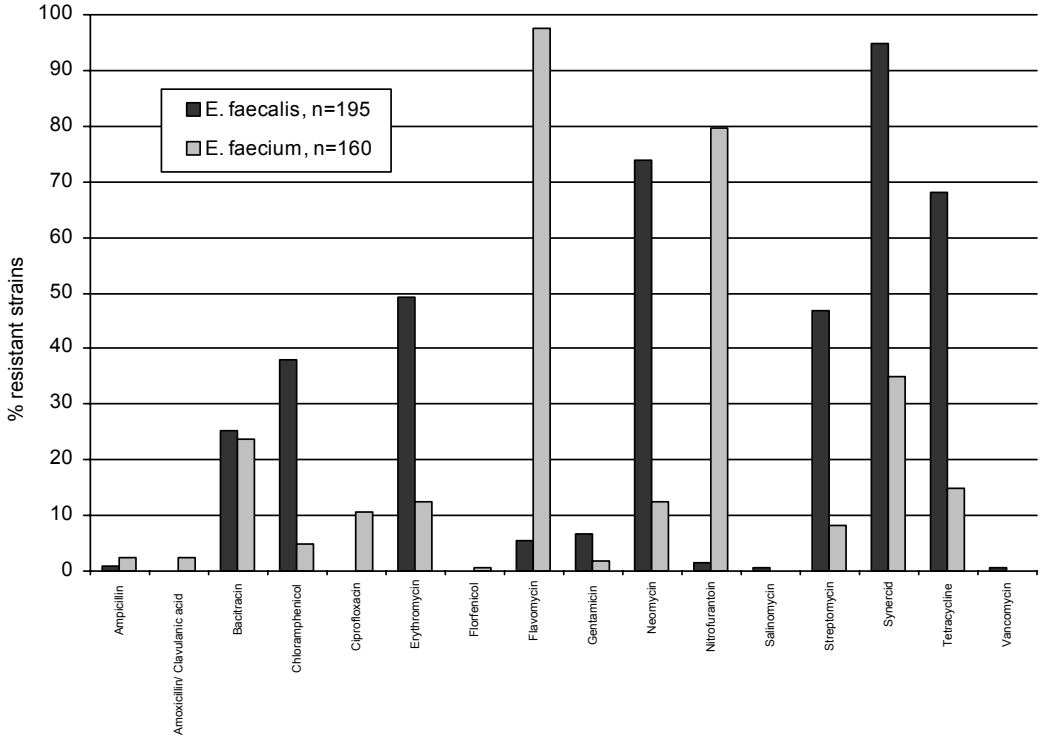

Figure 2. Prevalence of resistance in *E. faecalis* and *E. faecium* from veal calves

Campylobacter spp. were isolated from 202 (40.4%) out of the 500 faecal samples and 137 strains (67.8%) showed resistance to at least one of the tested antibiotics. Frequent resistance was observed to nalidixic acid (51.0% of all *Campylobacter* isolates), tetracycline (39.6%), ciprofloxacin (33.7%) and streptomycin (21.8%). No resistance to amoxicillin/ clavulanic acid, florfenicol and meropenem was detected. The 27 strains identified as *C. coli* showed resistance more often than the 129 *C. jejuni* isolates (88.8% and 54.3% of the isolates, respectively). Prevalence of resistance in *C. jejuni* and *C. coli* is shown in Figure 3. Multidrug resistance was more frequently observed in *C. coli* than in *C. jejuni* (63% and 38.8%, respectively). Two *C. coli* and two *C. hyointestinalis* with multiple resistance exhibited resistance to ciprofloxacin, erythromycin and tetracycline. No erythromycin-resistant *C. jejuni* was found.

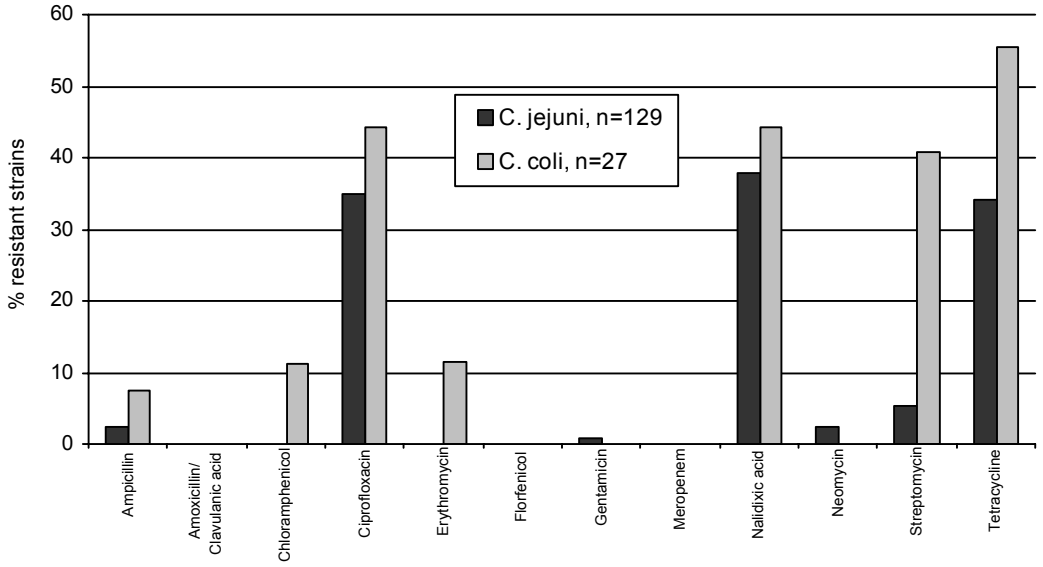

Figure 3. Prevalence of resistance in *C. jejuni* and *C. coli* from veal calves

The analysis of possible risk factors for increased antibiotic resistance at farm level revealed significant effects for calf purchase, large finishing groups, outdoor access, feeding of milk by-products and administration of antibiotics through feed upon arrival of the animals on the farm. Protective effects were obtained for production with specific regulations, i. a. restrictions in antimicrobial usage, and for administration of antibiotics by injection. The possible feeding of milk containing antimicrobial residuals showed no effect on the occurrence of resistance.

DISCUSSION

Resistance was frequently observed to antibiotics with high use in food animals such as tetracycline, streptomycin, penicillins and sulfonamides. Resistance to antibiotics used for human therapy was generally low. Only one vancomycin-resistant *Enterococcus* strain was found. However, a relatively high number of *E. faecium* isolates showed resistance to synercid, an antibiotic primarily used for the treatment of vancomycin-resistant *E. faecium*-infections in humans. About one-third of the *Campylobacter* isolates showed resistance to ciprofloxacin and four *Campylobacter* strains with multiple resistance exhibited resistance to ciprofloxacin, erythromycin and tetracycline, the antibiotics most frequently used for the treatment of human campylobacteriosis. However, *C. jejuni*, the *Campylobacter* species most frequently involved in human illness, was not among these multiresistant strains. Calf purchase, large finishing groups, outdoor access and feeding of milk by-products increased the risk for antibiotic resistance probably by having an influence on calf health and thereby an indirect impact on antibiotic use.

In conclusion, the study showed that veal calves may serve as a reservoir for resistant bacteria. However, most observed resistance prevalences were comparable to the prevalences found in bacteria from other Swiss food animals at slaughter (Anonymous, 2007). Nevertheless, calf

husbandry should be optimized not only with respect to animal welfare, but also to animal health and food safety. By improving farm management, the usage of antibiotics and thereby the risk of resistance can be reduced.

REFERENCES

Anonymous, 2007. Antibiotic Resistance. Swiss Zoonoses Report 2006, Federal Veterinary Office Magazine 3/07 (In press).