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# Antimicrobial resistance in *E. coli* isolated from food producing animals

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### Introduction

Commensal *E. coli* are regarded as general indicators for resistance among Gram negative bacteria. They are present in large numbers in nearly all animal species. Consequently, commensal *E. coli* from the intestinal flora can be isolated at almost every sampling occasion. This approach allows the surveillance of antimicrobial resistance among *E. coli* isolates from different animal sources. Because they have been studied worldwide, *E. coli* are also useful in comparing geographic distribution of antimicrobial resistances. Moreover, the genetic background of resistance is well known in this species, which allows a scientific interpretation of the resistance data.

#### **Materials and methods**

Faecal material was taken from 4 animal categories [broiler chickens, pigs, bovines (for meat production) and veal calves] in 2011. *E. coli* strains were identified by conventional isolation procedures. A total of 765 isolates (poultry: 420, pigs: 157, bovines: 154, veal calves: 34) were tested for susceptibility by a micro broth dilution method using Eucast breakpoints.

#### Results

Table 1. Antimicrobial resistance in commensal E. coli									Table 2. I	
Antimicrobial	Pigs		Poultry		Bovines		Veal calves			%R
Antimicrobiai										CI
	%R	CI	%R	CI	%R	CI	%R	CI		N
AMP	51.0	42.9-59.0	85.0	81.2-88.0	26.6	19.8-34.0	70.6	52.5-85.0		AMP
CHL	26.8	20.0-34.0	24.3	20.5-29.0	14.3	9.2-21.0	50.0	32.4-68.0		CHL
CIP	14.0	9.0-20.0	62.9	58.0-67.0	11.0	6.6-17.0	41.2	24.6-59.0		CIP
COL	0.6	0.0-3.0	0.5	0.1-2.0	0.6	0.0-4.0	14.7	5.0-31.0		COL
FFN	4.5	1.8-9.0	0.7	0.1-2.0	6.5	3.2-12.0	14.7	5.0-31.0		FFN
FOT	4.5	1.8-9.0	19.1	15.4-23.0	4.5	1.8-9.0	0.0	0.0-10.0		FOT
GEN	4.5	1.8-9.0	5.0	3.1-8.0	3.9	1.4-8.0	20.6	8.7-38.0		GEN
KAN	3.2	1.0-7.0	6.9	4.7-10.0	5.2	2.3-10.0	29.4	15.1-47.0		K A N
NAL	12.7	8.0-19.0	63.1	58.3-68.0	12.3	7.6-19.0	41.2	24.6-59.0		
SMX	58.6	50.5-66.0	74.3	69.8-78.0	28.6	21.6-36.0	79.4	62.1-91.0		
STR	43.3	35.4-51.0	60.1	55.1-65.0	23.4	16.9-31.0	52.9	35.1-70.0		SMX
TAZ	2.5	0.7-6.0	10.0	7.3-13.0	3.9	1.4-8.0	0.0	0.0-10.0		STR
TET	56.7	48.6-65.0	64.8	60.0-69.0	19.5	13.5-27.0	73.5	55.6-87.0		TAZ
TMP	50.3	42.2-58.0	63.1	58.3-68.0	19.5	13.5- 27.0	70.6	52.5-85.0		TET
	Table 1. AntimicrobialAntimicrobialAMPAMPCHLCIPCOLFFNFOTGENKANNALSMXSTRTAZTETTMP	Antimicrobial resistance   Antimicrobial P   AMP 51.0   CHL 26.8   CIP 14.0   COL 0.6   FFN 4.5   FOT 4.5   GEN 4.5   KAN 3.2   NAL 12.7   SMX 58.6   STR 43.3   TAZ 2.5   TET 56.7   TMP 50.3	Antimicrobial resistance in commensation   Antimicrobial Pigs   AMP 51.0 42.9-59.0   CHL 26.8 20.0-34.0   CIP 14.0 9.0-20.0   COL 0.6 0.0-3.0   FFN 4.5 1.8-9.0   FOT 4.5 1.8-9.0   GEN 4.5 1.8-9.0   MAN 3.2 1.0-7.0   NAL 12.7 8.0-19.0   SMX 58.6 50.5-66.0   STR 43.3 35.4-51.0   TAZ 2.5 0.7-6.0   TET 56.7 48.6-65.0   TMP 50.3 42.2-58.0	Antimicrobial resistance in commensal E. coli   Antimicrobial Pigs Por   AMP 51.0 42.9-59.0 85.0   CHL 26.8 20.0-34.0 24.3   CIP 14.0 9.0-20.0 62.9   COL 0.6 0.0-3.0 0.5   FFN 4.5 1.8-9.0 0.7   FOT 4.5 1.8-9.0 19.1   GEN 4.5 1.8-9.0 5.0   KAN 3.2 1.0-7.0 6.9   NAL 12.7 8.0-19.0 63.1   SMX 58.6 50.5-66.0 74.3   STR 43.3 35.4-51.0 60.1   TAZ 2.5 0.7-6.0 10.0   TET 56.7 48.6-65.0 64.8   TMP 50.3 42.2-58.0 63.1	Table 1. Antimicrobial resistance in commensal E. coli   Antimicrobial Pigs Poultry   AMP 51.0 42.9-59.0 85.0 81.2-88.0   CHL 26.8 20.0-34.0 24.3 20.5-29.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0   COL 0.6 0.0-3.0 0.5 0.1-2.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0   FOT 4.5 1.8-9.0 19.1 15.4-23.0   GEN 4.5 1.8-9.0 5.0 3.1-8.0   NAL 12.7 8.0-19.0 63.1 58.3-68.0   SMX 58.6 50.5-66.0 74.3 69.8-78.0   STR 43.3 35.4-51.0 60.1 55.1-65.0   TAZ 2.5 0.7-6.0 10.	Antimicrobial resistance in commensal E. coli   Antimicrobial Pigs Poultry Box   AMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5   FOT 4.5 1.8-9.0 19.1 15.4-23.0 4.5   GEN 4.5 1.8-9.0 5.0 3.1-8.0 3.9   KAN 3.2 1.0-7.0 6.9 4.7-10.0 5.2   NAL 12.7 8.0-19.0 63.1 58.3-68.0 12.3   SMX 58.6 50.5-66.0 74.3 69.8-78.0 28.6   STR 43.3 35.4-51.0 60.1 55.1-65.0 23.4   TAZ 2.5 0.7-6.0 10.0 7.3-13.	Antimicrobial resistance in commensal E. coli   Antimicrobial Pigs Poultry Bovines   AMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6 19.8-34.0   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3 9.2-21.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0 6.6-17.0   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6 0.0-4.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0   FOT 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0   FOT 4.5 1.8-9.0 19.1 15.4-23.0 4.5 1.8-9.0   GEN 4.5 1.8-9.0 5.0 3.1-8.0 3.9 1.4-8.0   KAN 3.2 1.0-7.0 6.9 4.7-10.0 5.2 2.3-10.0   NAL <th>Antimicrobial resistance in commensal E. coli Poultry Bovines Veal   Antimicrobial Pigs Poultry Bovines Veal   AMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6 19.8-34.0 70.6   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3 9.2-21.0 50.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0 6.6-17.0 41.2   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6 0.0-4.0 14.7   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7   FOT 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7   FOT 4.5 1.8-9.0 19.1 15.4-23.0 4.5 1.8-9.0 0.0   GEN 4.5 1.8-9.0 5.0 3.1-8.0 3.9 1.4-8.0 20.6   KAN 3.2 1.0-7.0 6.9 4.7-10.0</th> <th>Antimicrobial resistance in commensal E. coli Pigs Poultry Bovines Veal cluss   AMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6 19.8-34.0 70.6 52.5-85.0   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3 9.2-21.0 50.0 32.4-68.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0 6.6-17.0 41.2 24.6-59.0   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6 0.0-4.0 14.7 5.0-31.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   GEN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   GEN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   K</th> <th>Table 1. Antimicrobial resistance in commensal E. coli   Antimicrobial Pigs Poultry Bovines Veal calves   MMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6 19.8-34.0 70.6 52.5-85.0   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3 9.2-21.0 50.0 32.4-68.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0 6.6-17.0 41.2 24.6-59.0   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6 0.0-4.0 14.7 5.0-31.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   FFN 4.5 1.8-9.0 19.1 15.4-23.0 4.5 1.8-9.0 0.0 0.0-10.0   GEN 4.5 1.8-9.0 5.0 3.1-8.0 3.9 1.4-8.0 20.6 8.7-38.0   KAN 3.2 1.0-7.0 6.9 4.7-10.0 5.2 2.3-10.0</th>	Antimicrobial resistance in commensal E. coli Poultry Bovines Veal   Antimicrobial Pigs Poultry Bovines Veal   AMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6 19.8-34.0 70.6   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3 9.2-21.0 50.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0 6.6-17.0 41.2   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6 0.0-4.0 14.7   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7   FOT 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7   FOT 4.5 1.8-9.0 19.1 15.4-23.0 4.5 1.8-9.0 0.0   GEN 4.5 1.8-9.0 5.0 3.1-8.0 3.9 1.4-8.0 20.6   KAN 3.2 1.0-7.0 6.9 4.7-10.0	Antimicrobial resistance in commensal E. coli Pigs Poultry Bovines Veal cluss   AMP 51.0 42.9-59.0 85.0 81.2-88.0 26.6 19.8-34.0 70.6 52.5-85.0   CHL 26.8 20.0-34.0 24.3 20.5-29.0 14.3 9.2-21.0 50.0 32.4-68.0   CIP 14.0 9.0-20.0 62.9 58.0-67.0 11.0 6.6-17.0 41.2 24.6-59.0   COL 0.6 0.0-3.0 0.5 0.1-2.0 0.6 0.0-4.0 14.7 5.0-31.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   FFN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   GEN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   GEN 4.5 1.8-9.0 0.7 0.1-2.0 6.5 3.2-12.0 14.7 5.0-31.0   K	Table 1. 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Table 2. List of abbreviations								
%R	Resistant isolates (%)							
CI	Confidence interval							
Ν	Number of strains							
AMP	Ampicillin							
CHL	Chloramphenicol							
CIP	Ciprofloxacin							
COL	Colistin							
FFN	Florphenicol							
FOT	Cefotaxime							
GEN	Gentamicin							
KAN	Kanamycin							
NAL	Nalidixic acid							
SMX	Sulfonamide							
STR	Streptomycin							
TAZ	Ceftazidime							
TET	Tetracycline							
TMP	Trimethoprim							

### Multi-resistance in commensal E. coli













Multi-resistance in commensal *E. coli* from

bovines

100



Cumulative % of multi-resistance in commensal *E. coli* from bovines



## Conclusion

In general, it can be stated that resistance frequencies in poultry isolates are higher than in pig and bovine isolates. Resistance percentages in veal calves are similar to those in pigs, however it should be noted that the number of isolates tested was much lower. Noteworthy is the difference between calves and older bovines: veal calf isolates are clearly more multi-resistant than bovine isolates.



.JC