ANTIMICROBIAL RESISTANCE MONITORING IN STYRIA (AUSTRIA)

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Abstract

The Styrian Resistance Monitoring Programme (REMOST) was launched by the Department of Veterinary Administration in 1999. The resistance behaviour of zoonotic pathogens and indicator bacteria from slaughter pigs, cattle, broilers and bulk milk of cattle are tested on a continuous basis. These data are combined with current analysis results from human medicine and with international animal production data in order to assess the risk of transmission of resistance factors.

INTRODUCTION

The EU Council Resolution of 8 June 1999 on antibiotic resistance entitled "A strategy against the microbial threat" calls on Member States to develop multidisciplinary and cross-sectoral strategies to control antibiotic resistance (ANONYMOUS, 1999). The emergence of antibiotic resistance in animal pathogens is closely connected with therapeutic, prophylactic and metaphylactic measures in animal husbandry. The antibiotic resistance of zoonotic pathogens (*Salmonella enterica*, *Campylobacter* spp., *Listeria monocytogenes* or pathogenic *E. coli)* and of so-called indicator bacteria (*Enterococcus* spp. or *E. coli)* in food of animal origin are of increasing significance. The Department of Veterinary Administration in Styria began with the establishment of a resistance monitoring programme in 1999 after extensive preparatory work in order to ensure effective consumer protection (KÖFER and PLESS, 2002) with the trend-setting Danish activities playing a key role in this respect (BAGER, 2000).

MATERIALS AND METHODS

The REMOST-programme is designed to investigate the resistance behaviour of bacteria on a continuous basis. It consists of a sampling system, which indicates where, how and when samples are to be taken, an analysis system for the continuous analysis of data and a catalogue of measures based on these modules. Isolation of the bacterial strains is done by streaking the material to be tested (faeces, meat, milk) on different agar media: *E. coli* (Coli IDAgar, Biomerieux No. 42017), *Enterococcus faecalis/faecium* (CATC-medium, ÖNORM DIN 10106), *Salmonella enterica* (MSRV method), *Campylobacter jejuni/coli* (mCCDA). After biochemical verification of suspect colonies, the resistance behaviour is tested using the SENSITITRE® system of MCS-Diagnostics, Veldpoort 28, NL-6071 JL Swalmen.

The test results are published on an annual basis and are fed into a central database, which is linked to the VETGIS© Styria geographical information system (FUCHS et al., 2001).

RESULTS AND DISCUSSION

The REMOST report 2001 concentrates solely on the resistance situation of Salmonella in poultry, since the detection rate of Salmonella in faeces and on the meat surfaces of cattle and pigs

is very low. The resistance status of all Salmonella isolates tested is basically favourable. High resistance rates of 62 % for faecal isolates and 69 % for meat isolates from poultry (with the exception of *S. enteritidis*) were observed only to streptomycin. The quinolones nalidixic acid and ciprofloxacin demonstrated a differentiated picture. While the resistance rates to nalidixic acid were in the 20 to 30 % range, not a single Salmonella isolate showed resistance to ciprofloxacin. All of the five *S. typhimurium* DT 104 strains tested were resistant to five antibiotics.

Table 1. *Occurrence of resistance among Campylobacter jejuni from broilers (faeces) n = 97*

	range	min.	max.	breakpoint	MIC 50	MIC 90	res. in % (95%) Confidence Interval
Tetracycline	0,015-16	0,03	>16	8	0,25	>16	**31 (21,9 - 41,1)**
Ampicillin/ Sulbactan	0,015-32	0,03	32	16	2	16	**3 (0,6 - 8,8)**
Ampicillin	0,015-32	0,015	>32	16	2	32	**11 (5,8 - 19,4)**
Erythromycin	0,008-16	0,008	>16	16	0,25	0,5	**2 (0,3 - 7,3)**
Trimethoprim/ Sulfamethoxazole	0,015-16	0,015	>16	2	1	4	**14 (8,1 - 23,0)**
Gentamicin	0,015-32	0,015	16	8	0,25	1	**2 (0,3 - 7,3)**
Ciprofloxacin	0,008-16	0,008	>16	1	0,25	16	**44 (34,2 - 54,8)**
Nalidixic acid	0,015-32	0,03	>32	32	8	>32	**44 (34,2 - 54,8)**

Campylobacter spp. showed considerably higher resistance rates than *Salmonella* spp. The situation for *C. jejuni* is of particular significance in this respect, since this pathogen is involved in approx. 90 % of Campylobacter induced human illnesses. As expected, poultry showed high resistance rates to the quinolones nalidixic acid and ciprofloxacin with the resistance rates of *C. coli* (55 and 60 %, respectively), clearly exceeding those of *C. jejuni* (45 % each).

The analysis of the resistance behaviour of *E. coli* from poultry and pig samples produced high resistance rates to streptomycin, spectinomycin, tetracycline, trimethoprim and trimethoprim/sulphamethoxazole. The situation for isolates from cattle faeces and beef surfaces, in contrast, was much more favourable.

Table 2. *Occurrence of resistance (%) among isolates of E. coli from pigs (faeces) n = 131*

	range	min.	max.	breakpoint	MIC 50	MIC 90	res. in % (95 %) Confidence Interval
Tetracycline	2-32	2	>32	8	>32	>32	**71 (62,4 - 78,6)**
Chloramphenicol	2-64	4	>64	16	8	16	**3 (0,8 - 7,6)**
Florfenicol	2-64	2	32	16	8	16	**2 (0,5 - 6,5)**
Ampicillin	1-32	1	>32	16	4	8	**8 (3,7 - 13,6)**
Amoxicillin/ Clavulanic acid	2-32	2	16	16	4	8	**0 (0,0 - 2,8)**
Ceftiofur	0,5-8	0,5	1	4	0,5	0,5	**0 (0,0 - 2,8)**
Trimethoprim	4-32	4	>32	8	4	>32	**22 (15,4 - 30,2)**
Trimethoprim/ Sulfamethoxazole	1-8	1	>8	2	1	>8	**21 (14,7 - 29,4)**

Apramycin	4-64	4	64	8	8	32	**31**	**(23,5 - 40,0)**
Gentamicin	1-32	1	32	8	1	4	**2**	**(0,5 - 6,5)**
Neomycin	2-32	2	>32	8	2	8	**5**	**(2,2 - 10,7)**
Spectinomycin	2-128	8	>128	64	128	>128	**56**	**(46,8 - 64,4)**
Streptomycin	4-64	4	>64	16	>64	>64	**78**	**(69,8 - 84,6)**
Ciprofloxacin	0,03-4	0,03	>4	2	0,03	0,03	**1**	**(0,0 - 4,2)**
Nalidixic acid	4-128	4	>128	16	4	8	**4**	**(1,3 - 8,7)**
Colistin	4-64	4	16	8	4	4	**1**	**(0,0 - 4,2)**

Table 3. *Occurence of resistance (%) among isolates of Enterococcus spp. from cows (bulk milk samples) n = 421*

	range	**min.**	**max.**	**breakpoint**	**MIC 50**	**MIC 90**	**res. in % (95 % Confidence Interval**	
Amoxycillin + Clavulanic acid	0,5-32	1	>64	8	1	1	**0,7**	**(0,1 - 2,1)**
Chloramphenicol	2-64	2	64	16	8	64	**13,3**	**(10,2 - 16,9)**
Erythromycin	1-32	0,5	>32	4	1	>32	**13,8**	**(10,6 - 17,4)**
Florfenicol	2-32	1	>64	16	2	4	**0,2**	**(0,0 - 1,3)**
Flavomycin	0,5-32	0,5	>32	8	1	>32	**15,2**	**(11,9 - 19,0)**
Gentamicin	128-2048	128	>2048	512	128	128	**0,2**	**(0,0 - 1,3)**
Kanamycin	128-2048	128	>2048	1024	128	>2048	**18,1**	**(14,5 - 22,1)**
Nitrofurantoin	64-256	32	>256	64	32	32	**0,7**	**(0,1 - 2,1)**
Penicillin	2-128	2	>128	8	2	4	**1,4**	**(0,5 - 3,1)**
Salinomycin	1-32	0,5	>32	8	0,5	1	**0,5**	**(0,1 - 1,7)**
Streptomycin	128-2048	64	>2048	1024	128	>2048	**20,2**	**(16,5 - 24,3)**
Tetracycline	1-32	1	>32	8	16	>32	**50,6**	**(45,7 - 55,5)**
Vancomycin	1-32	1	>32	16	1	2	**0,7**	**(0,1 - 2,1)**

The resistance rates of *Enterococcus* spp. isolated from faecal and meat samples from cattle were also considerably below those obtained for poultry and pigs, as in the case of *E. coli*. The bacterial strains obtained from cattle revealed higher levels of resistance only to flavomycin, tetracycline and bacitracin. The poultry isolates showed very high rates of resistance to bacitracin, erythromycin, tetracycline and virginiamycin. *Enterococcus* spp. isolates from cattle faeces also displayed a high level of resistance to flavomycin, whereas isolates from bulk milk samples of cows showed only a high level of resistance to tetracycline.

The Copenhagen meeting on the Microbial Threat in 1998 identified key areas in monitoring antimicrobial resistance in bacteria of animal origin. REMOST 2001 is the second yearly report from the Department of Veterinary Administration in Styria for monitoring of antimicrobial resistance in bacteria randomly isolated from animals. The results of our investigation of the resistance behaviour of indicator bacteria and zoonotic pathogens are comparable with data from other countries, like Denmark (DANMAP, 2001) or Sweden (SWARM, 2001). In addition to the monitoring of antimicrobial resistance it will be necessary to collect valid data about the consumption of antibiotics and chemotherapeutics in livestock husbandry. The prudent use of antimicrobials in the production of food of animal origin under the guidelines of the principles of Good Veterinary

Practice (VAN MIERT, 1993) provide the basis for an optimalisation of the veterinarians support in the management of farm animals.

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