



Abstract

Background: *Campylobacter* spp are a frequent cause of diarrhea in man, mostly originating from poultry. It has been suggested that the veterinary use of antibiotics is largely responsible for resistance in human isolates particularly to quinolones.

Methods: From June to December 1998, 436 *Campylobacter* strains were isolated from poultry, and pigs. Species identification was performed by multiplex PCR and SDS-PAGE of whole-cell proteins. Their activity to 6 antimicrobial drugs was determined by the agar dilution method according to NCCLS standards. Breakpoints were: erythromycin ≥ 8 $\mu\text{g/ml}$, ampicillin and nalidixic acid ≥ 32 $\mu\text{g/ml}$, ciprofloxacin ≥ 4 $\mu\text{g/ml}$, and tetracycline and gentamycin ≥ 16 $\mu\text{g/ml}$.

Results and conclusions: Number *C. jejuni*/*C. coli* per animal species were: chickens, 246/58; turkeys, 88/4; pigs, 2/38. Erythromycin resistance was statistically significantly higher in *C. coli*, particularly from pigs. Alarming high resistance rates to ciprofloxacin were noted, particularly for *C. coli* from chicken. The latter suggests that resistance of *Campylobacter* in humans derives from animals.

Introduction

Campylobacters are important causes of gastroenteritis in developing and developed countries; they are the most frequently identified bacterial causes of diarrhea in the United States.

Diarrhea caused by *Campylobacter jejuni* and *C. coli* is a self-limiting disease and does not require therapy except in severe cases with prolonged disease and serious symptoms. Erythromycin is an old and well-established antimicrobial agent which has been the drug of choice for *Campylobacter* enteritis. Fluoroquinolones have also proved effective in the treatment and prevention of *Campylobacter* diarrhea. Several recent reports, however, have described a substantial increase of fluoroquinolone resistance in *Campylobacter* species.

Campylobacter infection is mainly a food-borne disease in which poultry play a particularly important role. There is growing scientific evidence that the use of antibiotics in food animals leads to the development of resistant pathogenic bacteria that can reach humans through the food chain.

Methods

From June to December 1998, 436 *Campylobacter* strains were isolated from poultry, and pigs. Species identification was performed by multiplex PCR (P. Vandamme et al., Int. J. Syst. Bact., 1997; 47: 1055-1060) and SDS-PAGE of whole-cell proteins. Their activity to 6 antimicrobial drugs was determined by the agar dilution method according to NCCLS standards. Breakpoints for resistance were: erythromycin ≥ 8 $\mu\text{g/ml}$, ampicillin and nalidixic acid ≥ 32 $\mu\text{g/ml}$, ciprofloxacin ≥ 4 $\mu\text{g/ml}$, and tetracycline and gentamycin ≥ 16 $\mu\text{g/ml}$.

Results (1)

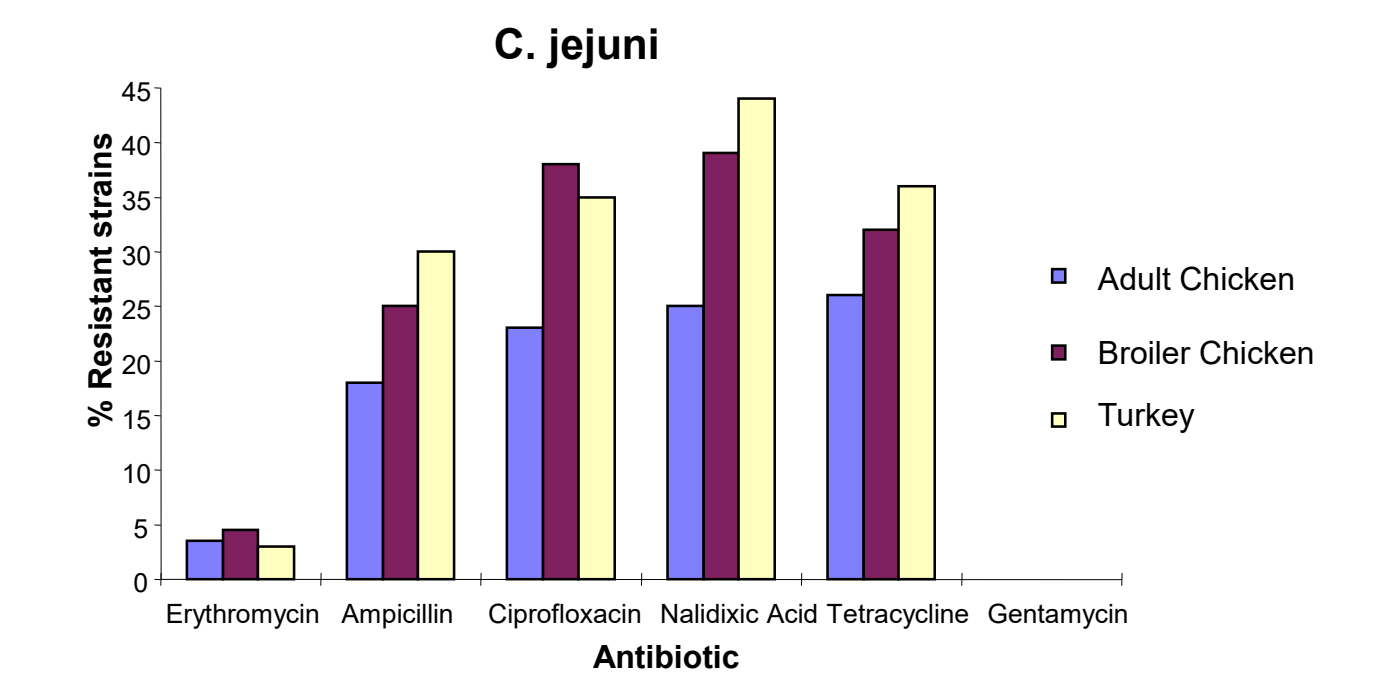
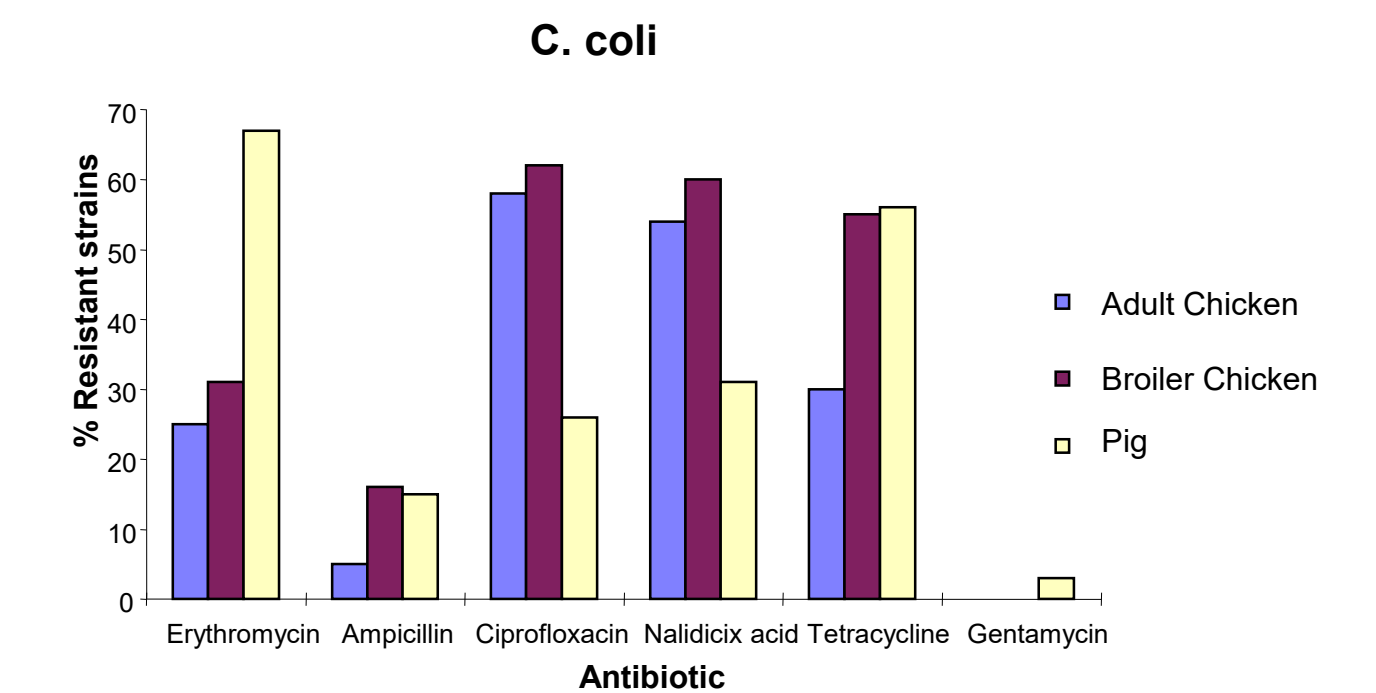
C. jejuni was found more often in poultry than *C. coli* (84 vs. 16%). In pigs the situation was reversed (99 vs. 1%). The number of *C. jejuni*/*C. coli* per animal species were: chickens, 246/58; turkeys, 88/4; pigs, 2/38.

We tested the susceptibility of these *Campylobacter* strains to 6 antibiotics. Results are shown in the table below.

Antibiotic	Chicken (304)			Turkey (92)			Pig (40)					
	<i>C. coli</i> (58)			<i>C. jejuni</i> (246)			<i>C. jejuni</i> (88)			<i>C. coli</i> (38)		
	MIC ₅₀	MIC ₉₀	% R	MIC ₅₀	MIC ₉₀	% R	MIC ₅₀	MIC ₉₀	% R	MIC ₅₀	MIC ₉₀	% R
Erythromycin	4	16	30	2	4	4	2	4	3	8	>64	67
Ampicillin	8	32	11	8	32	22	8	64	30	8	32	15
Ciprofloxacin	8	64	60	0.5	64	31	0.5	64	35	0.5	32	26
Nalidixic acid	64	>128	57	8	>128	32	8	>128	44	16	64	31
Tetracycline	4	>64	43	0.5	>64	29	0.5	>64	36	32	>64	56
Gentamycin	0.25	0.5	0	0.25	0.5	0	0.25	0.5	0	0.5	1	3

Resistance to the macrolide erythromycin was significantly higher in *C. coli*, particularly in *C. coli* isolated from pigs; 67 % of the *C. coli* strains isolated from pigs were resistant to erythromycin. Alarming high resistance rates to the fluoroquinolone ciprofloxacin were also noted, particularly for *C. coli* from chicken.

Results (2)



Discussion and conclusions

Alarming high resistance rates are noticed for erythromycin and the fluoroquinolones. Tylosin, an antibiotic of the same class as erythromycin is used as growth promotor in pigs. Interestingly, resistance to erythromycin was the highest for pigs.

The fluoroquinolones are used in human medicine, but it is unlikely that the human use of these antibiotics alone has led to the development of quinolone resistance in *Campylobacter* isolated from man. It seems more probably that the introduction of fluoroquinolones into veterinary medicine, i. e., in the treatment of poultry, contributed significantly to the appearance of quinolone resistant *Campylobacter* causing infections in man.