PIG REARING METHODS AND RATE OF ANTIMICROBIAL RESISTANT *ESCHERICHIA COLI*

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Introduction

The antimicrobial resistance question trends to be more and more considered as a global ecological problem. The normal intestinal microfloras of animals represent a reservoir of antibioresistant strains and/or antibioresistance genes, that can be transmitted to humans. *Escherichia coli* (*E. coli)* are common inhabitants of the intestinal tracts which show a great ability to gain resistance under antimicrobial use (**5**, **6**, **9**). Not only pathogenic to animals and humans, they can also be potential donors of antibioresistance determinants to be transferred to other pathogenic bacteria.

The aim of this study was to assess antimicrobial resistance rates in the *E. coli* population of healthy French pigs that were reared according to different methods.

Material and Methods

Four classes of pig farms with various rearing methods were constituted as follows:

Class	Age at slaughter	Ground surface / animal	Type of areas surface / animal	Antimicrobial use constraints
1	182 days	> 1.2 m^2	straw or outdoor	No preventive antibiotherapy and maximum 2 treatments / animal in case of disease
2	182 days	> 1.2 m^2	straw or outdoor	No antimicrobial growth promoters
3	-	0.65 to 1.1 m^2	slatted floor	Low health expenses
4	-	0.65 m^2	slatted floor	High health expenses

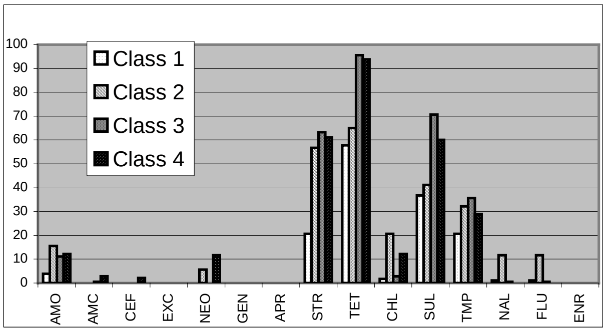
In each class, 6 pig farms belonging to at least 4 different commercial organizations were included in the study. Altogether, 24 farms were sampled. Sampling was carried out between april 2001 and april 2002.

In each farm, 30 finishing pigs were randomly selected and fecal material was collected via rectal swabs. Altogether 720 fecal samples were collected. The cotton-tipped 30 swabs from each farm were cut and pooled, thus forming a sole composite suspension which was plated onto Mac Conkey agar. From each plate, 30 colonies identified as being *E. coli* after biochemical trias, were tested for antimicrobial susceptibility using disk diffusion method on Müller-Hinton agar (BA 20, program 116). Interpretation of zone diameters and classification into susceptible or resistant categories were performed according to the guidelines of the Antibiogram comity of the French Society of Microbiology. Intermediate responses were included in the resistant group. The fifteen next antimicrobial compounds were included:

Name	Symbol	Breakpoint diameters after an overnight incubation at 37°C (mm)	Corresponding breakpoint concentrations (mg/L)
Amoxicillin	AMX	14-21	4-16
Amoxicillin and clavulanic acid	AMC	14-21	4-16
Cefalexin	CN	12-18	8-32
Ceftiofur	XNL	21-24	2-8
Neomycin	N	15-17	8-16
Gentamycin	GM	14-16	4-8
Apramycin	APR	11-14	16-32
Streptomycin	S	13-15	8-16
Tetracycline	TE	17-19	4-8
Chloramphenicol	C	19-23	8-16
Sulfonamides	SSS	12-17	64-256
Trimethoprime	TMP	12-16	4-8
Nalidixic Acid	NA	15-20	8-16
Flumequin	UB	21-25	4-8
Enrofloxacin	ENR	18-22	0.5-1

Results

Rates of resistant *E. coli* in the four classes:



Discussion

Resistance rates found in the standard classes 3 and 4 are in agreement with these found by the National Surveillance Plan performed in France in 2000 (**4**). High resistance rates were observed for the most commonly used antimicrobial compounds (tetracycline 95%, sulfonamides 65%, trimethoprim 32%). Some antibiotics which had been used extensively in the past caused significant resistance rates to persist (streptomycin 62%, chloramphenicol 7%). But little or no resistance was observed for some compounds used in human medicine, like the cephalosporins, the aminoglycosides and the quinolones families. With a percentage of 12%, few isolates were resistant to amoxicillin comparing with its use, and less than 2% were resistant to its association with clavulanic acid.

Classes 3 and 4 displayed strictly the same profile, so proving that previous health expenses is not a good indicator to estimate antimicrobial exposure, on one hand because they include drugs other than antimicrobials (vaccines, antiparasitic drugs…) and on the other hand because they were calculated from previous batches.

In the class 1 antimicrobial use is really exceptional and no pig included in the study received any antimicrobial treatment. So significantly lower resistance rates in this class is quite normal. The rates of 58% for tetracycline, 37% for sulfonamides and 21% for the trimethoprim and the streptomycin, were never more important than could be expected. These results confirm the well known fact that the selection of resistant fecal coliforms by antibiotic use, may not be rapidely reversed by long-term withdrawal (**7**). Contarily to the pre-antibiotic era *E. coli* collections that were sensible to all compounds (**5**), genetic resistance determinants are nowadays widespread among enteric bacteria, even in the absence of antibiotic use. The resistance genes persistence can be the consequence of the gene association with other genetic elements which help to conserve it (**2**, **3**, **11**).

The class 2 where rearing conditions were less intensive, showed resistance rates lower than the standard classes 3 and 4 for tetracycline and sulfonamides, which are really less used in this class. Several authors (**7**, **10**) ever reported such result in concreted pens compared with pigs on pasture: comparable or inferior resistance rates, depending on the antimicrobial families. But here the overall rates were not statistically different from these of the standard classes. This result suggests that an increased number in resistant strains from the intestine is mainly the result of antimicrobial exposure, that was quite the same between the classes 2 and 3. In the same way, several other researchers noted that herds with low antimicrobial use obtained resistance patterns approaching those of herds continuously exposed to antibiotics (**1**, **7**, **8**).

Conclusion

These results allow to suppose that less intensive pigs rearing conditions are not sufficient to reduce resistant strains rates significantly. Only a strict antimicrobial use limitation is effective in preserving the sensibility of most of the strains.

As the debate continues over the public health impact of agricultural use of antimicrobial medicines, veterinary and pig production organizations are waiting for information to achieve intended animal health goals while minimizing resistance problems.

These data are the result of a national approach to link usages and antimicrobial resistance rates, in order to clarify how to use antibiotics carefully.

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