PUBLIC HEALTH, FOOD QUALITY AND TRACEABILITY

Assessment of the *in vitro* sensitivity of enterobacteria collected from fecal samples of young calves treated or not with paromomycin

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INTRODUCTION

- Cryptosporidiosis, caused by *Cryptosporidium parvum,* is a severe disease of young calves resulting in diarrhea, weight loss, and occasionally mortality.
- In France, halofuginone and paromomycin are used orally to control the disease.
- Paromomycin is an aminoglycoside antibiotic used only to treat (and not prevent) diarrhea. Oral administration of paromomycin to calves may result in the selection of resistance to aminoglycosides and other antimicrobial agents in bacteria present in the gastrointestinal tract of exposed animals.

OBJECTIVE

The objective of this study was to compare the *in vitro* sensitivity to antimicrobials of bacteria isolated from the faeces of young calves exposed or not exposed to paromomycin, as well as calves treated or not treated with paromomycin.

MATERIALS AND METHODS

- Ten farms, representative of the French beef cattle production, were included in the study. In five farms, young calves were systematically exposed to paromomycin for the treatment of diarrhea (PR farms) whereas other five farms did not use paromomycin or any other aminoglycosides (non-PR farms).
- In PR farms, the faeces of 5 calves treated with paromomycin for diarrhea during the previous week were sampled on Day 0 (D0) and then 2 months later (D60). From the same five farms, faeces from 5 calves not treated with paromomycin were also collected on D0 and D60. In the five Not-PR farms, the faeces of 5 calves of approximately the same age, were also collected with the same sampling schedule.
- *Escherichia coli* and *Enterococcus* spp. isolates were obtained from the faecal samples and subjected to antibiograms for 15 antimicrobials and Etest® (bioMérieux, France) values for paromomycin.

In this study, the systematic use of paromomycin for treating diarrhea in young calves resulted in a higher *in vitro* occurrence of enterobacterial resistance to aminoglycosides and other antibiotics. Consequently, there is a potential rise in antimicrobial resistance among bacteria found in the gastrointestinal tract of these calves

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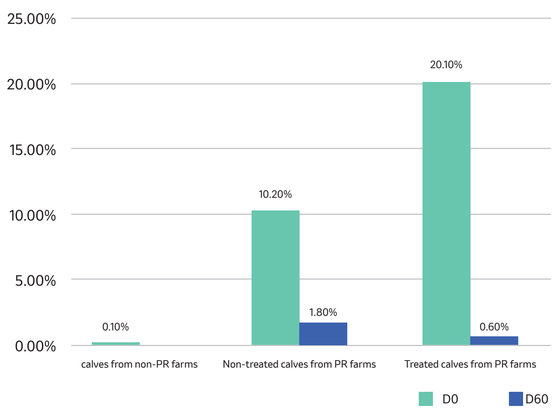
RESULTS

At D0, the proportion of the highest paromomycin Etest® value category (>1024 mg/L) increased among E. coli isolates with the paromomycin exposure, from 0.1% in calves of non-PR farms, 10.2% in not-treated calves in PR farms and 20.1% in calves that were treated with paromomycin in PR farms. This proportion drastically decreased at D60, to 0%, 1.8% and 0.6% respectively **(Fig 1).**

FIGURE 1. Proportion of the highest ETest® value category by level of paromomycin exposure among *E. coli* isolates



RESULTS

- Regarding PR farms, *E. coli* isolates collected at D0 **(Table 1)** from paromomycin treated calves, had a higher proportion of resistance for most antibiotics compared to the isolates of not treated calves from PR farms. Overall, the highest resistance was observed in calves treated with paromomycin.
- At D0 and D60 **(Table 2)**, the proportion of resistance was very low or negligible in *E. coli* isolates from calves from non-PR farms in comparison to calves from PR farms.
- *Enterococcus* isolates collected at D0 from treated and not-treated calves from PR farms presented a very high resistance proportion for almost all antibiotics tested. Isolates of non-PR farms presented the lowest resistance proportion compared to isolates of the PR farms. At D60, antimicrobial resistance was still high in PR farms.

TABLE 1. Percentage (%) of coliforms in the S/I/R (Susceptible/Intermediate / Resistant) categories at D0 according to the sampled calves.

Antimicrobial	Calves treated from PR farms (n of isolates = 249)			Calves not treated from PR farms (n of isolates = 236)			Calves from non-PR farms (n of isolates = 243)		
	S	I	R	S	I	R	S	I	R
Neomycin	25.4	0.8	73.8	57.3	1.3	41.4	100	0	0
Gentamycin	71.3	1.2	27.5	76.7	3.5	19.8	83.9	0	16.1
Apramycin	96.3	0	3.7	93.4	0	6.6	100	0	0
Florfenicol	66	0	64	63.4	0	36.6	83.9	0	16.1
Amoxicillin	10.7	2	87.3	39.6	0.9	59.5	95.3	0.4	4.2
Amoxicillin clavulanate	56.6	19.7	23.8	79.7	12.3	7.9	100	0	0
Cephalexin	81.6	0	18.4	98.2	0	1.8	99.6	0.4	0
Cefquinome	94.7	2.9	2.5	100	0	0	100	0	0
Ceftiofur	97.5	0	2.5	99.6	0	0.4	100	0	0
Colistin	100	0	0	100	0	0	100	0	0
Oxolinic acid	63.9	0.8	35.2	81.5	1.3	17.2	100	0	0
Flumequine	64.3	1.6	34	82.4	1.8	15.9	100	0	0
Marbofloxacin	91.8	0	8.2	89	0	11	100	0	0
Enrofloxacin	91.8	0	8.2	89	0	11	100	0	0
Trimethoprim sulfamethoxazol	45.9	0	54.1	50.7	0.4	48.9	83.9	0	16.1
Tetracycline	33.2	0	66.8	42.3	0.4	57.3	66.9	0	33.1

TABLE 2. Percentage (%) of coliforms in the S/I/R categories at D60 according to the sampled calves.

Antimicrobial	Calves treated from PR farms (n of isolates = 249)			Calves not treated from PR farms (n of isolates = 236)			Calves from non-PR farms (n of isolates = 243)		
	S	I	R	S	I	R	S	I	R
Neomycin	96	0	4	89.4	0	10.6	99.6	0	0.4
Gentamycin	98.4	0	1.6	99.2	0	0.8	100	0	0
Apramycin	100	0	0	100	0	0	100	0	0
Florfenicol	90.4	0	9.6	95.3	0	4.7	94.7	0	5.3
Amoxicillin	79.9	8.8	11.2	86.4	5.5	8.1	89.3	4.9	5.8
Amoxicillin clavulanate	96.4	0.8	2.8	99.6	0	0.4	96.7	0	3.3
Cephalexin	99.6	0	0.4	99.2	0.4	0.4	100	0	0
Cefquinome	99.2	0	0.8	100	0	0	98.8	1.2	0
Ceftiofur	99.6	0	0.4	100	0	0	100	0	0
Colistin	100	0	0	100	0	0	100	0	0
Oxolinic acid	98.4	0	1.6	98.7	0	1.3	100	0	0
Flumequine	98.4	0.4	1.2	98.7	0	1.3	100	0	0
Marbofloxacin	99.6	0	0.4	99.2	0	0.8	100	0	0
Enrofloxacin	99.6	0	0.4	99.2	0	0.8	100	0	0
Trimethoprim sulfamethoxazol	92.8	0	7.2	89.8	0.4	9.7	94.7	0	5.3
Tetracycline	86.3	0	13.7	79.2	0	20.8	96.3	0	3.7

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