CODA-CERVA
Veterinary and Agrochemical Research Centre

Report on susceptibility of *Salmonella* serotypes in Belgium.

P. Butaye

Susceptibility of *Salmonella* strains was assessed by MIC determination using Sensititer (Trek Diagnostics). Strains were isolated from different animal species and feed. There is only one strain per farm/animal/other per sampling point. An official epidemiological surveillance programme was only established for poultry in 2011.

Salmonella were serotyped by the *Salmonella* reference laboratory for animals, CODA-CERVA-VAR, Brussels.

MICs were interpreted according to the epidemiological breakpoints provided by EUCAST for *Salmonella*. For kanamycin the breakpoint for *E. coli* was used. This differs from the former surveillances on *Salmonella* in Belgium, where disk diffusion testing and clinical breakpoints were used. Therefore differences in resistance percentages between before and after 2011 should be interpreted with care since these differences may be due to the different method and breakpoints used.

Reading the table 1: Grey colors are the concentration tested of which the lowest concentration should be read as "≤". Strains listed out of the concentration range should be read as ">" than the highest concentration tested. Breakpoints are indicated by a dark line. Numbers tested are N and NR stands for Number resistant. The resistance percentages are indicated in the line %R.

The data are presented in different ways. Abbreviations are listed in table 1. Table 2 gives a general overview of all strains tested, followed by the presentation of the resistances by serotype (Table 3). in Table 4 the resistances are discussed by origin (animal species) and finally in Table 5 some specific resistances are highlighted.

Table 1. Abbreviations of antibiotics

Abbreviation	
AMP	Ampicillin
CHL	Chloramphenicol
CIP	Ciprofloxacin
COL	Colostin
FFN	Florphenicol
FOT	Cefotaxime
GEN	Gentamicin
KAN	Kanamycin
NAL	Nalidxic acid
SMX	Sulfonamide
STR	Streptomycin
TAZ	Ceftazidime
TET	Tetracycline
TMP	Trimethoprim

In Table 2, results on all *Salmonella* isolated are analysed. It should be noted that these results largely depend on the prevalence of the different serotypes. Some serotypes do not seem to acquire resistances easily, while with others, it is the inverse.

Highest resistance is seen against ampicillin and sulphonamides. Slightly lower is tetracycline, streptomycin, nalidixic acid and ciprofloxacin resistance. The latter is for the first time in the salmonella surveillance in Belgium interpreted by the ECOFFs (Epidemiological cut offs) provided by EUCAST and therefore is much higher than ever reported in Belgium. High level resistance (MIC>4µg/ml) is seen in 15 strains. Resistance against the cephalosporins, cefotaxime and ceftazidime, attained nearly 10% of the strains. Then the amphenicols chloramphenicol and florfenicol are following with approximately 5% of the strains being resistant. For the first time colistin resistance has been assessed on the whole collection and resistance has been detected in up to 5% of the strains. Resistance against the aminoglycosides gentamicin and kanamycin remains low in contrast to streptomycin.

Cephalosporin resistance has penetrated into many serotypes. It is highest in *S.* Paratyphi B, followed by *S.* Virchow, *S.* Infantis and *S.* Kentucky. The epidemiology of cephalosporin resistant *S.* Virchow and *S.* Infantis has been described in Belgium before.

Ciprofloxacin resistance has been interpreted according to the EUCAST ECOFFs and therefore is much higher than ever reported in Belgium. This has also a consequence as resistance against fluoroquinolones and quinolones (nalidixic acid) become virtually similar. Discrepancies can be explained by the presence of plasmid mediated quinolone resistance. However, this has not been studied and should be confirmed. High level of fluoroquinolone resistance was seen in 15 strains: 9 *S.* Kentucky, 1 *S.* Mbandaka, 2 *S.* Paratyphi B, 2 *S.* Rissen and 1 *S.* Tennessee. Based on the resistance profiles, at least two clones of *S.* Kentucky are circulating, which should be further investigated to investigate the clonal distribution. This phenomenon should be followed closely so it does not expand. It should be noted that *S.* Kentucky has gained importance in the US where it seems to replace *S.* Enteriditis.

Florfenicol resistance was typically associated with *S.* Typhimurium or non-motile variants. One strain was a *S.* Mbandaka and one was autoagglutinating. The strain showed typically the penta-resistance associated with the presence of the SGI1.

In Table 3, resistance in the different serotypes is shown. Specific serotypes were chosen based on their prevalence in the sample and based on their importance. It is clear from the data that actually *S.* Typhimurium with 277 strains and *S.* Partyphi B with 159 strains are the most prevalent serotypes. These are also the most resistant serotypes. A surprisingly high number of *S.* Minnesota were present (n=78). Following were *S.* Enteriditis almost equalling with *S.* Rissen and *S.* Senftenberg. Other serotypes were lower in numbers. Amongst the group “others” are numerous serotypes with few (max. 15 strains) per serotype. As the confidence interval for the prevalence of resistance of these serotypes is quite large, the data as such are little informative.

S. 4:- are to be regarded as non-motile variants of *S.* Typhimurium. Taking the susceptibility data of these two categories together they are by far the largest group. Comparing the prevalence of resistance against the different antibiotics, significant differences ($p \leq 0.05$, using Chi square) were only seen for ampicillin and trimethoprim, with the non-motile strains being more resistant. Comparing to the other serotypes and to the total, flofenicol resistance is relatively high. Florfenicol is indicative for the presence of the *Salmonella* Genomic Island 1 (SGI1), which is associated with multiple resistances. Cephalosporin resistance in *S.* Typmurium was nearly 5% and in the non-motile strains up to 10%. Further tests are necessary to determine whether these are ESBLs or plasmide mediated AmpC β-lactamases.

S. Agona has been frequently associated with the SGI1, however here, this serotype contains few resistances.

S. Enteriditis remains by large susceptible to most antibiotics. However comparing is difficult, it seems that resistance is increasing. Striking, however, is the extreme high prevalence of colistin resistance. Resistance against colistin has not been tested before on such a collection of strains in Belgium. This was due to the use of disk diffusion testing, being not very reliable for colistin testing unless prediffusion is used. As such, it is unclear when this resistance was introduced in these serotypes. This type of resistance is as far as currently known due to chromosomal mutations, and suggests a clonal spread. A further investigation on the high prevalence of this resistance is warranted since this type of resistance is connected to an increased resistance against innate immunity, which may cause enhanced possibilities for colonisation and persistence. However, a recent publication showed that MICs of colistin for *S.* Enteriditis may be intrinsically higher than for other *Salmonella* species except *S.* Dublin. Further research is needed to elucidate this.

Though the number of *S.* Kentucky is low (N=12), this serotype is important to follow up since it has been shown that it is increasing in poultry due to the decrease in *S.* Enteriditis. Both belong to the O9 serogroup. Compared to other serotypes, it has a high prevalence of gentamicin resistance.

S. Infantis has been shown before to be quite resistant to cephalosporins due to the presence of the plasmid located TEM-52 gene. While this resistance has diminished, still a little more than 17% of the strains is resistance. It would be interesting to know whether it is still the same gene and the same genetic background of the strains as in the past, which would evidence the persistence of his resistant clone. Compared to *S.* Virchow, of which there were only 9 strains tested, *S.* Infantis seems to better sustain.

In Table 4 results are shown per animal species the *Salmonella* strain was isolated from. Most strains originated from poultry, where an official *Salmonella* control programme exists. In pigs, the second largest group, control programmes are mainly based on serology. Few strains are from bovines and pigeons and are not from surveillances but caused pathology. For feed there is a quality control programme in which feed is checked for the presence of pathogens and contaminants, amongst one is *Salmonella*. In the group “other” are listed different animals species (except those listed above) or strains of which the origin is not known (not mentioned on submission at the *Salmonella* reference laboratory).

Interpreting these data must be done carefully since much may be dependent on the serotypes prevalent in the animal species. Significant differences were assessed using chi-square test and holding a $p \leq 0{,}05$. The highest level of ampicillin resistance was seen in pigs while cephalosporin resistance (also belonging to the β-lactam antibiotics) was evenly distributed over the different categories. It should however be noted that cephalosporin resistance was not detected in *Salmonella* from bovines, however, this may be due to the low number of strains tested, more strains should be tested to better asses. In bovines *Salmonella* has a clinical importance for animal health. Chloramphenicol resistance was mainly associated with pig and bovine strains, and similarly for florfenicol. Strikingly, highest resistance percentage against colistin was found in strains from bovines. This is due to the presence of this type of resistance in only two serotypes, *S.* Enteriditis and *S.* Dublin. All but one *S.* Dublin (n=11) came from bovines (one was from poultry) and all but 2 were resistant to colistin. The impact of this on bovine health should be assessed more in detail. However, it should be indicated that these serotypes seem to be naturally less susceptible to colistin.

Overall, a little more than 40% of the strains remained susceptible to all antibioitcs (Table5), and 50% of the strains were resistant to 2 or less antibiotics. Multi-resistance (defined here as resistant to 3 or more antibiotics) was seen in approximately 37% of the strains. Worrisome is that one strain, a serotype Mbandaka from a chicken was resistant to all the antibiotics tested. Serotypes resistant against 10 or more antibiotics were *S.* Typhimurium (n=3), *S.* Paratyphi B (n=3), *S.* Minnesota (n=2) and one strain for the serotypes *S.* Mbandaka, *S.* Derby, *S.* 7, 2:-, *S.* Kentucky and *S.* 4, -:2.

Table1. Antimicrobial susceptibility of *Salmonella* serotypes of all origins.

	AMP	CHL	CIP	COL	FFN	FOT	GEN	KAN	NAL	SMX	Str	TAZ	TET	TMP
≤0.008			5											
0.015	0	0	478	0	0	0	0	0	0	0	0	0	0	0
0.03	0	0	352	0	0	0	0	0	0	0	0	0	0	0
0.06	0	0	27	0	0	595	0	0	0	0	0	0	0	0
0.12	0	0	16	0	0	405	0	0	0	0	0	0	0	0
0.25	0	0	136	0	0	47	359	0	0	0	0	628	0	0
0.5	36	0	89	0	0	6	740	0	0	0	0	410	0	751
1	541	0	39	0	0	4	37	0	0	0	15	18	245	15
2	96	32	3	1094	90	7	5	0	0		0	16	606	4
4	15	361	0	43	732	4	2	1114	829	0	71	25	38	4
8	5	651	10	21	272	90	4	11	32	17	377	6	9	3
16	0	47	5	0	30	0	12	3	6	34	222	13	8	0
32	4	2	0	0	25	0	0	3	7	154	167	41	31	5
64	462	13	0	0	4	0	1	1	8	350	55	0	47	374
128	0	54	0	0	7	0	0	1	276	126	68	0	176	0
256	0	0	0	0	0	0	0	25	0	31	183	0	0	0
512	0	0	0	0	0	0	0	0	0	6	0	0	0	0
1024	0	0	0	0	0	0	0	0	0	4	0	0	0	0
>1024	0	0	0	0	0	0	0	0	0	436	0	0	0	0
N	1159	1160	1160	1158	1160	1158	1160	1158	1158	1158	1158	1157	1160	1156
NR	471	69	298	64	36	111	24	33	297	446	306	85	262	386
%R	40,6	5,9	25,7	5,5	3,1	9,6	2,1	2,8	25,6	38,5	26,4	7,3	22,6	33,4
CI	37,8-44	4,7-7	23,2-28	4,3-7	2,2-4	7,9-11	1,3-3	2-4	23,2-28	35,7-41	23,9-29	5,9-9	20,2-25	30,6-36

Grey color: concentrations tested. The lowest concentration of an antibiotic tested should be read as “≤”

Line: breakpoint, N: Number, NR: Number resistant, %R per cent resistant, CI: confidence interval,

Table 3. Prevalence of resistance amongst selected serotypes.

Salmonella Serotype			AMP	CHL	CIP	COL	FFN	FOT	GEN	KAN	NAL	SMX	Str	TAZ	TET	TMP
S. 4:-		N	55,0	55,0	55,0	55,0	55,0	55,0	55,0	55,0	55,0	52,0	55,0	55,0	55,0	55,0
		NR	44,0	4,0	16,0	3,0	2,0	6,0	0,0	2,0	15,0	44,0	38,0	5,0	30,0	37,0
		%R	80,0	7,3	29,1	5,5	3,6	10,9	0,0	3,6	27,3	84,6	69,1	9,1	54,5	67,3
		CI	67-90	2-18	17,6-43	1,1-15	0,4-13	4,1-22	0-6	0,4-13	16,1-41	67-90	55,2-81	3-20	40,6-68	53,3-79
S. Agona		N	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0	24,0
		NR	4,0	0,0	2,0	1,0	0,0	1,0	0,0	0,0	2,0	3,0	2,0	1,0	0,0	3,0
		%R	16,7	0,0	8,3	4,2	0,0	4,2	0,0	0,0	8,3	12,5	8,3	4,2	0,0	12,5
		CI	4,7-37	0-14	1-27	0,1-21	0-14	0,1-21	0-14	0-14	1-27	2,7-32	1-27	0,1-21	0-14	2,7-32
S. Derby		N	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	17,0	18,0	18,0	18,0	18,0
		NR	3,0	2,0	3,0	0,0	1,0	2,0	0,0	0,0	3,0	8,0	4,0	2,0	7,0	4,0
		%R	16,7	11,1	16,7	0,0	5,6	11,1	0,0	0,0	16,7	47,1	22,2	11,1	38,9	22,2
		CI	3,6-41	1,4-35	3,6-41	0-19	0,1-27	1,4-35	0-19	0-19	3,6-41	21,5-69	6,4-48	1,4-35	17,3-64	6,4-48
S. Enteriditis		N	64,0	64,0	63,0	63,0	64,0	63,0	64,0	64,0	63,0	63,0	63,0	63,0	64,0	63,0
		NR	5,0	2,0	5,0	39,0	0,0	1,0	1,0	0,0	5,0	8,0	5,0	0,0	2,0	3,0
		%R	7,8	3,1	7,9	61,9	0,0	1,6	1,6	0,0	7,9	12,7	7,9	0,0	3,1	4,8
		CI	2,6-17	0,4-11	2,6-17	47,9-73	0-6	0-8	0-8	0-6	2,6-17	5,6-23	2,6-17	0-6	0,4-11	41275,0
S. Hadar		N	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0
		NR	3,0	0,0	18,0	0,0	0,0	1,0	0,0	0,0	18,0	3,0	17,0	1,0	18,0	3,0
		%R	15,0	0,0	90,0	0,0	0,0	5,0	0,0	0,0	90,0	15,0	85,0	5,0	90,0	15,0
		CI	3,2-38	0-17	68,3-99	0-17	0-17	0,1-25	0-17	0-17	68,3-99	3,2-38	62,3-97	0,1-25	68,3-99	3,2-38
S. Infantis		N	41,0	41,0	41,0	41,0	41,0	41,0	41,0	41,0	41,0	39,0	41,0	41,0	41,0	41,0
		NR	11,0	0,0	2,0	0,0	0,0	7,0	0,0	0,0	2,0	10,0	4,0	7,0	1,0	1,0
		%R	26,8	0,0	4,9	0,0	0,0	17,1	0,0	0,0	4,9	25,6	9,8	17,1	2,4	2,4
		CI	14,2-43	0-9	0,6-17	0-9	0-9	7,2-32	0-9	0-9	0,6-17	13-42	2,7-23	7,2-32	0,1-13	0,1-13
S. Kentucky		N	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0
		NR	9,0	0,0	9,0	0,0	0,0	2,0	8,0	2,0	9,0	8,0	8,0	1,0	8,0	2,0
		%R	75,0	0,0	75,0	0,0	0,0	16,7	66,7	16,7	75,0	66,7	66,7	8,3	66,7	16,7
		CI	42,8-95	0-26	42,8-95	0-26	0-26	2,1-48	34,9-90	2,1-48	42,8-95	34,9-90	34,9-90	0,2-38	34,9-90	2,1-48

Table 3 continued

Salmonella Serotype		AMP	CHL	CIP	COL	FFN	FOT	GEN	KAN	NAL	SMX	Str	TAZ	TET	TMP
S. Livingstone	N	26,0	26,0	26,0	26,0	26,0	26,0	26,0	26,0	26,0	26,0	26,0	25,0	26,0	26,0
	NR	3,0	1,0	1,0	1,0	0,0	0,0	0,0	1,0	1,0	3,0	2,0	0,0	1,0	3,0
	%R	11,5	3,8	3,8	3,8	0,0	0,0	0,0	3,8	3,8	11,5	7,7	0,0	3,8	11,5
	CI	2,4-30	0,1-20	0,1-20	0,1-20	0-13	0-13	0-13	0,1-20	0,1-20	2,4-30	0,9-25	0-13	0,1-20	2,4-30
S. Minnesota	N	78,0	78,0	78,0	78,0	78,0	78,0	78,0	78,0	78,0	68,0	78,0	78,0	78,0	77,0
	NR	17,0	5,0	8,0	1,0	3,0	6,0	1,0	1,0	7,0	20,0	14,0	6,0	9,0	13,0
	%R	21,8	6,4	10,3	1,3	3,8	7,7	1,3	1,3	9,0	29,4	17,9	7,7	11,5	16,9
	CI	13,2-33	2,1-14	4,5-19	0-7	0,8-11	2,9-16	0-7	0-7	3,7-18	16,4-37	10,2-28	2,9-16	5,4-21	9,2-27
S. Montevideo	N	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0
	NR	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	0,0	0,0	0,0	1,0
	%R	7,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	7,1	0,0	0,0	0,0	7,1
	CI	0,2-34	0-23	0-23	0-23	0-23	0-23	0-23	0-23	0-23	0,2-34	0-23	0-23	0-23	0,2-34
Other	N	266,0	266,0	264,0	266,0	266,0	266,0	266,0	266,0	266,0	252,0	266,0	266,0	266,0	266,0
	NR	74,0	9,0	55,0	13,0	3,0	20,0	4,0	8,0	56,0	75,0	40,0	13,0	42,0	59,0
	%R	27,8	3,4	20,8	4,9	1,1	7,5	1,5	3,0	21,1	29,8	15,0	4,9	15,8	22,2
	CI	22,5-34	1,6-6	16-26	2,6-8	0,2-3	4,7-11	0,4-4	1,3-6	16,3-26	24,2-36	11-20	2,6-8	11,6-21	17,3-28
S. Paratyphi B	N	159,0	159,0	159,0	159,0	159,0	159,0	159,0	159,0	159,0	157,0	159,0	159,0	159,0	159,0
	NR	129,0	3,0	133,0	1,0	1,0	46,0	2,0	9,0	132,0	95,0	45,0	35,0	21,0	155,0
	%R	81,1	1,9	83,6	0,6	0,6	28,9	1,3	5,7	83,0	60,5	28,3	22,0	13,2	97,5
	CI	74,2-87	0,4-5	77-89	0-3	0-3	22-37	0,2-4	2,6-10	76,3-89	51,7-67	21,5-36	15,8-29	8,4-19	93,7-99
S. Rissen	N	62,0	63,0	63,0	62,0	63,0	62,0	63,0	63,0	62,0	61,0	62,0	62,0	63,0	62,0
	NR	13,0	4,0	2,0	0,0	0,0	2,0	4,0	2,0	3,0	13,0	5,0	1,0	9,0	13,0
	%R	21,0	6,3	3,2	0,0	0,0	3,2	6,3	3,2	4,8	21,3	8,1	1,6	14,3	21,0
	CI	11,7-33	1,8-16	0,4-11	0-6	0-6	0,4-11	1,8-16	0,4-11	1-13	11,7-33	2,7-18	0-9	6,9-26	11,7-33
S. Senftenberg	N	59,0	59,0	59,0	59,0	59,0	59,0	59,0	59,0	59,0	57,0	59,0	59,0	59,0	59,0
	NR	8,0	1,0	5,0	0,0	0,0	3,0	1,0	0,0	5,0	8,0	5,0	2,0	2,0	6,0
	%R	13,6	1,7	8,5	0,0	0,0	5,1	1,7	0,0	8,5	14,0	8,5	3,4	3,4	10,2
	CI	6-25	0-9	2,8-19	0-6	0-6	1,1-14	0-9	0-6	2,8-19	6-25	2,8-19	0,4-12	0,4-12	3,8-21

Table 3 continued

Salmonella Serotype			AMP	CHL	CIP	COL	FFN	FOT	GEN	KAN	NAL	SMX	Str	TAZ	TET	TMP
S. Mbandaka		N	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	20,0	21,0	21,0	21,0	21,0
		NR	3,0	1,0	3,0	1,0	1,0	1,0	1,0	1,0	3,0	3,0	3,0	1,0	5,0	2,0
		%R	14,3	4,8	14,3	4,8	4,8	4,8	4,8	4,8	14,3	15,0	14,3	4,8	23,8	9,5
		CI	3-21	0,1-24	3-21	0,1-24	0,1-24	0,1-24	0,1-24	0,1-24	3-21	3-21	3-21	0,1-24	8,2-47	1,2-30
S. Typhimurium		N	227,0	227,0	227,0	227,0	227,0	227,0	227,0	227,0	227,0	216,0	227,0	227,0	227,0	226,0
		NR	141,0	36,0	29,0	4,0	25,0	11,0	2,0	7,0	30,0	142,0	115,0	10,0	103,0	80,0
		%R	62,1	15,9	12,8	1,8	11,0	4,8	0,9	3,1	13,2	65,7	50,7	4,4	45,4	35,4
		CI	55,5-60	11,4-21	8,7-18	0,5-4	7,3-16	2,4-9	0,1-7	1,2-6	9,1-18	55,6-69	44-57	2,1-8	38,8-52	29-42
S. Virchow		N	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	8,0	9,0	9,0	9,0	9,0
		NR	5,0	1,0	4,0	0,0	0,0	2,0	0,0	0,0	4,0	1,0	0,0	1,0	1,0	2,0
		%R	55,6	11,1	44,4	0,0	0,0	22,2	0,0	0,0	44,4	12,5	0,0	11,1	11,1	22,2
		CI	21,2-86	0,3-48	13,7-79	0-34	0-34	2,8-60	0-34	0-34	13,7-79	0,3-48	0-34	0,3-48	0,3-48	2,8-60

Table 4. Antimicrobial resistance in *Salmonella* serotypes according to the animal isolated from.

			AMP	CHL	CIP	COL	FFN	FOT	GEN	KAN	NAL	SMX	Str	TAZ	TET	TMP
Poultry		N	755	756	755	755	756	755	756	756	755	722	755	754	756	754
		NR	298	24	252	37	12	91	18	21	254	266	175	70	117	276
		%R	39,5	3,2	33,4	4,9	1,6	12,1	2,4	2,8	33,6	36,8	23,2	9,3	15,5	36,6
		CI	36-43	2-5	30-37	3,5-7	0,8-3	9,8-15	1,4-4	1,7-4	30,3-37	31,8-39	20,2-26	7,3-12	13-18	33,1-40
Pig		N	142	142	142	141	142	141	142	142	141	140	141	141	142	140
		NR	100	26	15	5	13	10	5	9	12	97	76	8	85	73
		%R	70,4	18,3	10,6	3,5	9,2	7,1	3,5	6,3	8,5	69,3	53,9	5,7	59,9	52,1
		CI	62,2-78	12,3-26	6-17	1,2-8	5-15	3,4-13	1,2-8	2,9-12	4,4-14	60-76	45-62	2,5-11	51,3-68	42,9-60
Bovines		N	29	29	29	29	29	29	29	29	29	28	29	29	29	29
		NR	8	5	2	11	1	0	0	1	3	16	10	0	9	4
		%R	27,6	17,2	6,9	37,9	3,4	0	0	3,4	10,3	57,1	34,5	0	31	13,8
		CI	12,7-47	5,8-36	0,8-23	20,7-58	0,1-18	0-12	0-12	0,1-18	2,2-27	37,2-76	17,9-54	0-12	15,3-51	3,9-32
Pigeon		N	16	16	16	16	16	16	16	16	16	13	16	16	16	16
		NR	2	1	2	0	1	1	0	0	1	4	1	1	2	3
		%R	12,5	6,3	12,5	0	6,3	6,3	0	0	6,3	30,8	6,3	6,3	12,5	18,8
		CI	1,6-38	0,2-30	1,6-38	0-21	0,2-30	0,2-30	0-21	0-21	0,2-30	7,3-52	0,2-30	0,2-30	1,6-38	4-46
feed		N	122	122	119	122	122	122	122	122	122	119	122	122	122	122
		NR	45	12	8	6	8	4	0	1	8	41	34	3	32	19
		%R	36,9	9,8	6,7	4,9	6,6	3,3	0	0,8	6,6	34,5	27,9	2,5	26,2	15,6
		CI	28,3-46	5,2-17	2,9-13	1,8-10	2,9-13	0,9-8	0-3	0-4	2,9-13	25,3-43	20,1-37	0,4-7	18,7-35	9,6-23
Other		N	95	95	94	95	95	95	95	95	95	90	95	95	95	95
		NR	18	1	19	5	1	5	1	1	19	22	10	3	17	11
		%R	18,9	1,1	20,2	5,3	1,1	5,3	1,1	1,1	20	24,4	10,5	3,2	17,9	11,6
		CI	11,6-28	0-6	12,5-29	1,7-12	0-6	1,7-12	0-6	0-6	12,5-29	15,1-33	5,2-19	0,7-9	10,8-27	5,9-20

Table 5. Multi-resistance in *Salmonella* isolates

N antibiotics	N strains	N strains cumulative	% Strains	% strains cumulative
0	471	471	40,6	40,6
1	107	578	9,2	49,8
2	53	631	4,6	54,4
3	107	738	9,2	63,6
4	137	875	11,8	75,4
5	99	974	8,5	84,0
6	79	1053	6,8	90,8
7	65	1118	5,6	96,4
8	20	1138	1,7	98,1
9	9	1147	0,8	98,9
10	4	1151	0,3	99,2
11	7	1158	0,6	99,8
12	1	1159	0,1	99,9
13	0	1159	0,0	99,9
14	1	1160	0,1	100,0